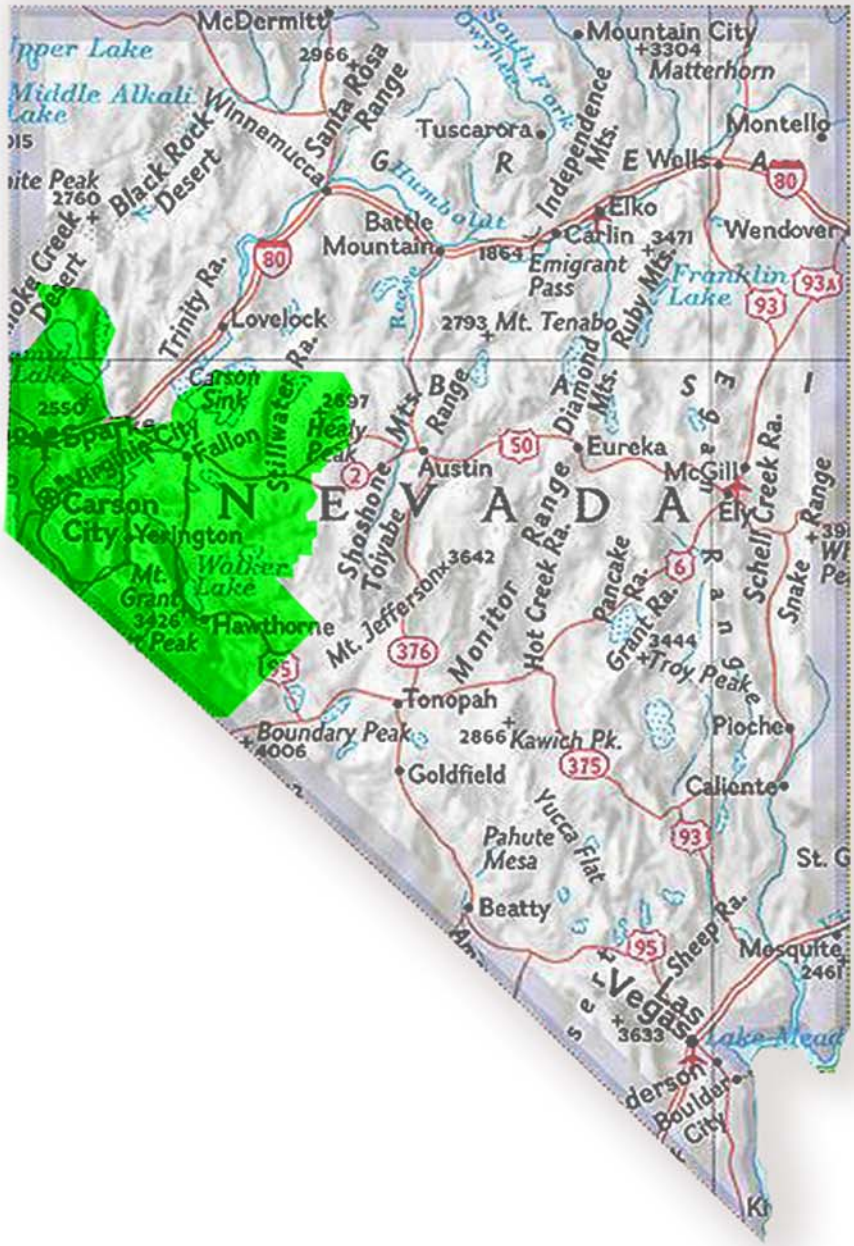
United States Department of the Interior
Bureau of Land Management

Carson City Field Office
Carson City, Nevada

July 2006

EA-NV-030-06-025

Carson City Field Office
Geothermal Leasing Environmental Assessment



MISSION STATEMENT

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based upon the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation, rangelands, timber, minerals, watershed, fish and wildlife, wilderness, air and scenic, scientific and cultural values.

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CHAPTER 1
INTRODUCTION/PURPOSE AND NEED

1.1 INTRODUCTION

This environmental assessment (EA) is an evaluation of the impacts on the natural and human environment that could result from the Carson City Field Office (CCFO) of the Bureau of Land Management (BLM) issuing leases for geothermal resources. The EA is an analysis of impacts on the quality of the environment, serves as a vehicle for interdisciplinary review of the proposal and, if necessary, facilitates the preparation of an environmental impact statement (EIS). This document has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA, and the Federal Land Policy and Management Act of 1976 (FLPMA). The document is consistent with the CCFO Consolidated Resource Management Plan (CRMP) and the President's National Energy Policy (NEP), Executive Order (EO) 13212, and the Energy Policy Act of 2005.

The proposed action considered in this EA—issuing leases for geothermal resources—is considered a federal action and a commitment to resource development, so it requires NEPA analysis. While issuing a lease for geothermal resources confers on the lessee the right to future exploration and development of geothermal resources within the lease area, it does not confer the right to explore for or develop geothermal resources if such activities would extend beyond the level of casual use. As a result, the proposed issuance of geothermal leases would have no direct impacts.

Issuance of geothermal leases could have indirect impacts because such leasing represents a commitment of resources, and it is reasonably expected that subsequent exploration, development, production, and closeout activities would occur. The EA therefore presents a broad scope analysis of the potential indirect and cumulative impacts from geothermal leasing to determine whether these indirect impacts by the lessee could be significant.

Leasing may be approved under an EA level of analysis only if no significant impacts are expected to occur. In order to achieve this objective, the preparers of this EA used two separate screening protocols to determine which areas could be approved for future geothermal leasing and have a low potential for significant environmental impacts.

The first screening process identifies the areas that the BLM may lease, in accordance with law or policy. This phase of the screening process is presented in Sections 1.2 and 1.3 below. The second screening process identifies the areas that may be leased without a high risk of significant indirect impacts resulting from subsequent geothermal development activities. This resource analysis phase of the screening process is presented in the environmental analyses in Chapters 3 and 4.

The NEPA decision for this EA will apply only to those lease areas that meet the standards of each screening process. Lease areas removed from consideration by the second screening process will require more extensive environmental analysis in the context of an EIS before leasing could be considered.

For clarity in this document, both the BLM and other federal land together will be referred to as federal lands. Federal lands also include split estate lands, where the government disposed of the surface estate and retained the mineral rights.

1.2 BACKGROUND FOR GEOTHERMAL RESOURCES AND LEASING

Geothermal resources are underground reservoirs of hot water or steam created by heat from the earth. Geothermal steam and hot water can reach the surface of the earth in the form of hot springs, geysers, mud pots, or steam vents. These resources also can be accessed by wells, and the heat energy can be used for generating electricity or other direct uses, such as heating greenhouses and aquaculture operations or for dehydrating vegetables.

It is the policy of the Department of the Interior, consistent with Section 2 of the Mining and Mineral Policy Act (MMPA) of 1970 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 (30 USC § 1001, et seq.), which was amended and supplemented by the Energy Policy Act (PL 109-58, August 8, 2005) provides regulatory guidance for geothermal leasing by the BLM.

The first step in developing geothermal resources on federal lands is to issue a lease for geothermal resources in a defined area. Lease applications, in accordance with provisions of the Geothermal Steam Act, are generally submitted for at least one full section of land, which is a mapped area of one square mile. Consequently, lease applications may be submitted for sections that include inholdings of land where the BLM has no authority to lease. In such cases, the BLM may still consider lease applications because it is not precluded from leasing the remaining land over which it has leasing authority. As a result, while lease applications may be submitted for more

than one section, and while applications may be approved for less than one section, the section is the basic geographic unit for analysis in this EA.

Leasing geothermal resources by the BLM, as evaluated in this EA, confers on the lessee a right to future exploration and development of geothermal resources within the lease area. However, it does not confer on the lessee the right to conduct any ground-disturbing activities to explore for or develop geothermal resources. The four stages of geothermal resource development within a lease are exploration, development, production, and closeout. Each of the four stages under the lease requires separate BLM authorization and NEPA compliance when ground-disturbing activities are proposed.

A geothermal lease typically grants the lessee access to geothermal resources in the lease area for 10 years. The terms of the lease require the lessee to show a certain level of diligence toward developing the geothermal resources within the lease area, or the lease may be terminated. Once an area is developed for productive use of geothermal energy, the lease allows the lessee use of the resource for 40 years, with a right of renewal for another 40 years. Geothermal exploration and production on federal land conducted through leases is subject to terms and stipulations to comply with all applicable federal and state laws pertaining to various considerations for sanitation, water quality, wildlife, safety, and reclamation. Lease stipulations may be site-specific and are derived from the environmental analysis process.

Historically, federal land was leased for geothermal activities through either a noncompetitive or competitive process. Most public land was leased through a noncompetitive lease granted to the first qualified offeror. Additionally, certain lands were designated as known geothermal resource areas (KGRAs) and offered only through a competitive bid process. KGRAs are areas where the BLM had determined, based on geologic and technical evidence, that a person with geothermal knowledge would spend money to develop the geothermal resource, areas that were located near wells capable of commercial production of geothermal fluids, or areas where there was a competitive interest in geothermal resource development (not a singular criterion existed). The intent of the competitive lease approach was for the public to receive a fair market value for leasing the right to develop these resources. KGRAs were defined for a broad area that might have included lands where the BLM was not authorized to lease, such as private land, tribal land, or land administered by certain other agencies.

Since the Energy Policy Act of 2005 was passed, the BLM replaced the term KGRA with "lease areas" to identify potential lease areas. In addition, leases are no longer issued through a noncompetitive process. Lease applications listed in this document will be processed in accordance with the regulations that were established before the 2005 Energy Policy Act was passed. The BLM is developing regulations to implement direction from the Energy Policy Act on geothermal leasing that may affect existing leases.

In accordance with the Geothermal Steam Act, the BLM has leasing authority for geothermal resources on the following lands:

- Those administered by the Department of the Interior, including public, withdrawn, and acquired lands;
- Those administered by the Department of Agriculture, with its concurrence;
- Those conveyed by the United States where the geothermal resources were reserved to the United States; and
- Those subject to Section 24 of the Federal Power Act, as amended (16 USC 818), with concurrence from the Secretary of Energy.

The CCFO specifically administers fluid mineral leases on lands managed by the US Forest Service (USFS) in the Humboldt-Toiyabe and Inyo National Forests, the Bureau of Reclamation (BOR), the US Fish and Wildlife Services (USFWS), and the Department of Defense (DOD). As such, these agencies have provided input into the development of this EA. Considered in this EA are lands administered by these agencies and located where noncompetitive lease applications have been submitted, except where leasing is precluded by one of the authorities stated above or where the agencies did not concur.

Policy established in the CCFO CRMP and other established laws and regulations preclude the BLM from issuing geothermal leases in specific areas. The BLM is prohibited from issuing leases on the following:

- Private land or land owned by the State of Nevada (in accordance with the Geothermal Steam Act);
- Wildlife management areas administered by the Department of the Interior (in accordance with the Geothermal Steam Act);
- Tribal lands (in accordance with the Geothermal Steam Act);
- Lands in southern Washoe County, except those within or adjacent to the Steamboat KGRA (in accordance with the Southern Washoe County Urban Interface Plan Amendment);
- Lands in the Carson Lake Pastures area (in accordance with the Truckee-Carson-Pyramid Lake Water Rights Settlement Act);
- The Grimes Point Archaeological Area (in accordance with CCFO CRMP); and
- Lands designated as Wilderness Areas or Wilderness Study Areas (WSAs), except where expressly permitted (in accordance with the Geothermal Steam Act).

Input has also been provided by key agencies or groups with special expertise, interest, or administrative responsibility pertaining to the general geographical area during the preparation of this EA; these include local tribes (the Pyramid Lake Paiute, the Reno-Sparks Indian Colony, Yomba Shoshone, the Fallon Paiute-Shoshone, the Walker River Paiute, the Washoe Tribe of Nevada and California, the Bridgeport Indian Colony, the Lovelock Paiute Tribe, and the Yerington Paiute), the USFS Humboldt-Toiyabe National Forest, USFS Supervisor Office in Sparks, Nevada, the USFS Carson City Ranger District, the USFS Bridgeport Ranger District, and the BOR Lahontan Basin Area Office.

1.3 CCFO LEASING OF GEOTHERMAL RESOURCES

As of August 8, 2005, 61 noncompetitive lease applications, covering approximately 109,884 acres, had been filed for geothermal resources within the CCFO management area. Until regulations for the implementation of the Energy Policy Act of 2005 are approved, no new lease applications are accepted.

Of the total area available for leasing, it is possible that there would be a high risk of significant environmental impact if after leasing, subsequent geothermal resource development were to occur in certain areas. Therefore, resource analysis presented in Chapter 4 of this EA will serve as a screening mechanism to determine which of the lease areas initially determined suitable for leasing could be leased without the potential for significant impacts on the environment. As part of its NEPA decision for this EA, the BLM may deny leasing in areas with a high potential for significant environmental impacts.

1.4 LOCATION OF THE PROPOSED ACTION

The BLM CCFO manages approximately 4.9 million acres of public land (Figure 1-1). The planning area encompasses all or portions of Washoe, Churchill, Lyon, Storey, Carson City, Nye, Douglas, and Mineral Counties in Nevada and portions of Alpine, Plumas, and Lassen Counties in California. Noncompetitive lease applications filed with the CCFO are within ten general areas in five counties (Figure 1-2), as follows:

- Steamboat;
- Hazen;
- Salt Wells;
- Lee Hot Springs;
- North Aurora;
- South Aurora;
- Wabuska Hot Springs;
- Gabbs Valley;
- Hawthorne; and

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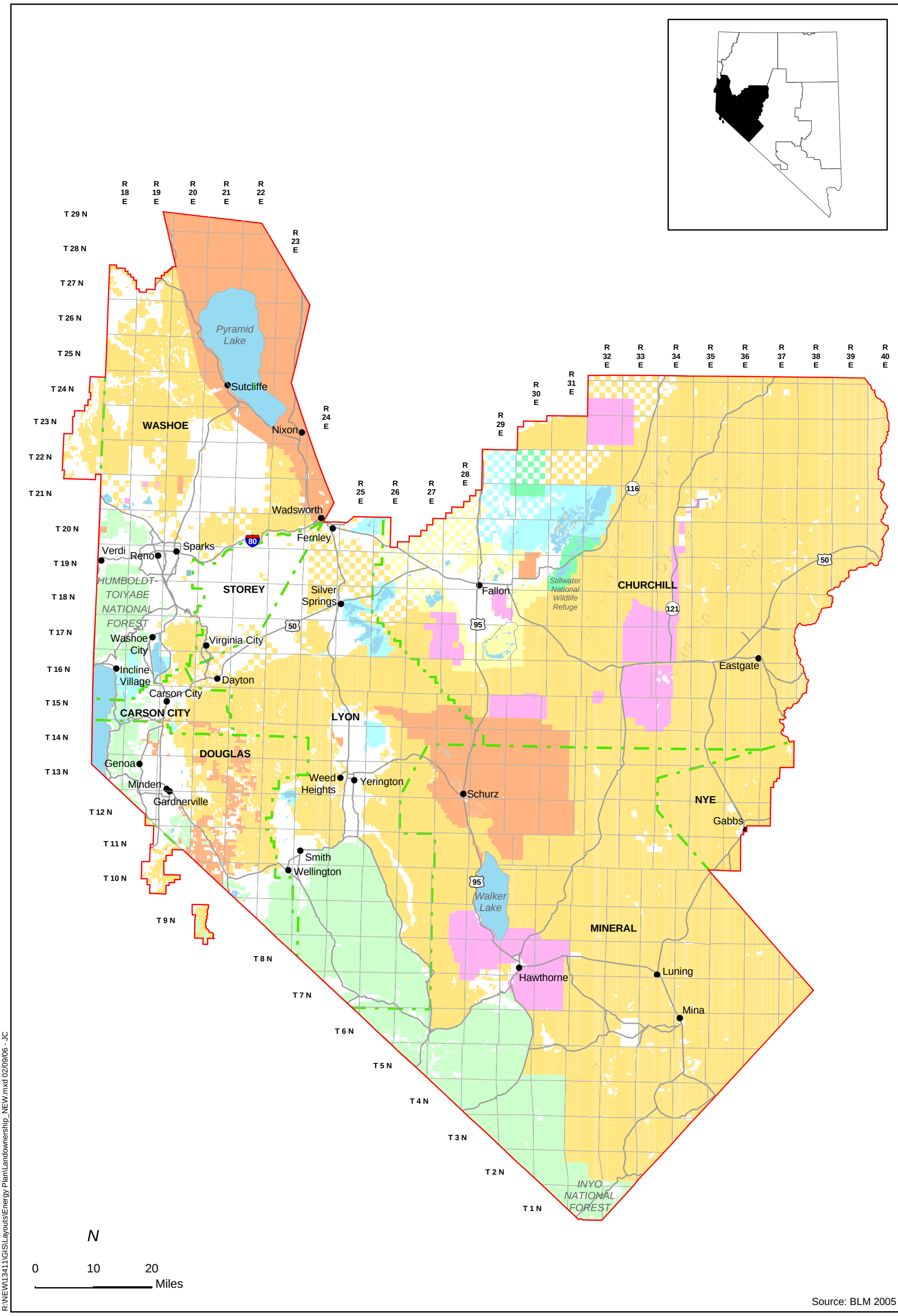

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Legend

- Bureau of Land Management
- Bureau of Reclamation
- Department of Defense
- US Forest Service
- US Fish & Wildlife
- Indian Trust
- Private
- County/City Parks
- Nevada State
- National Parks Service
- Water

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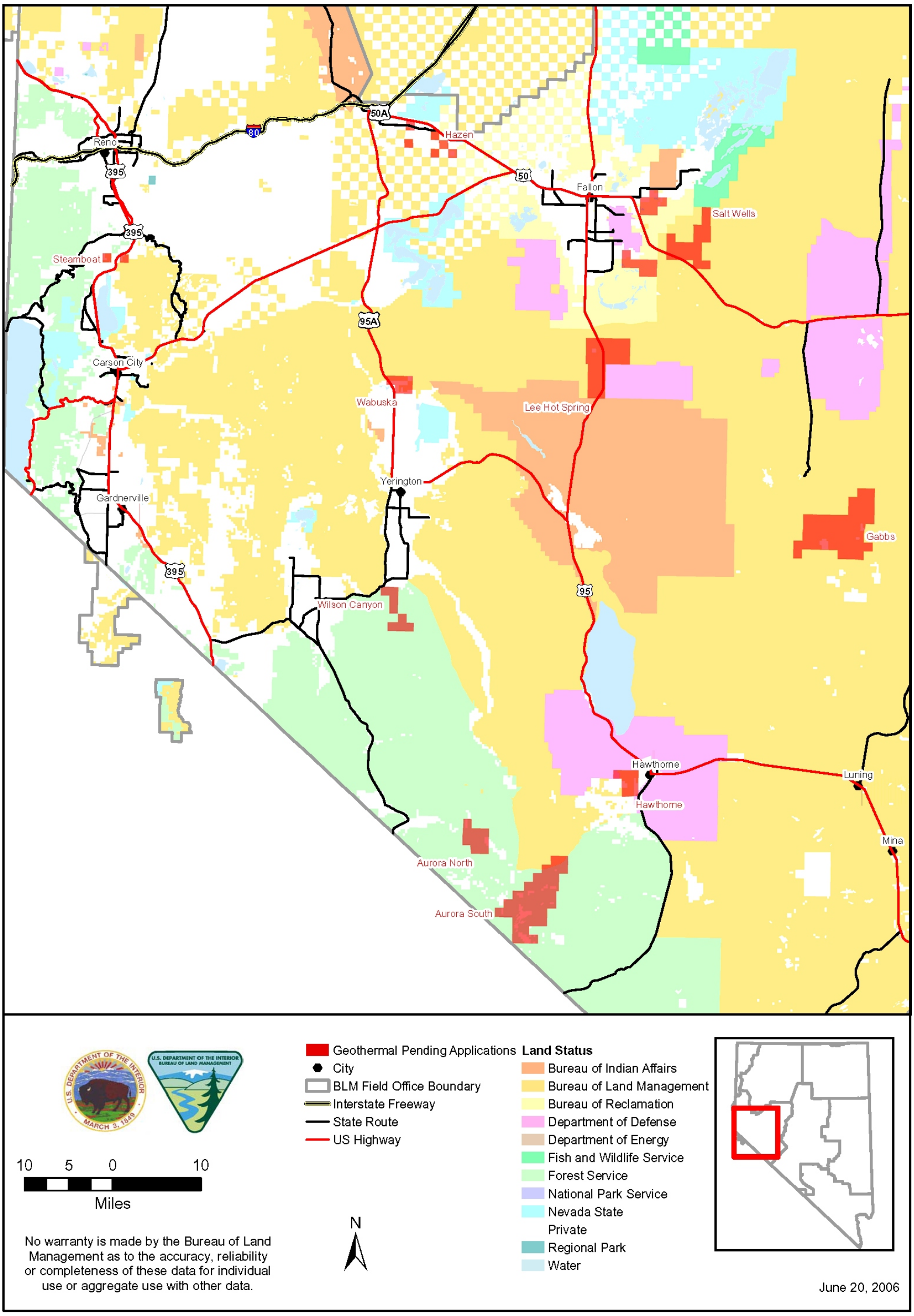
Land Ownership Geothermal EA

Carson City Field Office, Nevada

Figure 1-1



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Carson City Field Office, Nevada

Figure 1-2

- Wilson Canyon.

1.5 PURPOSE OF THE PROPOSED ACTION

The purpose of the proposed action is to lease geothermal resources administered by the CCFO within the CCFO management area.

In May 2001, President George W. Bush established the National Energy Policy Development Group, which created the NEP, a comprehensive set of legislative and administrative proposals.

The National Energy Policy Act of 2005 amended and supplemented the Geothermal Steam Act of 1970, and regulations are currently being written to implement the 2005 act.

1.6 NEED FOR THE PROPOSED ACTION

Demand for energy in the United States has increased dramatically in a relatively short time. In accordance with this demand, the BLM's need to process pending geothermal lease applications, while maintaining its responsibilities for safety, public health, and environmental protection, has also increased.

1.7 CONFORMANCE STATEMENT

The proposed action is consistent with the CCFO CRMP and with other federal, state, and local laws, regulations, and plans to the maximum extent possible. The CRMP states that the desired outcome for minerals and energy management is to "encourage development of energy and mineral resources in a timely manner to meet national, regional, and local needs consistent with the objectives for other public land uses."

The proposed action is also consistent with the Toiyabe National Forest Plan. Under the subheading Forest Management Direction-Forest-Wide Standards and Guidelines, states that the Toiyabe National Forest shall be managed to "encourage exploration and development of mineral resources and minimize possible adverse impacts on surface resources."

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CHAPTER 2
PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The BLM is proposing to lease 61 noncompetitive lease applications within approximately 109,884 acres of federal land (the proposed action). The areas where noncompetitive leases would be offered or approved are listed in Table 2-1 and are shown on Figures 2-1 through 2-10.

As described in Chapter 1, issuance of geothermal leases confers on the lessee a right to future exploration and development of geothermal resources within the lease area. However, leasing geothermal resources does not confer on the lessee the right to proceed with any ground-disturbing activities related to exploring for or developing geothermal resources.

After a lease has been granted, it is reasonably foreseeable that the operator may propose subsequent exploration and development activities for BLM approval. These subsequent activities would each require BLM authorization and, if necessary, environmental review. For exploration other than casual use activities, the operator must file an exploration permit that identifies, among many things, the areas to be explored and the method of exploration. When the operator has filed this permit with the local BLM office, the proposed action identified in the exploration permit undergoes NEPA review to determine if there are any environmental conflicts in the area to be disturbed. If so, the BLM may, at its discretion, approve or disapprove the permit or modify it by requiring additional mitigating measures. Should the operator not be willing to accept the decision, the permit can be modified and resubmitted, or the decision can be appealed.

Table 2-1
Proposed Geothermal Lease Areas

Township/ Range	Section	Lease Applicant (if applicable)	Serial Number (if applicable)	Approximate Area (acres)*
Steamboat Lease Area				
17 N 19E	12			
17N 20E	8	EVERGREEN ENERGY LLC	N74884	1,777
			Total:	**2,388**
Hazen Lease Area				
19N 26E	4	MACKIE STUART J	N76014	489
19N 26E	6			
20N 25E	34	KINGZETT JAMES M	N77739	2,560
20N 25E	22	KINGZETT JAMES M	N77646	1,280
	32	KINGZETT JAMES M	N76139	630
20 N 26E	30	KINGZETT JAMES M	N75005	626
			Total:	**5,585**
Salt Wells Lease Area				
17N 29E	1, 2	ORMAT NEVADA INC	N79107	1,280
17N 30E	5, 6, 7, 8	ORMAT NEVADA INC	N79106	2,556
17N 31E	5, 6	WESTERN GEO PARTNERS	N80607	1,280
18N 29E	35	ORMAT NEVADA INC	N79103	80
18N 30E	22, 26, 27	WESTERN GEO PARTNERS	N77722	1,920
	25, 34, 35, 36	WESTERN GEO PARTNERS	N77436	2,560
18N 31E	5, 8, 17	WESTERN GEO PARTNERS	N80606	1,952
	18, 19, 20	WESTERN GEO PARTNERS	N80609	1,891
	30, 31	WESTERN GEO PARTNERS	N77435	1,260
18N 30E	5, 6	STILLWATER HOLDINGS	N77158	2,271
19N 30E	31, 32, 33			
	29	STILLWATER HOLDINGS	N77690	400
			Total:	**17,450**
Lee Hot Springs Lease Area				
15N 29E	4			
	5			
	8			
	9	VULCAN POWER CO	N74255	2,420
	16			
	17			
	20			
	21	VULCAN POWER CO	N74256	2,560
16N 29E	19			
	20			
	21			
	22	VULCAN POWER CO	N74257	2,537
	23			
	26			
	29			
	30	VULCAN POWER CO	N74258	2,394
	27			
	34	EARTH POWER RES INC	N73930	1,280
	28			
	33	RON BARR	N73679	1,280

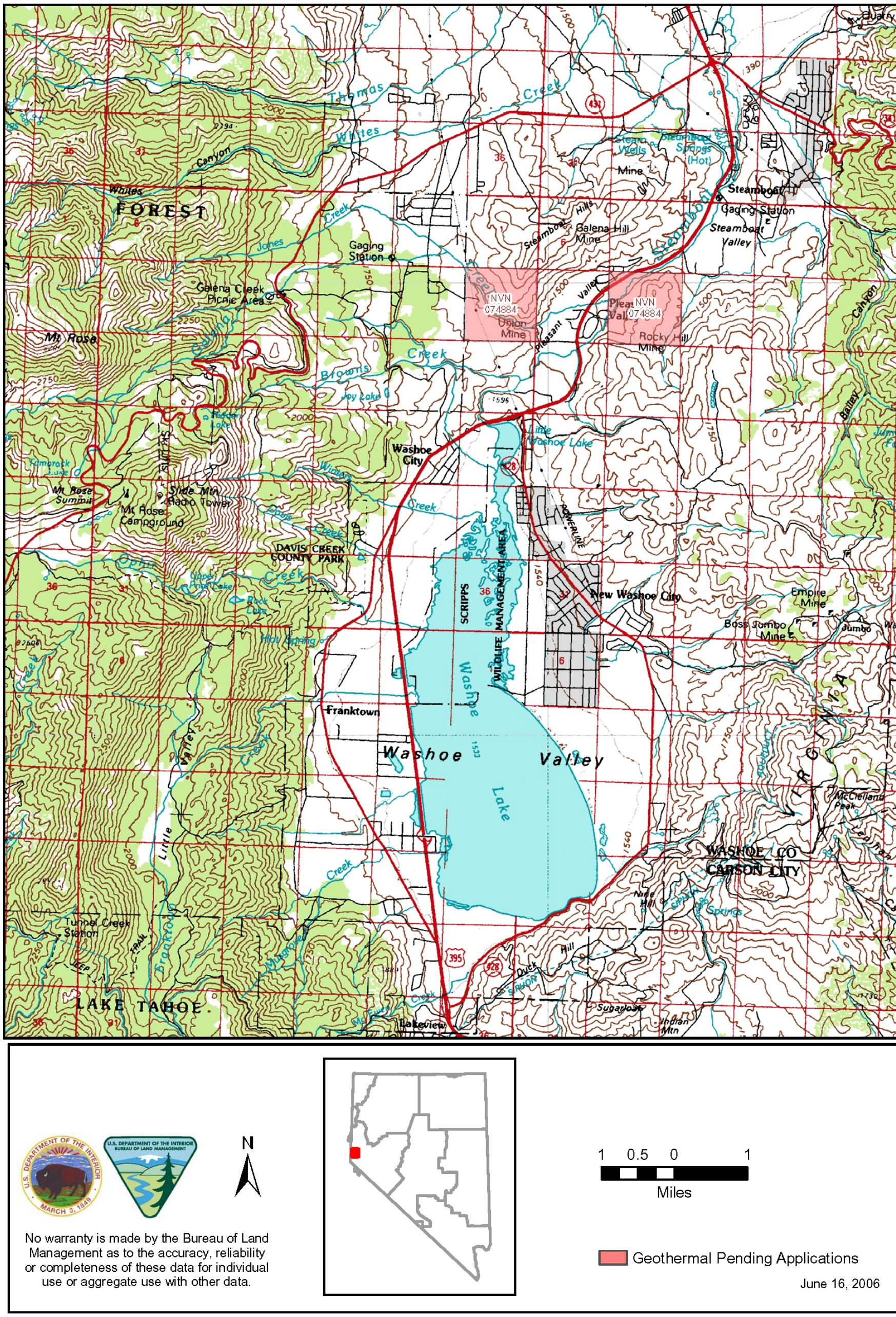
Table 2-1
Proposed Geothermal Lease Areas *(continued)*

Township/ Range	Section	Lease Applicant (if applicable)	Serial Number (if applicable)	Approximate Area (acres)
	28			
	31			
	32			
	33	VULCAN POWER CO	N74259	2,559
	35	VULCAN POWER CO	N74260	640
			Total:	**15,670**
North Aurora Lease Area				
7N 27E	30, 31, 32, 33	VULCAN POWER CO	N79890	2,560
6N 27E	4, 5, 6, 8	VULCAN POWER CO	N79888	2,560
	9	VULCAN POWER CO	N79889	640
			Total:	**5,760**
South Aurora Lease Area				
5N 27E	12, 13, 14	VULCAN POWER CO	N79885	1,920
5N 28E	2, 3, 4, 5	VULCAN POWER CO	N74249	2,599
	6, 7, 8, 17	VULCAN POWER CO	N79886	2,560
	9, 10, 11, 15	VULCAN POWER CO	N74250	2,560
	16	VULCAN POWER CO	N74251	640
	18, 19, 20, 21	VULCAN POWER CO	N79883	2,560
	22, 29, 30, 31	VULCAN POWER CO	N79884	2,560
	32, 33	VULCAN POWER CO	N79887	1,280
6N 28E	13, 14, 22, 23	VULCAN POWER CO	N74252	2,560
	24, 26, 27, 28	VULCAN POWER CO	N74253	2,560
	32, 33, 34, 35	VULCAN POWER CO	N74254	2,560
			Total:	**24,359**
Wabuska Hot Springs Lease Area				
15N 25E	14			
	15			
	16			
	22			
	23	HOMESTRETCH GEO LLC	N79988	1,520
			Total:	**1,520**
Gabbs Valley Lease Area				
13N 34E	17, 20, 29, 32	ORMAT NEVADA INC	N76822	2,560
12N 34E	17, 18, 19	ORMAT NEVADA INC	N76823	1,898
	6, 7	ORMAT NEVADA INC	N76827	2,314
13N 33E	24, 18, 19	ORMAT NEVADA INC	N76824	1,920
	25, 36, 30, 31	ORMAT NEVADA INC	N76826	2,560
12N 33E	1, 2, 11,12	ORMAT NEVADA INC	N76821	
	1, 2, 11,12	MILLER DUSTY LLC	N78774	2,560
	13, 14, 23, 24	ORMAT NEVADA INC	N76825	2,560
13N 33E	31, 32, 33	MILLER DUSTY LLC	N78771	1,920
	34, 35	MILLER DUSTY LLC	N79705	1,280
12N 33E	5, 6, 7, 8	MILLER DUSTY LLC	N78772	2,541
	3, 4, 9, 10	MILLER DUSTY LLC	N78773	2,552
	15, 16	MILLER DUSTY LLC	N79706	1,280
	17, 18			
12N 32E	13, 24	MILLER DUSTY LLC	N78775	2,553
			Total:	**28,498**

Table 2-1
Proposed Geothermal Lease Areas *(continued)*

Township/ Range	Section	Lease Applicant (if applicable)	Serial Number (if applicable)	Approximate Area (acres)
Hawthorne Lease Area				
8N 29E	25	WESTERN GEO PARTNERS	N77893	200
7N 30E	5, 6	WESTERN GEO PARTNERS	N77984	945
8N 30E	29, 30, 31, 32	WESTERN GEO PARTNERS	N77985	1,823
			Total:	**2,968**
Wilson Canyon Lease Area				
10N 25E	1	WESTERN GEO PARTNERS	N80598	646
	2, 3	WESTERN GEO PARTNERS	N77602	1,311
11N 25 E	15, 16, 22, 35	WESTERN GEO PARTNERS	N80601	2,449
	27	WESTERN GEO PARTNERS	N77600	1,280
			Total:	**5,686**
Total Area (Approximate)				**109,884**

*Lease applications are estimates – acreages within lease areas sometimes have multiple applications within the same Section, consequently, acreages are double counted for these areas.
Serial Number=Lease Unit ID Number.



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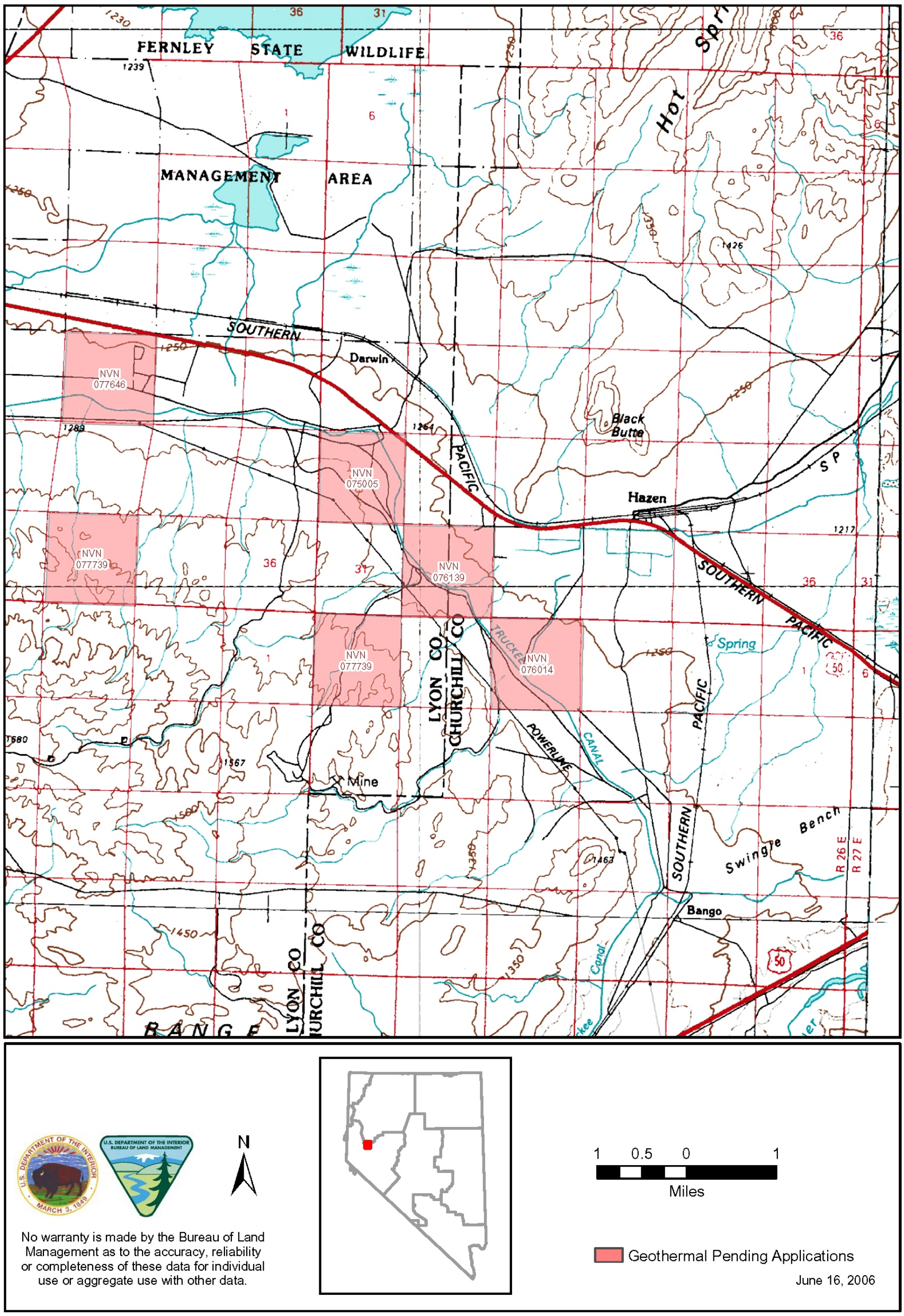
Geothermal Pending Applications

June 16, 2006

Geothermal Pending Applications Steamboat

Carson City Field Office, Nevada

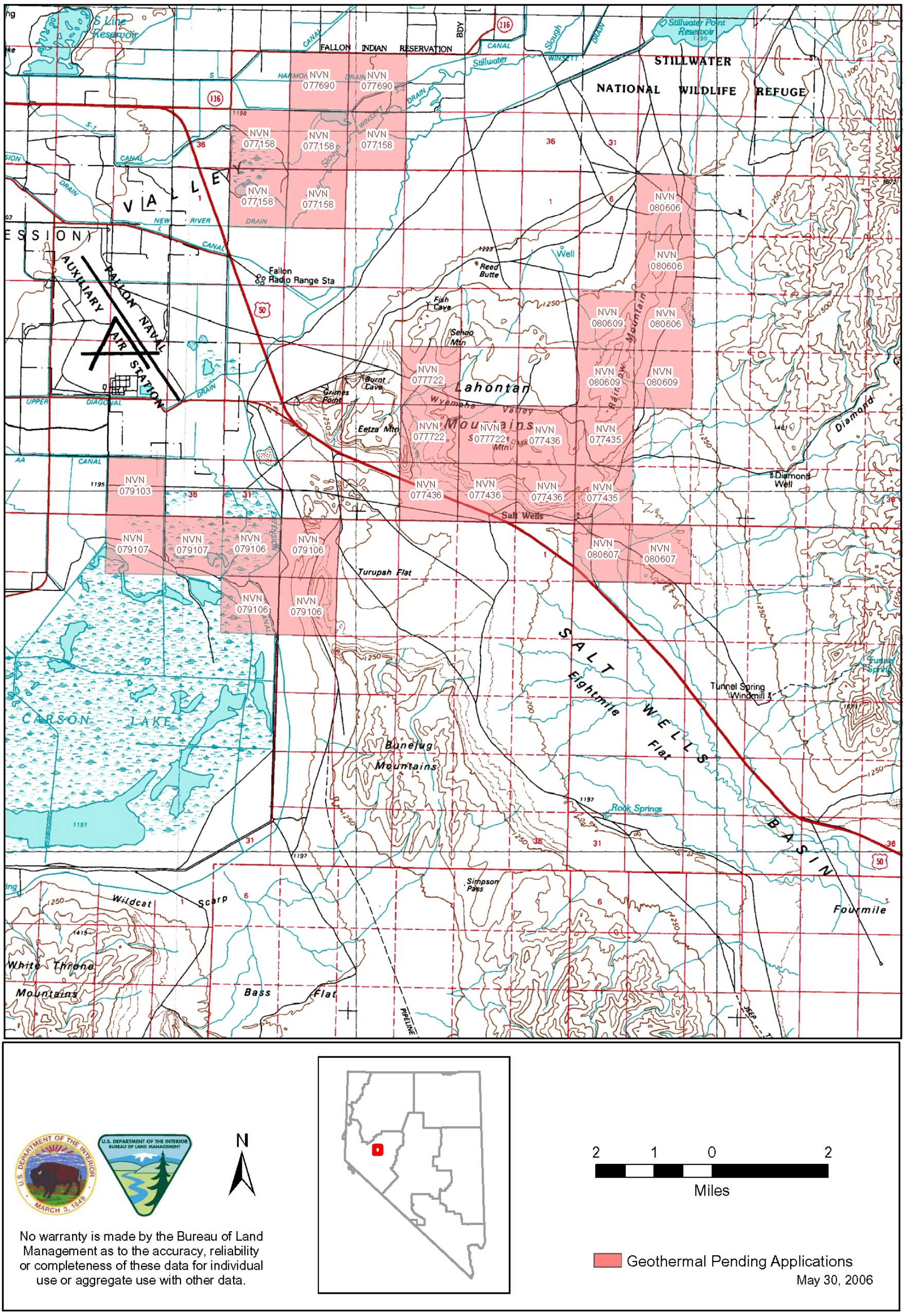
Figure 2-1



Geothermal Pending Applications Hazen

Carson City Field Office, Nevada

Figure 2-2



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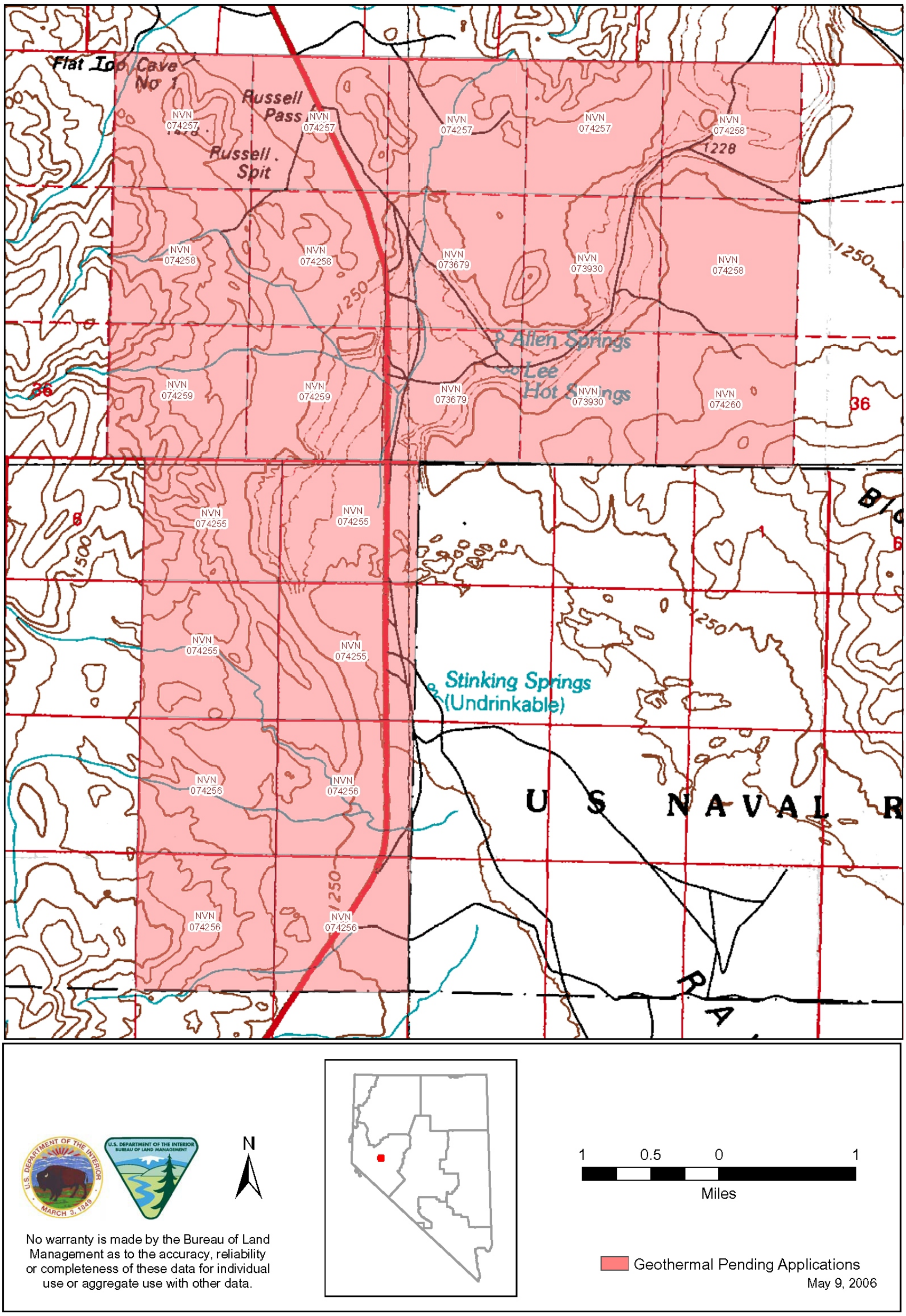
Geothermal Pending Applications
May 30, 2006

Geothermal Pending Applications Salt Wells

Carson City Field Office, Nevada

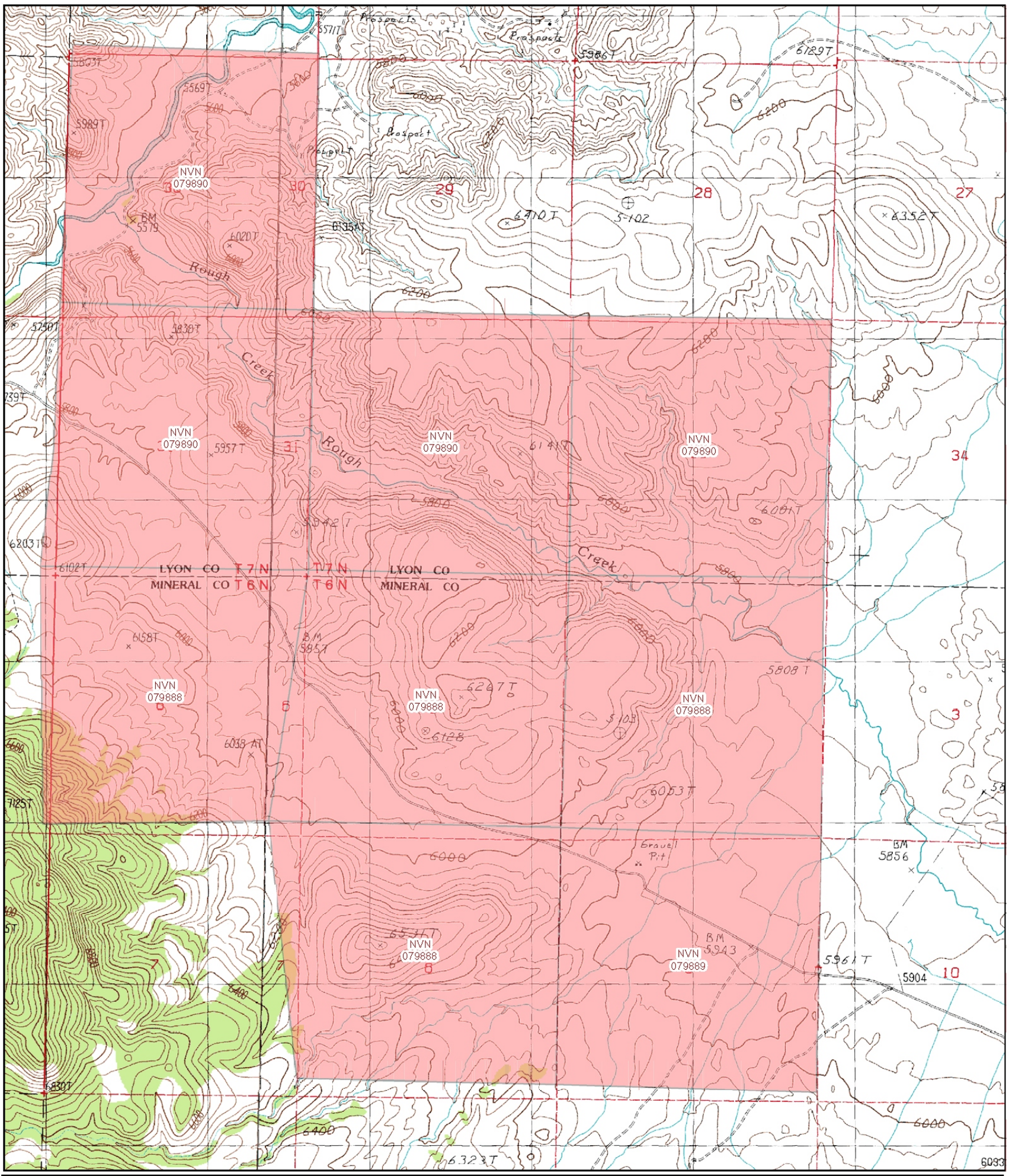
Figure 2-3



Geothermal Pending Applications Lee Hot Spring

Carson City Field Office, Nevada

Figure 2-4



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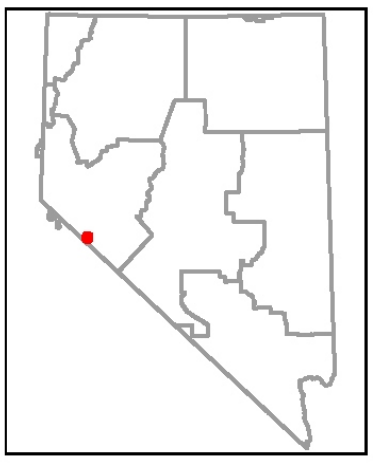
No warranty is made by the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual use or aggregate use with other data.



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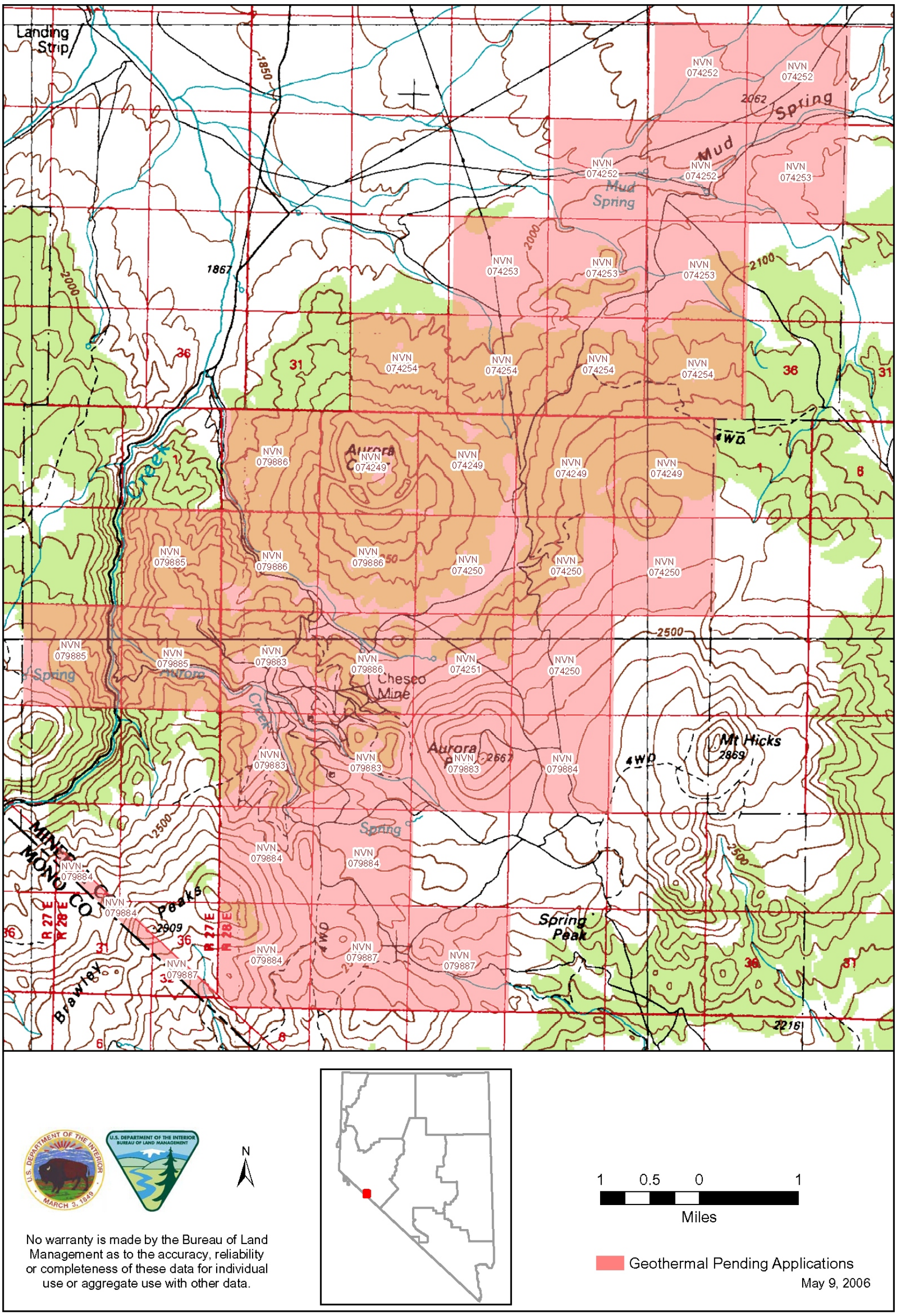
Geothermal Pending Applications

May 9, 2006

Geothermal Pending Applications Aurora North

Carson City Field Office, Nevada

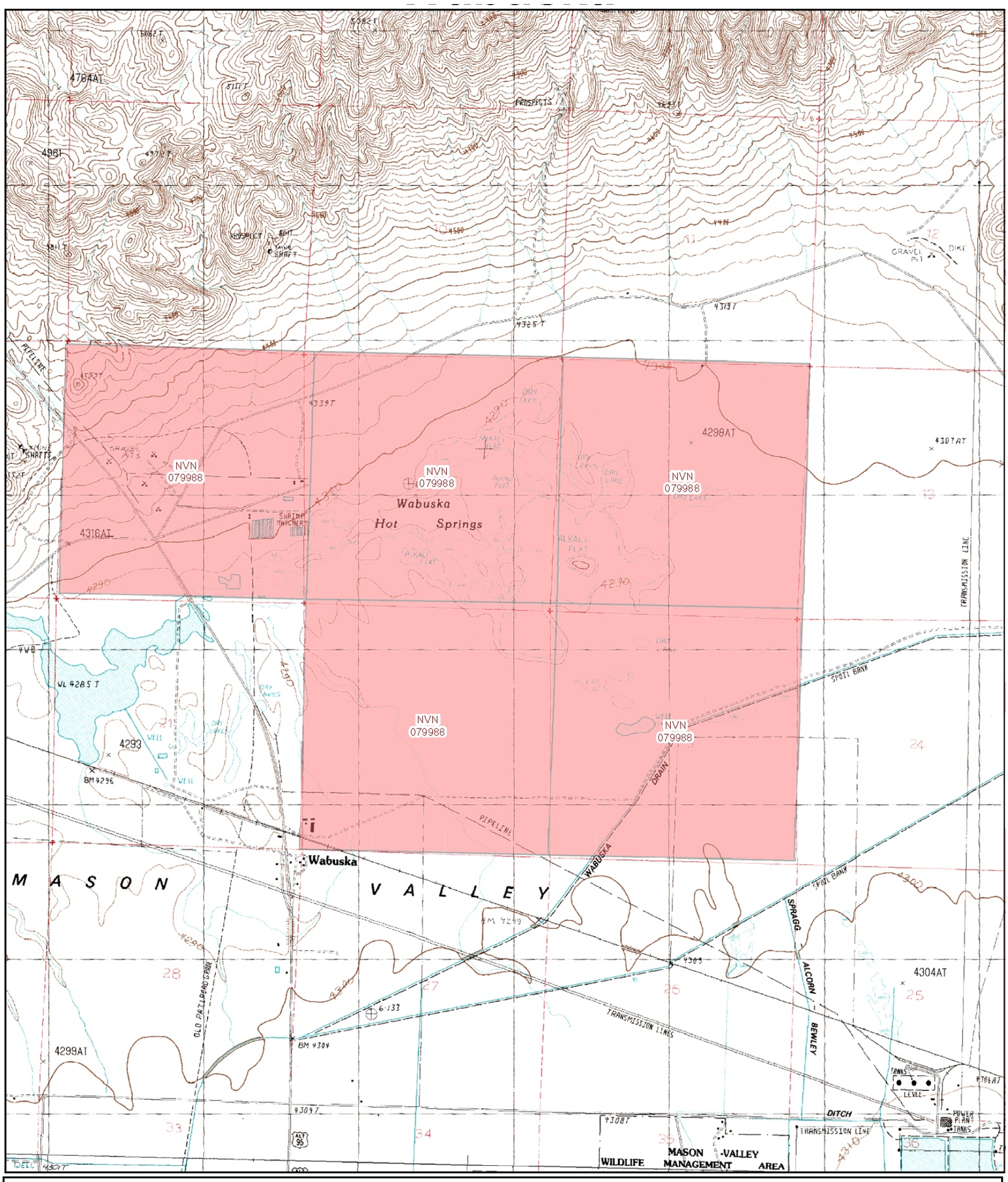
Figure 2-5



Geothermal Pending Applications Aurora South

Carson City Field Office, Nevada

Figure 2-6

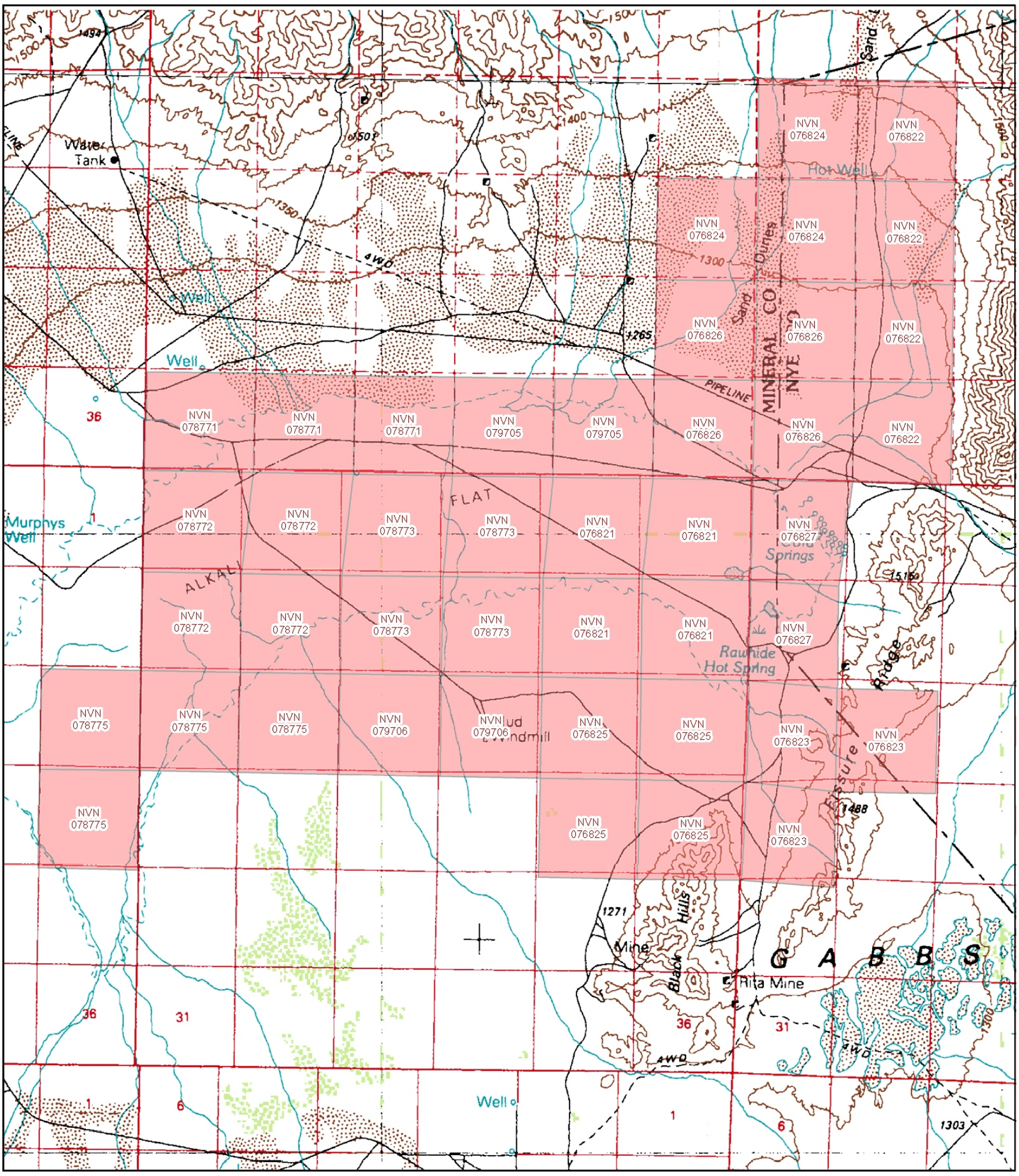


No warranty is made by the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual use or aggregate use with other data.

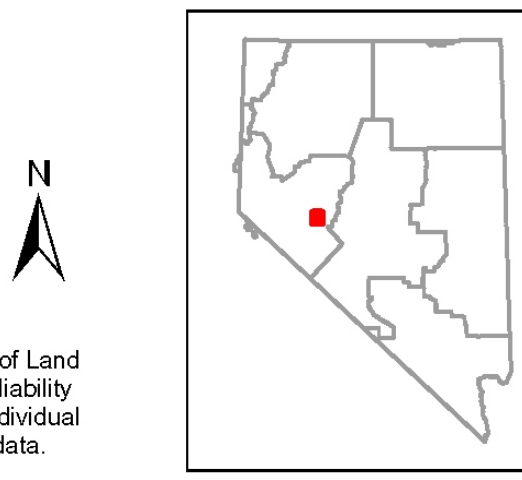
Geothermal Pending Applications Wabuska

Carson City Field Office, Nevada

Figure 2-7



No warranty is made by the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual use or aggregate use with other data.



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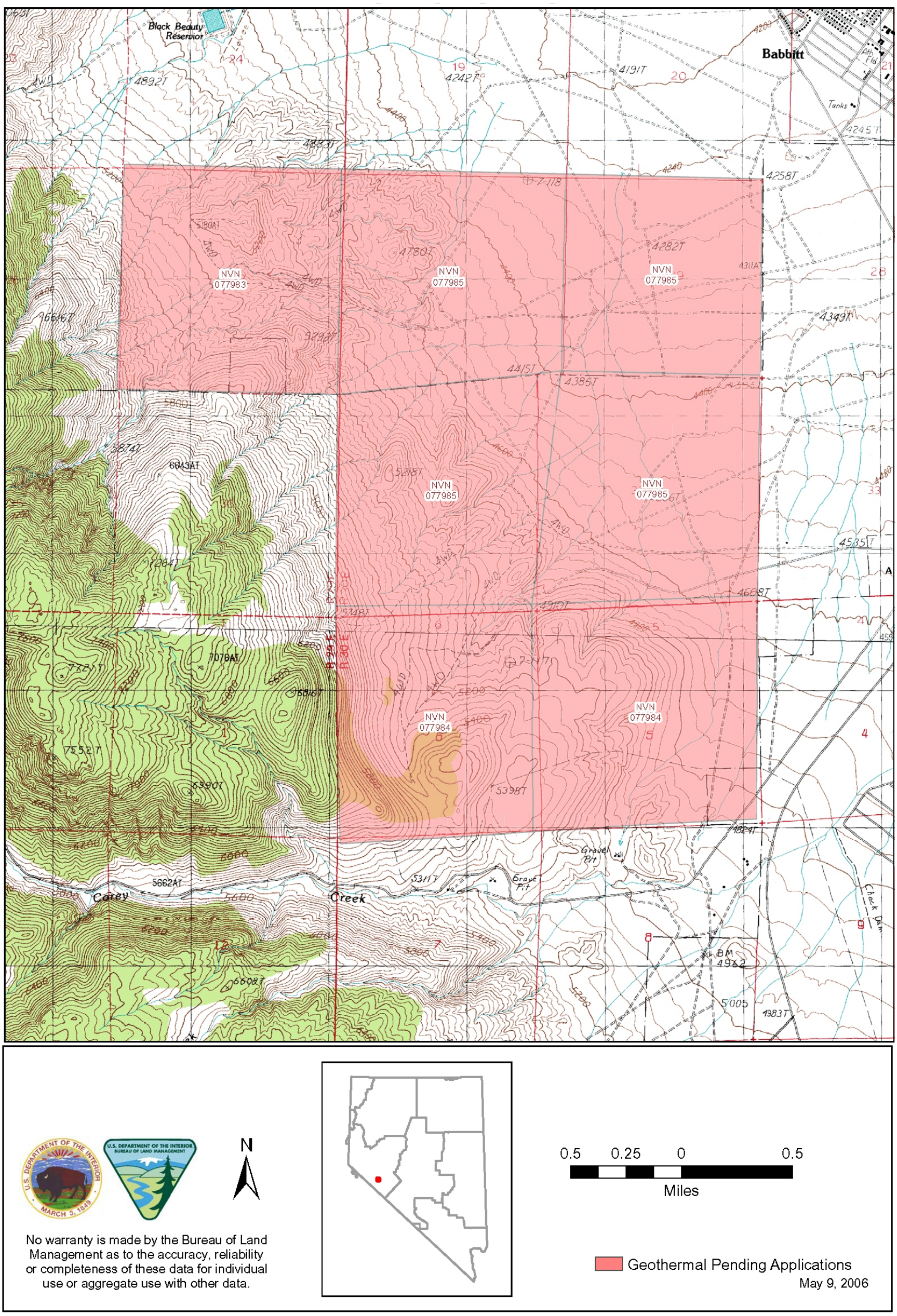
Geothermal Pending Applications

May 9, 2006

Geothermal Pending Applications Gabbs

Carson City Field Office, Nevada

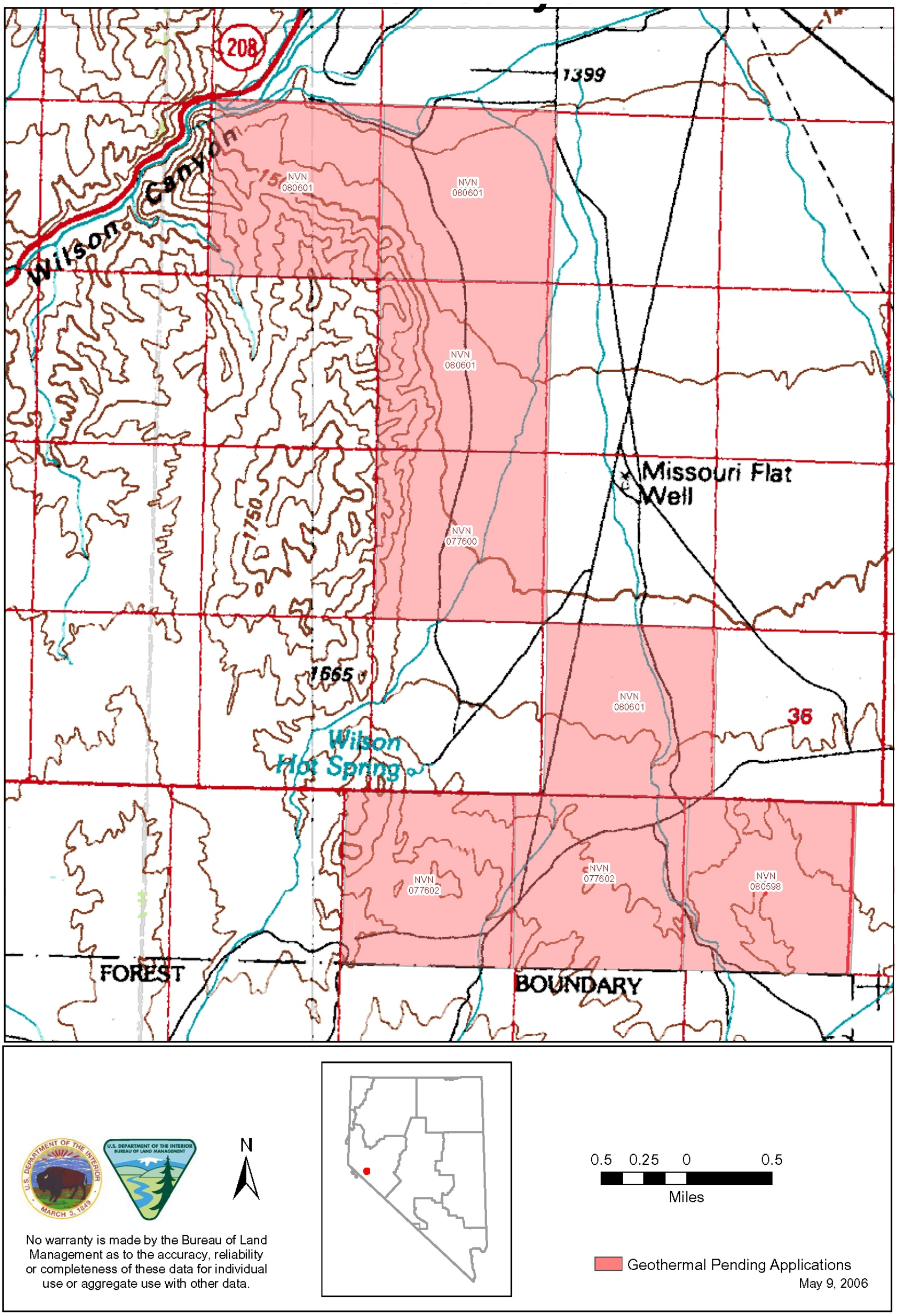
Figure 2-8



Geothermal Pending Applications Hawthorne

Carson City Field Office, Nevada

Figure 2-9



Geothermal Pending Applications Wilson Canyon

Carson City Field Office, Nevada

Figure 2-10

The development phase occurs when the operator has located a potentially economic geothermal reservoir. The operator must file an operations plan to describe how an operator will drill for and test the geothermal resources covered by the lease. The action proposed in the operations plan would undergo NEPA review by the local BLM office to evaluate the possible environmental impacts of the action. If environmental conflicts are likely to occur, the BLM may again approve, modify, or disapprove the plan.

Barring abandonment of exploration and development wells, the final phase of this process is the creation of, for example, geothermal power plants or dehydration plants. After the appropriate paperwork is filed with the local BLM office, the proposed action undergoes NEPA review to evaluate the potential for environmental impacts and once again undergoes the approval process.

All decisions to approve or disapprove either an application or a plan are subject to appeal, either by the proponent or by affected interests. An appropriate level of public scoping, to include outreach to those potentially affected, will be done as part of the NEPA review. Decisions to approve an application or plan generally include mitigating measures as conditions of environmental clearance or permit approval in order to minimize adverse impacts on other resources. Standard operating procedures specified in the CCFO CRMP provide for modifying or restricting leasing as part of environmental review or permit approval (see Appendix B). Typical measures that could be required for any permit approval or environmental clearance are listed in Appendix B. These measures are not conditions of leasing and part of the proposed action. The assumption is that the BLM would require such mitigating measures for all subsequent geothermal exploration, development, operation or closeout activities and that the potential indirect impacts of the proposed leasing action would therefore be mitigated in part by these measures.

Measures that are recommended to be conditions of leasing are presented in Appendix C, Lease Stipulations. Lease stipulations are designed to mitigate potential impacts from geothermal exploration, development, operation, or closeout in the CCFO management area. Recommended lease stipulations are assumed to be part of the proposed action.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, no areas would be offered or approved for geothermal leasing. Geothermal leasing would continue as at present and would be guided by the CCFO CRMP (BLM 2001a) and the regional environmental analyses for geothermal leasing in the Fort Churchill-Clan-Alpine area (BLM 1974a), Mina area (BLM 1974b), Pine Nut-Walker area (BLM 1974c), and Pyramid area (BLM 1974d). EAs or EISs would be required for each geothermal lease application in order to augment the outdated stipulations associated with the 1974 geothermal regional assessments. There would be no change in the actual permitted action from that of the proposed action.

The No Action Alternative would not permit further geothermal leasing and would be inconsistent with the intent of the Geothermal Steam Act, the NEP, and EO 13212, which state that agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects. The No Action Alternative serves as a benchmark against which the proposed action is evaluated.

CHAPTER 3
AFFECTED ENVIRONMENT

Introduction

This section presents the existing environment for lands potentially affected by geothermal leasing in the ten lease areas identified: Steamboat, Hazen, Salt Wells, Lee Hot Springs, North Aurora, South Aurora, Wabuska, Hawthorne, Gabbs Valley, and Wilson Canyon (Figure 1-2). Existing conditions for potentially affected resources are presented for the general lease areas and for specific lease areas, as appropriate.

Scoping and Issue Identification

In accordance with FLPMA and NEPA, this document has been prepared with input from and coordination with interested agencies, organizations, and individuals within the region. During the scoping process for this EA, input was solicited from key agencies or groups with special expertise, interest, or administrative responsibility pertaining to the general geographical area, including local tribes (the Pyramid Lake Paiute, the Reno-Sparks Indian Colony, Yomba Shoshone, the Fallon Paiute-Shoshone, the Walker River Paiute, the Washoe Tribe of Nevada and California, the Bridgeport Indian Colony, the Lovelock Paiute Tribe, and the Yerington Paiute), the USFS Humboldt-Toiyabe National Forest, USFS Supervisor Office in Sparks, Nevada, the USFS Carson City Ranger District, the USFS Bridgeport Ranger District, and the BOR Lahontan Basin Area Office.

General Setting of the Proposed Action

A general description of the affected area is provided below. Detailed descriptions of the affected environment in the proposed lease areas can be found in the following documents, which are incorporated by reference into this EA:

- BLM Regional Environmental Analysis Record, Geothermal/Oil and Gas Leasing in the Pine Nut-Walker Area, 1974;
- BLM Regional Environmental Analysis Record, Geothermal/Oil and Gas Leasing in the Pyramid Area, 1974;

- BLM Regional Environmental Analysis Record, Geothermal/Oil and Gas Leasing in the Mina Area, 1974; and
- BLM Regional Environmental Analysis Record, Geothermal/Oil and Gas Leasing in the Fort-Churchill, Clan-Alpine Area, 1974.

The ten areas proposed for geothermal leasing are in western Nevada within the management area of the BLM CCFO. Most of the proposed lease areas are in the Great Basin, in areas characterized by flat valley bottoms, playas, or low, rolling arid terrain. The predominant vegetation in these areas is greasewood and shadscale. Three of the lease areas, Steamboat, North Aurora and South Aurora, are along the eastern fringe of the Sierra Nevada Mountains and are characterized by more vegetation, including Jeffrey pine, pinyon, and juniper.

Resources Either Not Present or Not Affected by the Proposed Action

The following resources are either not in the area potentially affected by the proposed action or are present but would not be affected by the proposed action:

- Farmlands—no prime or unique farmlands are within the proposed lease areas.
- Public Health and Safety/Hazardous Materials—Various volatile working fluids for heat exchange turbines could be used in developing a power plant. The impacts of specific fluids used would be discussed in a supplemental NEPA analysis.

Resources Present and Brought Forward for Analysis

Based on recommendations of BLM resource specialists and issues raised during scoping, and the known occurrence of specific resources in the area, it has been determined that the following resources could be affected by the proposed action and are carried forward for analysis:

- Air quality;
- Land use;
- Soils/geology/minerals;
- Water resources (including floodplains);
- Vegetation/riparian habitat/invasive plant species;
- Wildlife/fisheries/migratory birds;
- Special status species (threatened or endangered plant or animal species);
- Cultural (including Native American consultation) and paleontological resources;
- Livestock grazing;

- Wild horses and burros;
- Visual resources;
- Recreation and special designations, including Areas of Critical Environmental Concern, Wilderness Study Areas and Wild and Scenic Rivers;
- Public safety and hazardous materials; and
- Socioeconomics and environmental justice.

The following sections of Chapter 3 provide an overview of the above resources within the ten lease areas.

3.1 AIR QUALITY

This section is a description of the regulations that protect the air quality of public land and the air quality in the region of influence (ROI) for the proposed action. The region of influence for air quality is the CCFO planning area.

Policies and Plans

Ambient Air Quality Standards

The US Environmental Protection Agency (EPA) has established national ambient air quality standards for several different pollutants, which are often referred to as criteria pollutants (ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, fine and inhalable particulate matter [$PM_{2.5}$ and PM_{10}], and lead). The EPA standards for each pollutant must not be exceeded. Nevada has the right to establish more stringent state or county standards but may not lessen the federal standards. With minor exceptions, Nevada ambient air quality standards must not be exceeded in areas where the general public has access. Table D-1 in Appendix D compares the national ambient air quality standards with those of Nevada. If a county meets the federal or state air quality standards it is considered to be in attainment.

Conformity Requirements

Section 176(c) of the Clean Air Act (CAA), 42 USC § 7506(c), requires federal agencies to ensure that actions undertaken in nonattainment areas are consistent with the CAA and with federally enforceable air quality management plans. The EPA has promulgated separate rules that establish conformity analysis procedures for transportation-related actions and for other (general) federal agency actions. The EPA general conformity rule applies to federal actions occurring in nonattainment areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified thresholds. The emission thresholds that trigger requirements of the conformity rule are called de minimis levels.

Regional Setting of the Carson City Field Office Planning Area

Climate and Meteorology

The planning area is in the intermountain west, which tends to be dominated meteorologically by recurring high and low pressure systems. Summer is often marked by stationary high pressure systems that develop over the region. These systems augment clear-sky conditions but also can result in large-scale stagnation of underlying air when light wind conditions persist. Winter weather conditions are influenced predominantly by transient storm systems. Precipitation in the vicinity of the planning area is limited because of the Sierra Nevada Mountains on the western edge, which act as a barrier. This barrier results in precipitation in the mountains to the west, rather than in the lowlands to the east. Precipitation in the planning area falls mostly from December through March. Winter precipitation is typically rain and snow from large-scale weather systems. Summer precipitation is rain, which is often the result of localized activity caused by solar heating, rising air, and associated thunderstorms.

Criteria Pollutants

All counties in the planning area, except for Washoe County, are in attainment for all criteria pollutants. Washoe County is a nonattainment area for carbon monoxide and PM_{10} standards in hydrographic area 87, which is in the southwestern portion of the county (USEPA 2006a, 2006b). The applicable de minimis levels for actions undertaken in all or part of Washoe County are 100 tons per year of carbon monoxide and 70 tons per year of PM_{10}.

3.2 LAND USE

This section is a discussion of the current land ownership and use within the ROI for each of the ten lease areas that are part of the proposed action. The ROI is the land area within and adjacent to potential lease areas.

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.

In the CCFO CRMP the BLM identifies management actions for twenty resources in the CCFO planning area (BLM 2001b). These resources include lands and realty, ROW corridors, and communication sites. Administrative actions and standard operating procedures are identified for the proper management of these resources. The CRMP contains specific guidance on withdrawn lands with respect to water resources and minerals.

A land use lease is an authorization to possess and use public land for a fixed period of time. A lease is issued when there is going to be substantial construction, development, and improvement and there is an investment of large amounts of capital that will be amortized over time. Leasing is proposed only on lands administered by the BLM or on other lands where the BLM has the express legal authority to lease with the concurrence of the other agency. On certain lands, the surface ownership is private or is owned by another nonfederal entity, while the BLM retains subsurface mineral ownership. These areas are known as "split-estate" lands. BLM lands are administered for multiple use, including wilderness, recreation, livestock grazing/wild horse management, and mining, which may be incompatible with geothermal uses. Lands within the proposed lease areas may be subject to a variety of land use authorizations. These authorizations cover a variety of improvements, including telephone lines, roads, power transmission lines, grazing improvements, and water pipelines. Most authorizations are nonexclusive, and therefore compatible rights can be granted.

Land use authorizations are issued for a variety of purposes, both short term and long term. Short-term uses include agricultural leases, military training areas, and other uses involving minimal land improvements or disturbances. Long-term uses include ROWs for power lines, highways, roads, pipelines, communication sites, electric power generation sites, irrigation, and sand and gravel sites.

Land use permits are authorized when uses of public lands will be short term and involve little or no land improvement, construction, or investment. Permits have been a method used to clear up unauthorized use, stipulating that the applicant remove or halt the unauthorized use and rehabilitate the land if necessary.

ROW authorizations include such uses as power lines, pipelines, roads, highways, and communications sites. ROW corridors are designated in the CRMP for the planning area. According to the CRMP, all applicants for ROW grants, whether or not they are within corridors, are subject to standard approval procedures, as outlined in the ROW regulations (43 CFR § 2802).

According to current BLM guidance and the President's National Energy Policy, the BLM objective is to continue to make BLM-administered land available for needed ROWs where consistent with national, state, and local plans and to group ROWs to minimize environmental impacts and proliferation of separate ROWs.

Nevada State Senate Bill 40 of 1983 also directs the BLM to give consideration to appropriate state, local, and tribal lands in the development of land use plans for federally administered lands. The BLM land use plans are reviewed for consistency with local policy plans for public lands and BLM land use plans are made compatible to the extent that the Secretary of the Interior finds consistent with federal law and the purpose of FLPMA.

The Washoe County Comprehensive Plan, including the relevant area and specific plans for the Steamboat lease area, guides development on private lands surrounding proposed lease areas. Energy production is considered a permitted use in open space and public areas under special use permit. The comprehensive plan specifically recognizes and encourages further use and development of geothermal resources in this area.

Regional Setting of the Carson City Field Office Planning Area

The geothermal lease areas are located throughout west-central part of Nevada and include land in Mineral, Washoe, Churchill, Nye, and Lyon Counties. The total lease area covers approximately 109,884 acres. Lands within and adjacent to potential lease areas are owned or administered by a variety of entities, including the BLM, USFS, BOR, USFWS, US Navy, DOD, the US Department of Energy (DOE), the State of Nevada, local agencies, Native American groups, and private interests. Land ownership within each of the ten lease areas is shown in general on Figure 1-1. BLM lands are administered for multiple uses, including wilderness, recreation, livestock grazing/wild horse management, and mining, which may be incompatible with energy development uses.

The USFS manages the Humboldt-Toiyabe National Forest in Washoe, Lyon, and Mineral Counties for multiple uses, including recreation, grazing, wildlife habitat, fisheries, watersheds, and heritage resource protection and interpretation. Dispersed recreation is the predominant sensitive use in this area. In accordance with the Steam Act, the BLM administers geothermal leasing on USFS lands, with the concurrence of USFS.

BOR has withdrawn land to the north and west of the Salt Wells lease area as part of the Newlands Project, which provides water for domestic, irrigation, and other uses. Access to features of the Newlands Project must be coordinated through BOR. No sensitive land uses are associated with the Newlands Project, although portions of the system are listed on the National Register of Historic Places (NRHP).

The USFWS manages the Stillwater National Wildlife Refuge (NWR), Fallon NWR, and Stillwater Wildlife Management Area (WMA), which are adjacent to the Salt Wells lease areas. The BLM cannot authorize leases within NWRs or WMAs, in accordance with the Geothermal Steam Act. The USFWS is proposing to modify and extend the boundaries of the Stillwater NWR.

There are few population centers within the ROI. The main population centers include Reno in Washoe County, Carson City and Fallon in Churchill County, and Hawthorne in Mineral County. Southern Washoe County is a heavily urbanized area that includes nearly half a million people and is one of the fastest growing areas in the nation. Shopping centers and subdivisions surround the Steamboat lease area. Other population centers include Fernley and Yerington in Lyon County and Hazen in Churchill County.

The Stillwater Range WSA and Job Peak WSA are near the Salt Wells lease area. WSAs are managed to preserve the wilderness characteristics, regardless of suitable or unsuitable recommendations by BLM field offices. Management objectives for wilderness emphasize managing areas recommended for wilderness designation as wilderness in the long run. Neither the Stillwater WSA nor the Job Peak WSA are recommended as suitable for wilderness designation. The former Burbank WSA near the Wabuska lease area has been designated as a scenic area. Also, the Steamboat lease area is in the vicinity of the Mount Rose Wilderness Area.

Lease Areas

Steamboat Lease Area, Washoe County

Geothermal leasing by BLM in the Steamboat area was modified by approval of the Southern Washoe County Urban Interface Plan Amendment (BLM 2001a). The plan amendment established that no future geothermal leasing would occur on public lands, except within or adjacent to the established Steamboat lease area. Lands proposed for leasing within or adjacent to the Steamboat lease area are managed by the BLM or USFS. While the BLM retains the right to develop leasable minerals on these lands, including geothermal resources, development would have to be compatible with surface land uses.

Land in and around the Steamboat lease area is the most urban of all the lease areas considered in this EA. Subdivisions of the greater Reno area extend south to the Steamboat lease area.

Surrounding lands are private or administered by the BLM, USFS, or the State of Nevada. Land uses in the area are varied and include residential developments, ranging from low- to high-density, and commercial uses. Several residential areas are next to land sections proposed for leasing. There are also educational facilities, including the Pleasant Valley Elementary School and the historic Galena Creek School. Much of the developed land in the Steamboat Springs lease areas is next to Highway 395 in Pleasant Valley and to the west of Steamboat Hills, along Jones Creek. Steamboat Valley, with what appears in aerial photographs to be primarily residential and agricultural land uses, is immediately to the north of the eastern Steamboat Springs lease area. Steamboat Springs proper is farther to the northeast of Steamboat Valley.

Land uses in the areas also include undeveloped, open space, and agricultural areas. There are several recreational areas, including the Pleasant Valley Park, Callahan Creek Park, and a golf course along Bordeaux Drive near Callahan Creek Park. The Whispering Pines Cemetery is also near Callahan Creek Park.

Four geothermal power facilities are operating in the Steamboat area. Another geothermal power facility operated by Caithness Sequais is at least 305 feet to the west.

Hazen Lease Area, Churchill and Lyon Counties

Both BLM and BOR lands are proposed for leasing in and around the Hazen lease area. BLM lands are managed for multiple uses, and BOR lands are withdrawn as part of the historic Newlands Project, features of which are listed in the NRHP. The Truckee Canal, part of the Newlands Project, traverses portions of the Hazen lease area, but is not one of the features listed in the NRHP (NV SHPO 2006). The State of Nevada administers certain lands within the lease area that are withdrawn by BOR, as part of the Fernley State WMA. The federal government retained the right to geothermal leasing on these lands.

Surrounding lands are private or are administered by the State of Nevada and are generally undeveloped open space and agriculture. The town of Fernley is approximately five miles west of the lease area. The Fernley WMA, managed by the Nevada Department of Wildlife (NDOW), is both within and north of the Hazen lease area. The Pyramid Lake Indian Reservation is approximately six miles northwest of the Hazen lease area.

Salt Wells Lease Area, Churchill County

Both BLM and BOR lands are proposed for leasing in and around the Salt Wells lease area. The BLM lands are managed for multiple use, and BOR lands are withdrawn as part of the Newlands water project. The Pony Express National Historic Trail is within the vicinity of the lease area but does not cross it. The Grimes Point Archaeological Area and the Fallon Indian Reservation are also in the vicinity but are outside the Salt Wells lease area. The Stillwater NWR is adjacent to and to the north of the lease area. Surrounding lands are mostly BLM, BOR, USFWS, and US Navy lands, with a few small inholdings of private land. The city of Fallon is approximately six miles northwest

of the lease area and NAS Fallon is immediately west of the proposed lease areas. Building structures over 50 feet is prohibited on Navy withdrawn land.

The Carson Lake Pastures area immediately west of the lease area was approved for sale to the State of Nevada in the Settlement Act, Pub. L. 101-618, for use as a WMA. Although the property has not been transferred to the state, BOR and the State of Nevada view this property as obligated under the Settlement Act, however, geothermal leasing is proposed and would not conflict with management objectives. Portions of several sections proposed for leasing are part of the Carson Lake Pastures area.

Lee Hot Springs Lease Area, Churchill County

The BLM manages lands proposed for leasing in the Lee Hot Springs area for multiple use.

Surrounding lands are mostly BLM, US Navy, and Walker Indian Reservation lands. The US Navy administers land immediately east of the proposed lease area as the B-19 training range. The Walker Indian Reservation is immediately south of the proposed lease area.

The Pony Express National Historic Trail passes north of the proposed lease area. Public lands surrounding the city of Fallon landfill were specifically identified for disposal for future expansion of the landfill in an amendment to the CRMP. This land use may preclude future leasing. Several proposed lease sections are Navy withdrawn lands. Development of structures in excess of 50 feet is prohibited on withdrawn lands.

North and South Aurora Lease Areas, Mineral County

Both BLM and USFS lands are proposed for leasing in the North and South Aurora areas. BLM lands are managed for multiple uses.

Grazing is the principle land use in this area, although small inholdings of private agricultural, mineral extraction, or open land are found within the federal lands proposed for leasing. The Chesco Gold Mine is partially within a tract proposed for leasing. This NRHP-listed Aurora Historic District and a wild horse area are within the South Aurora lease area.

Wabuska Lease Area, Lyon County

The BLM manages lands proposed for leasing in the Wabuska area for multiple use.

The BLM administers surrounding lands, or they are private. The Mason Valley WMA is approximately seven miles south of the lease area, and the Walker Indian Reservation is approximately four miles east of the lease area. A geothermal plant is in operation in the Wabuska area.

Hawthorne Lease Area, Mineral County

The BLM manages for multiple uses the lands proposed for leasing in the Hawthorne lease area. The BLM, USFS, or US Navy administers surrounding lands, or they are private.

There are no planning documents for Mineral County that designate surrounding land uses.

Gabbs Lease Area, Mineral and Nye Counties

The BLM manages lands proposed for leasing in the Gabbs area for multiple use. The BLM also administers surrounding lands, or they are private.

There are no planning documents for Mineral County or the portions of the Gabbs lease area in Nye County that designate surrounding land uses.

Wilson Canyon Lease Area, Lyon County

BLM and USFS lands are proposed for leasing in the Wilson Canyon area. The USFS manages most of the land within the Wilson Canyon lease area, where recreation, primarily off-highway vehicle (OHV) use, is the principle land use. BLM lands are managed for multiple uses. The BLM also administers surrounding lands, or they are private.

There are no planning documents for Lyon County that designate surrounding land uses.

3.3 SOILS, GEOLOGY, AND MINERALS

This section is an overview of regional and site-specific geology, soils, and mineral resources. Individual lease areas are discussed in further detail. The ROI for each lease area is the land within and adjacent to potential lease parcels. Figures 2-1 through 2-10, in the previous chapter, show topographic features of the study area described in this section.

Regional Geology

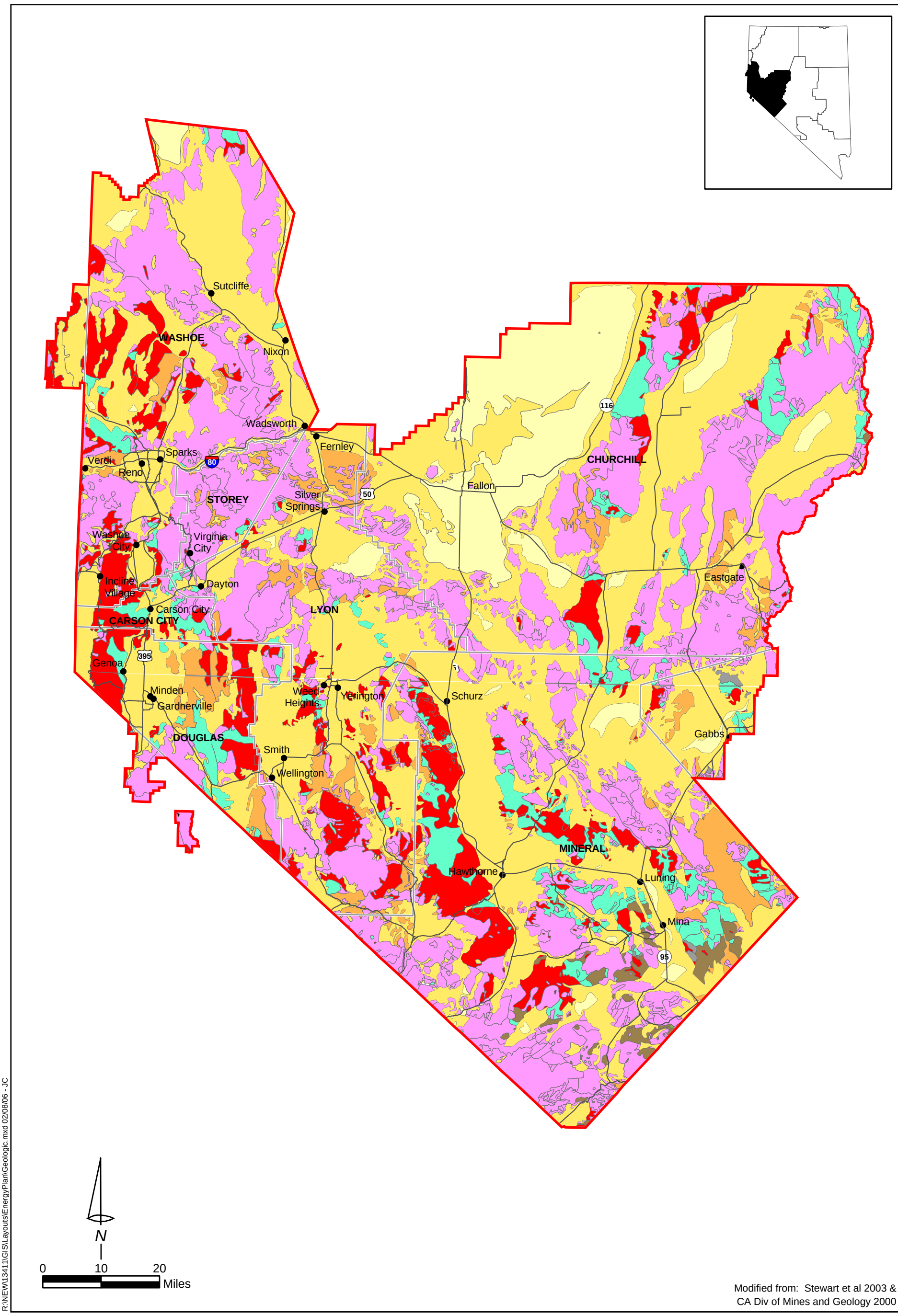
Almost all of the lease areas lie within the western part of the Basin and Range (or Great Basin) physiographic province. The Basin and Range province is characterized by discrete, north- or northeast-trending, fault-bounded mountain ranges, typically about 20 miles wide and less than 80 miles long, separated by narrow, deep, alluvium-filled valleys. Relief varies, but valleys typically have elevations of between 4,000 and 6,000 feet, while the mountain ranges typically have elevations of between 6,000 and 8,000 feet (Bonham 1969).

The faulting that formed the mountain ranges began relatively recently in geologic time (about 16 million years ago) and resulted from extension and thinning of the earth's crust in the region between the Sierra Nevada and Rocky Mountains. The crustal extension was accompanied by a large amount of volcanic activity, which has varied in character and intensity. Massive volumes of pyroclastic materials (volcanic ash that erupted with great violence, as in the 1980 eruption of Mount St. Helens in Washington) covered some areas of the Basin and Range province to depths of many hundreds of feet. These eruptions involved primarily rhyolitic materials, which has a mineral composition similar to granite. Later, as the molten rock (magma) gradually became depleted in the more volatile constituents and increased in iron and magnesium content, eruptions became less violent, and basalt lavas prevailed.

The extensional tectonic regime caused vertical block faulting, in which small blocks of crust dropped downward to create small basins, while adjacent blocks of crust tipped upward and formed ranges. The faulting exposed older Paleozoic layered sedimentary rocks in some of the ranges. The Paleozoic rocks include carbonate rocks (limestone and dolomite). Figure 3-1 is a geologic map of the CCFO, modified from the digital geologic map of Nevada (Stewart et al. 1978).

The region remained enclosed, with insufficient precipitation to create drainages that extended to the ocean for any significant length of time. Therefore, as the ranges eroded, the sediments filled the local basins, rather than being carried to the edge of the continent as occurred east of the Rocky Mountains. Many basins contain alluvial sediments thousands of feet thick.

During the last 100,000 years, the region was wetter than it is now, and the basins contained large lakes. Ancient shorelines of the Pleistocene lakes can still be seen high above the current valley floors in many basins. However, within the past 10,000 years,



Modified from: Stewart et al 2003 & CA Div of Mines and Geology 2000

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Legend

Carson City Field Office

County Boundaries

Geologic Units

Quaternary
- Alluvial
- Playa

Tertiary
- Volcanic
- Sedimentary

Mesozoic
- Plutonic, Volcanic
- Sedimentary (Includes some volcaniclastics and other sediments of volcanic origin)
- Uncertain

Paleozoic
- Sedimentary
- Ultramafic

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Geologic Map
CCFO Geothermal Leasing EA

Carson City Field Office, Nevada

Figure 3-1

the climate has become drier, and the Pleistocene lakes shrank. Over the long term, evaporation of the runoff that reached the basins resulted in precipitation of the mineral salts dissolved in the water, creating brines and salt deposits at the centers of the basins. In some basins, the lakebeds, or playas, are covered with the precipitated salts, inhibiting or preventing growth of vegetation.

Crustal extension and block faulting are ongoing, making the region seismically active. The thin crust means that molten rock is relatively close to the surface, at depths of just a few miles or less. In many areas groundwater is in contact with hot rock at relatively shallow depths, creating underground convection systems that circulate the groundwater and transfer heat to the surface. Hot springs are one of the surface manifestations of this natural heat transfer process.

In many locations, especially near fault zones where the rock is highly fractured and heat and groundwater move more freely through the rock, hot groundwater can be economically exploited for direct heating, or to create electrical energy. (See discussion of geothermal resources below.)

The circulation of heated, mineral-laden groundwater (hydrothermal fluids) through fractured rock has also resulted in precipitation and concentration of economic minerals, including gold, silver, copper, zinc, mercury, and many others.

The concentration of mineral salts in the basin sediments makes water quality poor in many basins. Typically, water quality decreases with depth near the basins, and potable supplies must be taken from basin margins or higher elevation valleys.

In many areas the block faulting of the ranges has exposed older rocks at the surface. The cores of most of the ranges in the planning area consist of granitic rocks resulting from the cooling and crystallization of rhyolitic magma deep below the surface during the age of dinosaurs (Mesozoic Era) and before the formation of the Basin and Range topography. Although less common in the plan area, some of the ranges contain exposures of the older rocks into which the granitic magma intruded. These occur, for example, in the north end of the Stillwater Range in Churchill County, and in several of the ranges at the southeast end of the planning area in Mineral County.

Steamboat Lease Area

Physiography

The Steamboat lease area is in the southern half of Washoe County, which is in the eastern edge of the Sierra Nevada, just west of the area dominated by typical Basin and Range topography. Relief varies, but valleys typically have elevations of between 4,000 and 6,000 feet, while the mountain ranges typically have elevations of between 6,000 and 8,000 feet (Bonham 1969). Relief in the Steamboat Springs area is about 6,400 feet (Thompson and White 1964). The lease area is in a structural trough, bounded on the east by the north-trending Virginia Range and on the west by the Carson Range and

Mount Rose. The center of the trough contains Steamboat Hills, a northeast-trending intensely faulted structure, tilted up along at least three systems of normal faults (Thompson and White 1964). Between Steamboat Hills and the Virginia Range are Pleasant Valley and Steamboat Valley, through which Steamboat Creek flows north to Truckee Meadows.

Geology

Most of the exposed rocks in Washoe County are Tertiary age or younger. Pre-Tertiary rocks occur in the southern portion of the county. Here, metamorphosed volcanic and sedimentary rocks of the late Paleozoic and middle Mesozoic are intruded by granitic rocks of late Mesozoic age (Bonham 1969). In the Steamboat Springs area, the basement rocks are deeply eroded and are overlain by thick Tertiary and Quaternary volcanic and sedimentary deposits. The oldest Tertiary volcanic deposits consist of rhyolite tuff, followed by Oligocene through Pliocene andesitic lavas and tuff-breccias of the Alta and Kate Peak formations. The volcanic deposits were overlain in places by freshwater sediments, including diatomaceous shale. These are in turn overlain by basalt lava flows and rhyolitic pumice deposits of the Pliocene-age Truckee Formation.

The area was uplifted, tilted more than 30 degrees, and deeply eroded during the late Tertiary. Volcanic eruptions of andesitic and basalt lava continued into the Pleistocene, with basalt and basalt andesite flows of the Lousetown Formation. The area was glaciated at least four times, leaving moraine deposits of glacial till (Thompson and White 1964).

The Steamboat Springs volcanic area includes six rhyolite domes. The western dome is about two miles south-southwest of Steamboat Hot Springs, a questionable dome underlies the hot springs, and four other domes are northeast of the springs. The southwest dome and one of the northeast domes are more than half a mile in diameter and nearly 500 feet in maximum relief (USGS 2002a).

The combination of shallow volcanism and abundant groundwater recharge created a hydrothermal system that circulated through the fractures in the rock, altering the rock and forming rich vein deposits, including gold and silver deposits of the Comstock Lode District. Virginia City, which was the center for development of the Comstock Lode, is in the Virginia Range southeast of the Steamboat lease area.

Seismicity

Many of the rangefront faults of the Steamboat Hills and the western margin of the Virginia Range have been active during Quaternary time and are considered to be currently active. Within a 20-mile radius of the project area there are more than 20 major Quaternary faults that may be capable of generating earthquakes of magnitude 6.6 or larger (dePolo et al. 1997). The nearest of these to the Steamboat lease area is the Eastern Reno Basin fault zone, which trends approximately north-south from the eastern margin of Steamboat Valley along the margin of Truckee Meadows to east of Sparks. The fault zone passes through the lease area. The nearest active fault on the west

side of the project area is the Mount Rose fault zone, which trends north-south about two miles west of the lease area. Both the Mount Rose fault zone and the Eastern Reno Basin fault zone are estimated to be capable of magnitude 7.1 and 7.0 earthquakes, respectively (dePolo et al. 1997).

The US Geological Survey estimates that there is about a five percent chance of the lease area experiencing a peak bedrock acceleration of between 40 and 50 percent of the acceleration of gravity due to an earthquake within the next 50 years in the project region, with the higher accelerations in the southern part of the region, near Washoe Lake (USGS 2006a). This is a moderately high bedrock acceleration. These estimates are for bedrock acceleration and do not account for amplification in unconsolidated sediments. Shaking intensity is likely to be stronger in areas underlain by unconsolidated sediments. Also, a shallow groundwater table can cause sandy sediments to liquefy during ground shaking. Liquefaction is a sudden loss of strength resulting from an increase in soil water pore pressure that causes sediments to become mobile and lose their ability to support weight. The area is in Seismic Zone 4 (the highest zone rating) of the Uniform Building Code (UBC).

Mineral Resources

The area has been intensely prospected because of its proximity to the Comstock Lode District to the east. The area yields a number of hydrothermal ore deposits, including lead, zinc, and silver (Union Lead Mine near the mouth of Galena Creek), gold (east side of Pleasant Valley, southeast of Little Washoe Lake, and near Steamboat Springs), silver (Steamboat Hills), and mercury (near Steamboat Springs and at the Wheeler Ranch on Evans Creek) (Thompson and White 1964). Hydrothermal mineralization is associated with faults and fractures and with hydrothermal fluids containing iron and arsenic sulfides. Disseminated tungsten ore is found southeast of Little Washoe Lake, where granitic rocks intrude limestone.

Soils

The main soil associations found in the main part of the lease area include Flex very gravelly sandy loam, Indiano-Duco-Cagle association, and Koontz gravelly and stoney loams. Almost all of the soils in the main part of the lease area consist of sandy loams, gravelly loams, and sandy loams. In the northern section the soils consist of Old Camp rock outcrop and boulder sandy loams. There are no areas classified as prime farmland in the lease area (USDA 2006a).

The Flex series soils are very shallow and shallow, well drained soils with very high surface runoff and moderate permeability (moderately high or high saturated hydraulic conductivity). The soils are formed in residuum weathered from altered andesite and metavolcanic rock. The Flex soils occur on hills and mountains with slopes of 8 to 50 percent. Flex soils are used for wildlife habitat, watershed, and urban development (USDA 2006b).

The Indiano-Duco-Cagle series consists of shallow, well drained soils with very high surface runoff and moderately slow permeability (moderately high saturated hydraulic conductivity). The Duco soils occur on structural benches, hills, and mountains with slopes of 4 to 75 percent. The soils formed in colluvium and residuum derived dominantly from volcanic rocks. Cagle soils are fine, moderately deep to paralithic contacts, and occur on adjacent south and west-facing slopes. These soils are used for forest land, rangeland, and wildlife habitat (USDA 2006b).

The Koontz series consists of shallow, well drained soils with high or very high surface runoff and moderately slow permeability (moderately high saturated hydraulic conductivity). These soils formed in residuum and colluvium derived from metavolcanic rocks. The Koontz soils occur on hills and mountains with slopes of 8 to 50 percent. Koontz soils are used for livestock grazing and wildlife habitat (USDA 2006b).

Hazen Lease Area

Physiography

The Hazen area straddles the border between Lyon County and Churchill County, the Virginia Range is to the south and west, and the Truckee Range is to the northwest. The lease area lies between the northern flanks of the Virginia Range and Highway 50. The lease area lies adjacent to the southern border of the Fernley State Wildlife Management Area. The area lies on the southwestern margin of the Carson Desert, which is described below for the Stillwater area.

Geology

The Hot Springs Mountains are underlain mainly by Pliocene basalt, andesite, and sedimentary deposits. Cinnabar Hill, in the northeastern part of the range, contains rhyolite and quartz diorite intrusions and is in the Desert Mining District, a gold and silver producing area. The Hot Springs Mountains are dominated by many high-angle northeast-trending faults that parallel the Midas Trough fault system, one of the three major fault systems that intersect in the Carson Desert (Maurer et al. 1994). The Midas Trough system is a zone of left-lateral faults that extends from near Carson City, through Idaho and into Montana and has been active for about 15 million years. The Dead Camel Mountains, south of the Hazen area, contain a broad exposure of Tertiary sedimentary pyroclastic (volcanic ash) deposits, intruded by Pliocene basalt flows. The Truckee Range is almost entirely composed of Pliocene basalt and is traversed by northeast-trending faults, similar to the Hot Springs Mountains.

Seismicity

The Hazen area is a seismically active area, cut by many young faults. Seismic potential of the region is similar to that described below for the Soda Lake lease area.

Mineral Resources

The west side of the Hot Springs Mountains is in the Leete Mining District, an area of salt and minor borax production. Metallic mineral deposits are apparently confined to

the northern Hot Springs Mountains, in the vicinity of Bradys Hot Springs, where hydrothermal mineral deposits, including mercury (cinnabar), silver, and gold, have been produced.

Soils

Between the Virginia Range and the Truckee Canal, the soil is almost all Biddleman association in the western part of the lease area and Celeton very cobbly sandy loam in the eastern part of the lease area (USDA 2006a).

The soils belonging to the Biddleman association occur in broad bands bordering uplands on high shoreline terraces with slopes of 0 to 15 percent.. The soils are about 60 percent Biddleman gravelly sandy loam. The Biddleman series consists of very deep, well drained soils with medium or high surface runoff and moderately slow permeability in the subsoil and very rapid permeability in the underlying sandy material. The soils are used for limited grazing and wildlife habitat (USDA 2006b).

The Celeton series consists of very shallow and shallow, well drained soils with very high surface runoff and moderately rapid permeability. The soils formed in colluvium derived from volcanic rocks over residuum weathered from diatomite. Celeton soils occur on hills and rock pediments with slopes of 2 to 50 percent. Celeton soils are used for livestock grazing and wildlife habitat (USDA 2006b).

The area north of the Truckee Canal is mainly "badlands", marsh and Parran silty clay. Parran soils are very deep, nearly level, and somewhat poorly drained soils that formed in clayey alluvium. They occur on low lake terraces and in basins. The soils are used for limited grazing. Badlands are large bands of moderately steep shorelines of ancient Lake Lahontan. The soils are severely eroded and highly alkaline and are generally barren of vegetation.

Immediately north of the canal are some minor areas classified as prime farmland if irrigated (Swingler sandy loam) surrounded by larger areas of land classified as prime farmland if irrigated and reclaimed of excess salts and sodium (USDA 2006a).

Salt Wells Lease Area

Physiography

The overall lease area is in the western part of the Basin and Range physiographic province. The Carson Desert is the largest intermontane basin in northern Nevada, about 70 miles long and ranging from 8 to 30 miles wide. The area lies within a shallow structural trough that trends to the northeast and slopes gently toward Carson Sink, a nearly flat salt-encrusted playa about 20 miles wide. The Salt Wells lease area consists of three smaller separated lease areas east of Fallon Naval Air Station, including the area northeast of the Harmon Reservoir, the east flank of the Lahontan Mountains and the Rainbow Mountains, and the eastern edge of Carson Lake.

Geology

The Carson Desert is underlain by Quaternary sand dunes and stream sediments, interbedded lake deposits of Pleistocene Lake Lahontan, and volcanic rocks that are about 1,000 feet thick. These form the principal shallow groundwater system. The basin fill deposits are in turn underlain by Tertiary and older igneous and sedimentary rocks. The Stillwater Range contains early to middle Mesozoic sedimentary rocks intruded by middle to late Mesozoic igneous rocks. The igneous intrusions resulted in volcanic eruptions during the Tertiary, creating andesitic lava flows, which were in turn covered by welded and nonwelded tuffs, which were followed by basalt flows. Northeast-trending faults run parallel to the Walker Lane fault system in the Salt Wells Basin and in the area west of the Bunejug Mountains. The Bunejug Mountains are primarily composed of Pliocene basalt, as are the Lahontan Mountains to the north.

The major uplift and block faulting that formed the ranges occurred during the late Tertiary and continued until as recently as about one million years ago (Morgan 1982). Two sets of Tertiary or younger faults are seen in the basin, the oldest trending generally northwest, which occurred during the Miocene, and a younger north to northeast-trending set, which probably occurred since the late Pliocene and which is still active. The most recent major episode of faulting occurred in the late Pleistocene. The intersections of the older and younger faults are thought to be zones of high fracture permeability that may be conducive to formation of a geothermal reservoir (Morgan 1982).

Lake Lahontan, which covered a large portion of Churchill and Mineral Counties, rose and receded in a number of episodes in response to glacial cycles. Basins alternately filled with water and then dried out, causing lakes to merge and separate, and leaving evidence of the lake levels in erosional terraces on the margins of the basins. During wet periods deposits tended to be dominated by silts and clays, but during dry periods sand dunes and coarser alluvium would dominate. Throughout the period, volcanic eruptions continued, some of the volcanic material being deposited in the water and some when the water had receded. Thus, a wide range of sedimentary deposits is complexly interbedded in the basin.

Seismicity

The US Geological Survey estimates that there is about a 95 percent chance that peak bedrock acceleration in an earthquake would exceed 30 to 40 percent of the acceleration of gravity within the next 50 years in the project region (USGS 2002b). This is a moderately high bedrock acceleration. Ground shaking could be more intense in areas underlain by unconsolidated basin fill materials. The area is in Seismic Zone 4 (the highest zone rating) of the UBC.

Mineral Resources

Most of the lease area is underlain by basin fill deposits. No significant metallic ore deposits have been identified, and the area does not contain any important nonmetallic mineral deposits, such as sand, gravel, and salt.

Soils

In the smaller lease area northeast of the Harmon Reservoir, the dominant soils are the Appian clay, Bunejug-Erber clay loams, marshland, and Isolde fine sand (USDA 2006a). The Appian series consists of very deep, well-drained soils with low or medium surface runoff and moderately slow permeability in the subsoil and rapid permeability in the underlying sandy material. Appian soils occur on lake plains, alluvial flats, and basin-floor remnants with slopes of 0 to 2 percent. They formed in alluvium derived from mixed rocks over lacustrine sediments. Appian soils are used for livestock grazing, irrigated agriculture, and wildlife habitat. Alfalfa and small grains are the principal irrigated crops (USDA 2006b).

Bunejug soils are poorly drained, with very slow runoff and moderate permeability. Most of these soils have altered drainage and are now somewhat poorly drained. Bunejug soils occur on smooth, nearly level floodplains at elevations of 3,850 to 3,950 feet with slopes of less than one percent. These soils formed in moderately coarse alluvium from mixed rock sources. Bunejug soils are used for alfalfa, small grains, corn silage, and pasture when irrigated. The Natural Resource Conservation Service (NRCS) classifies the Bunejug-Erber clay loams as prime farmland if irrigated and reclaimed of excess salts and sodium (USDA 2006b).

The Isolde fine sands occur in lesser amounts in the eastern portion of the lease area. The Isolde series consists of very deep, excessively drained soils with negligible to low surface runoff and very rapid permeability. The soils formed in eolian sand derived from mixed rocks. Isolde soils are on dunes with slopes of 0 to 30 percent. The dunes are semistabilized by vegetation and are superimposed over various other landforms of intermontane basin landscapes. Isolde soils are used for rangeland and wildlife habitat (USDA 2006b).

Slightly saline to strongly saline soils often border lake basins in this region. The soils can be farmed if reclaimed of excess salts and sodium, but this is a lengthy process due to their slow permeability. Small areas with soils classified as prime farmland if irrigated (Dia loam) occur in the northwestern corner of the southwestern part of the lease area. Other minor areas throughout this part of the lease area are classified as prime farmland if irrigated and reclaimed of excess salts and sodium. In the northeastern part of the lease area, the northern edge and northeastern corner contain small areas classified as prime farmland if irrigated (Dia loam, Dithod loam, and East Fork clay loam). Other areas throughout this part of the lease area are classified as prime farmland if irrigated and reclaimed of excess salts and sodium (USDA 2006a).

The smaller lease area on the eastern flank of the Lahontan Mountains is dominated by Labou-Rock outcrop with Bango-Stumble association, Biddleman association, and the Pirouette-Osobb association soils. The Rainbow Mountains are dominated by the Revaze-Singatse-Rock outcrop (USDA 2006a).

The Bango-Stumble soils consists of very deep, well drained to somewhat excessively drained soils with negligible to slow surface runoff and moderately slow to rapid permeability. They are formed in alluvium over lacustrine deposits. Bango soils are on smooth lake terraces and have a sandy loam surface layer, underlain by cobbley or gravelly sandy loam and by strongly alkaline sandy and silty loam. Stumble soils are formed on alluvial fans that have encroached on Bango soils. The soils are suitable for livestock grazing and wildlife habitat. The soils can produce alfalfa, pasture, and grains, if irrigated, but they are not classified as prime farmland (USDA 2006b).

Biddleman association soils are discussed in detail above.

The Pirouette-Osobb association consists of nearly level to moderately steep soils in large areas of rolling uplands. The soils are generally shallow (about 20 inches), well drained, stony sandy loam to cobbley clay loam, derived from tuffs and basalts and including areas of rock outcrop. Average annual precipitation is about five to seven inches. The soils are used for grazing and wildlife habitat.

Between the Lahontan and Rainbow mountains at the north end of the lease area lie Churchill-Playas complex soils. Isolde-Parran-Appian association, Playas, and Hawsley sand soils occur along the southern edge of the Lahontan and Rainbow mountains (USDA 2006a).

The Churchill series consists of very deep, moderately well drained soils with very high surface runoff and very slow permeability. The soils formed in alluvium over lacustrine deposits derived from mixed rocks. Churchill soils occur on lake terraces with slopes of 0 to 2 percent. Churchill soils are used for rangeland and wildlife habitat (USDA 2006b). Playa soils occur on nearly level basin floors and consist of clayey material that ranges from sand to clay and are strongly alkaline. Drainage is poor and water tends to pond on the soils. They are generally barren of vegetation (SCS 1975).

East of Carson Lake there is marsh, badland, and Isolde Parran complex then Labou-Rock outcrop complex and Biddleman then Playas farther to the east. The northern part of Carson Lake is dominantly Erber clay, Pelic clay, and Bunejug sandy loam with some marsh (USDA 2006a).

The characteristics of Isolde, Parran, Biddleman, and Bunejug soils and playas are described above. The Erber series consists of very deep, poorly drained with very slow runoff and rapid permeability unless restricted by underlying lacustrine beds. The water table is at or near the surface mainly during the spring, unless drained. The drainage has been altered in most areas of these soils and such areas are somewhat poorly drained. The Erber soils are formed in mixed sandy and loamy alluvium from dominantly granitic, basalt, and andesitic rocks. They occur on flood plains at elevations of 3,800 to 4,000 feet with slope gradients of less than 1 percent. Most of these soils are cultivated and are in irrigated pastures. The NRCS has classified the Erber loam as a prime farmland if irrigated (USDA 2006b).

The Pelic series consists of very deep, very poorly drained with negligible surface runoff and very rapid permeability. These soils are susceptible to frequent ponding for long duration from February through May with water up to 1.0 foot deep. These soils are susceptible to frequent flooding for long periods between April and October. The soils formed in alluvium derived from mixed igneous rocks. Pelic soils occur on flood plains and oxbows with slopes are 0 to 2 percent. Pelic soils are used for livestock grazing and wildlife habitat (USDA 2006b).

Small areas north of Carson Lake are classified and prime farmland if irrigated (Erber loam and Bunejug sandy loam). Almost half of the area north of Carson Lake is classified as prime farmland if irrigated and reclaimed of excess salts and sodium (USDA 2006a).

Lee Hot Springs Lease Area

Physiography

The Lee Hot Springs lease area is in southwestern Churchill County, just south of the Carson Desert, in the Basin and Range physiographic province. The western margin of the lease area is on the east flank of the Desert Mountains, the northeast margin of the lease area is bounded by White Throne Mountain, and the central and southeastern portion of the lease area overlies the northern margin of Rawhide Flats. This is a closed saline basin, containing a playa lake, and includes the northwestern limb of the Blow Sand Mountains.

Geology

The Desert Mountains are an east-trending range. The oldest rocks exposed in the range are Miocene rhyolites, overlain by dacite flows, which are in turn overlain by basalt and andesite as young as Pliocene age (Willden and Speed 1974; Stewart and Carlson 1978). White Throne Mountain is a low mainly volcanic hill south of Carson Lake. The mountain has been mapped as mostly basalt of the Bunejug Formation (north of the lease area) overlying Eagles House Rhyolite (within the lease area), of late Tertiary age (6 to 17 million years old) (Stewart and Carlson 1978). The Blow Sand Mountains are a low range of mostly volcanic rocks. The rocks exposed in the lease area are Pliocene age basalt, but the range is underlain by pre-Tertiary marble, granodiorite, and quartz diorite (Willden and Speed 1974).

Seismicity

The US Geological Survey estimates that there is about a five percent chance of the lease area experiencing a peak bedrock acceleration of between 30 and 40 percent of the acceleration of gravity due to an earthquake within the next 50 years in the project region (USGS 2006a). This is a moderate bedrock acceleration. These estimates are for bedrock acceleration and do not account for amplification in unconsolidated sediments. Shaking intensity is likely to be stronger in areas underlain by unconsolidated sediments or areas with a shallow groundwater table. The area is in Seismic Zone 4 (the highest zone rating) of the UBC.

Mineral Resources

Mineral deposits in the Desert Mountains include Pliocene diatomite and a large perlitic flow near the top of the rhyolite sequence. The diatomite has been mined to some extent, but the perlite has not been developed (Willden and Speed 1974). Perlite deposits are present in the White Throne Mountains, but most of the deposits are reportedly buried beneath thick volcanic flows. Most mining has been done outside the lease area. The nearest large-scale mining is in the Holy Cross Mining District, south of the lease area.

Soils

The land west of Highway 95 in the lease area is generally upland sloping and rocky, while east of Highway 95 it is on the basin floor. The soils reflect these differences. West of Highway 95 the soils tend to be rocky, while east of Highway 95 they are finer and contain a higher percentage of clays. At the south end of the lease area the soil belongs predominantly to the Isolde-Pirouette-Hawsley association. These soils are found on slopes of up to 30 percent, in areas with precipitation of about six inches per year. Most of the soils are sandy. Isolde soils are formed on stabilized dunes, and Hawsley soils are formed on wind-deposited sand sheets. Pirouette soils are stony, very fine sandy loam, formed in residuum and colluvium derived from volcanic (basalt) rocks. The soils are well drained, moderately to highly permeable, and slightly to strongly alkaline. They are used mainly for wildlife habitat and grazing (USDA 2006b). Adjacent to and east of Highway 95, in the southern part of the lease area, are soils of the Isolde-Parran-Appian association (north) and of the Hawsley-Isolde association (south). As described above, the Isolde and Hawsley soils are both formed on loose wind-deposited sands and are permeable and well drained. The Parran and Appian soils are also formed from fine sandy parent material. Parran soils are formed on stabilized dunes. Appian soils are very deep and well drained and are formed in loamy alluvium over sandy lake sediments. Typically, the surface is sandy loam, underlain by friable clay loam (USDA 2006b). The Isolde-Parran-Appian soils cover the margins of Rawhide Flats.

In the northwestern part of the lease area are soils of the Old Camp-Mirkwood-Nemico association in upland areas to the west, with Pirouette-Osobb-Rock Outcrop association in the center, and Biddleman association soils on the east, nearest the highway. There is also a small band of Singatse-Rock Outcrop association soils in the northwest corner, bounded on the north and south by Buckaroo-Bluewing association soils. The Old Camp-Mirkwood-Nemico soils are shallow (12 to 16 inches) and well drained and are formed on colluvium derived from volcanic rocks, on a range of slopes from shallow to very steep. The clay content ranges from about 25 to 45 percent. The Old Camp soils are more gravelly, and the Nemico soils tend to be more clayey. These soils are primarily used for wildlife habitat and rangeland (USDA 2006b).

Pirouette-Osobb soils are shallow to very shallow soils that formed in colluvium derived from volcanic rocks. Pirouette soils overlie basalt, and Osobb soils overlie rhyolite tuff, at depths of about 18 to 20 inches. They are well drained and have medium to high

runoff and moderate permeability. Biddleman soils are very deep well-drained soils that formed on alluvium derived from coarse beach terrace sediments deposited over saline lake sediments. They consist of stratified sand and gravel, containing about 70 to 80 percent rounded pebbles at depths of from about eight inches to five feet (USDA 2006b).

Singatse soils are very shallow gravelly loams that form in colluvium derived from volcanic rocks. Depth to andesite bedrock is about 4 to 10 inches. The Buckaroo-Bluewing soils are very deep well-drained soils that formed in alluvium derived from mixed volcanic rocks. Bluewing soils are sandier, and Buckaroo soils are finer and clayier. Both soils contain increasing amounts of pebbles with depth (USDA 2006b).

East of Highway 95 in the northern portion of the lease area Hawsley-Appian-Ruhe association predominates on the valley floor, with scattered islands of Singatse-Rock Outcrop association. The Hawsley soils are sandy and formed on sand sheets. Appian soils are fine and sandy. The Ruhe series consists of shallow well drained soils that formed in wind-deposited sand and alluvium derived from mixed rocks. Ruhe soils are on lake terraces and beach terraces with slopes of 0 to 15 percent (USDA 2006b).

North and South Aurora Lease Areas

Physiography

The lease area includes two separate lease areas, North Aurora and South Aurora. North Aurora straddles the border between Lyon and Mineral County near the border with California. Rough Creek bisects the lease area from southeast to northwest before joining East Walker River.

The South Aurora lease area includes Aurora Crater, which is about 7,500 feet in elevation, and Aurora Peak. To the southeast is Mount Hicks. Aurora Peak and Mount Hicks are both under 9,800 feet in elevation. The lease area includes the eastern slopes of the Brawley Peaks. Mud Spring is in the northern part of the study area, northeast of the crater, along Mud Spring Creek, which issues from Mud Spring Canyon east of the study area. Drainage is generally toward the northwest, toward the East Walker River. The Aurora Crater area lies within the Walker Lane, one of the three major fault systems in west-central Nevada. The Walker Lane is a system of northwest-trending right-lateral strike-slip faults that is about 80 to 120 miles wide and extends about 400 miles along the California border from near Las Vegas to northwest of Reno (Maurer et al. 1994). The fault system has been active for the past 15 million years.

Geology

The Aurora Crater geothermal area is in the Aurora-Bodie volcanic field, situated between the Sierra Nevada and the Great Basin. The area is underlain by approximately 25 square miles of andesitic lavas, breccias, and ashflow tuffs, which erupted 8 to 15 million years ago (USGS 2002b). Andesite domes and flows 4.5 to 2 million years in age occur at Cedar Hill, to the south of the Aurora Crater, and in other areas in the field.

Pleistocene and younger (less than 10,000 years old) to late Holocene basaltic rocks form well-preserved cinder cones and flows cover approximately 30 square miles. The Mud Springs volcano, which is probably Pleistocene in age, consists of a steep-fronted bulbous flow surrounding a depressed vent area and a four-mile-long ridged flow, together creating a remarkably distinctive landform.

Aurora Crater is approximately seven miles west of Mud Springs volcano. It is a mile-wide breached crater that erupted approximately 250,000 years ago. The topography of the entire area has been covered by ash, probably erupted from the younger Mono Craters to the southwest. Gold and silver found in quartz veins in the Miocene (but not younger) volcanic rocks were mined until about 1950, with mining centers at Bodie, California, and Aurora, Nevada.

The Aurora Crater area is approximately 30 miles northeast of the Long Valley Caldera and the Mono-Inyo Craters Chain, south of Mono Lake, California.

Seismicity

The region of Aurora Crater is seismically active. It is northeast of the Long Valley Caldera, in California, part of a chain of volcanic centers near the California-Nevada border that includes the Inyo and Mono Craters.

The US Geological Survey estimates that there is about a five percent chance of the lease area experiencing a peak bedrock acceleration of between 40 and 50 percent of the acceleration of gravity due to an earthquake within the next 50 years in the project region (USGS 2006a). This is a moderate bedrock acceleration. These estimates are for bedrock acceleration and do not account for amplification in unconsolidated sediments. Shaking intensity is likely to be stronger in areas underlain by unconsolidated sediments or areas with a shallow groundwater table. The area is in Seismic Zone 4 (the highest zone rating) of the UBC.

Based on the frequency of eruptions along the Mono-Inyo Craters volcanic chain in the past 5,000 years, the probability of an eruption occurring in the Long Valley Caldera in any given year is somewhat less than one percent per year, or roughly one chance in a few hundred in any given year. This is comparable to the annual chance of a magnitude 8.0 earthquake (like the 1906 San Francisco Earthquake) along the San Andreas Fault in coastal California or of an eruption from one of the more active Cascade Range volcanoes in the Pacific Northwest, such as Mount Rainier in Washington or Mount Shasta in California.

During a typical explosive eruption of a Mono-Inyo vent, tephra (volcanic ash and larger rock fragments) may accumulate near the vent to a thickness of over 30 feet. Areas downwind of an explosive eruption could be covered with a layer of volcanic ash and pumice more than eight inches thick at a distance of 22 miles and two inches thick at 53 miles.

Records suggest that, annually, winds in the area blow toward an east or northeasterly sector more than 50 percent of the time and toward some easterly direction more than 80 percent of the time. In general, the grain size and thickness of ash accumulations gradually decrease with increasing distance from a vent (USGS 2002c, 2002d).

Mineral Resources

The lease area is in the old Aurora Mining District, later called the Esmeralda Mining District, after the Esmeralda gold vein. The town of Aurora, about two miles south of Aurora Crater, was the center of this mining activity and the largest town in Nevada in 1860. It is now a ghost town. There are many pits and adits south of the crater and several prospects elsewhere, adjacent to the crater. However, most of the significant epithermal gold deposits were shallow and easy to reach and were removed by the late 1800s. Recent gold and silver mines in the vicinity of the lease area include the Borealis Mine, north of Mud Spring Canyon, and the Chesco Mine, between Aurora Crater and Aurora Peak. Reclamation activities were successfully completed at the Borealis Mine in 1990 to clean up waste piles used in the cyanide heap leach process.

Soils

In North Aurora, the dominant soil associations are the Ravenhall-Harr-Rock outcrop; the Theon, Theon-Olac, Theon-Lapon-Olac, and Theon-Rock-outcrop-Old Camp group, the Loomer-Rowel-Wassit association; and the Wellsed-Mickey-Vect, Wellsed-Ravenell-Haar, and Wellsed-Wedlar group. Along short stretches of Rough Creek and along the East Walker River are narrow sections of soils classified as prime farmland if irrigated and reclaimed of excess salts and sodium (USDA 2006a).

In South Aurora, the western portion of the lease area includes the Aurora Crater. Soils on the crater are classified as Borealis-Rock Outcrop association. The Borealis soils are derived from volcanic ash and basalt and occur on slopes of up to 30 percent. The soils are moderately deep and well drained and have very fast runoff and very slow permeability. The A horizon consists of ashy sand loam, but the B horizon, at about one foot deep, is clayey.

To the east of the crater the predominant soil is Borealis-Antholop-Rock Outcrop association. The Antholop soil is a shallow well-drained soil on moderate slopes, formed in weathered basalt rock. The A horizon is a sandy loam, but the B horizon quickly becomes clayey and is indurated with silica cement at depths of more than 16 inches. The subsoil is gravelly to cobbley and alkaline.

Soils in the south-central part of the lease area are Nire Stony Fine Sandy Loam on 4 to 15 percent slopes. The Nire soils cover the south-facing slope of the crater.

Soils in the northern part of the lease area, on the north slope of the crater sloping down to the basin floor at the head of Mud Spring Canyon, are distributed in east-west bands that roughly parallel Mud Spring Creek. South of the spring is a patch of soils belonging to the Loomer-Rowel-Wassit association. North of that is a broad swath of soils of the

Antholop-Wedlar association. Just north of that is a longer band of soils belonging to the Wellsed-Mickey-Veet association. Farther north and away from Aurora Crater are soils of the Wellsed-Smedley-Mickey association. Small patches of other soils are also interspersed among these.

The Loomer-Rowel-Wassit soils are shallow (12 to 18 inches deep overlying bedrock) well-drained soils formed on weathered volcanic rocks, on slopes of 8 to 75 percent. Loomer and Rowel soils are extremely cobbley loams, with rapid runoff and slow permeability. Loomer soils contain more clay, and Rowel soils are sandier. Wassit soils are gravelly, rather than cobbley, sandy loam, and are less clayey than either the Loomer or Rowel soils (USDA 2006b).

Antholop soils are shallow and well drained and are formed on weathered basalt. They are found on plateaus with slopes of 2 to 15 percent. Alkalinity increases with depth, with increased cementation. At depths from about 16 to 60 inches the subsoil is silica cemented and contains about 60 percent cobbles and stones and 40 to 55 percent clay. Wedlar soils are very deep well-drained soils that form on weathered granitic rocks or welded tuff, on fans and inter-plateau basins. The clay content increases with depth to about three feet, ranging from loamy sand to loam, to sandy clay loam. The bottom three feet of the soil profile is massive, hard, gravelly sandy loam. Permeability of both soils is slow, and runoff is high (USDA 2006b).

Wellsed-Mickey-Veet soils are gravelly sandy loams that formed on predominantly granitic rocks with some volcanic rocks. Wellsed soils are moderately deep and formed on alluvial fans and piedmonts. Mickey soils are shallow, on slightly steeper slopes. Veet soils are very deep and formed on alluvial fans, piedmonts, and stream terraces. The Wellsed-Mickey-Vest soils are found in a band that generally follows the fall line of the slope below the mouth of Mud Spring Canyon.

The Wellsed-Smedley-Mickey soils are farther north of Aurora Crater and farther from the stream terrace deposits of Mud Spring Creek. In place of the deep Veet soil component, the association contains Smedley soils, which are shallow and overlie strongly cemented hardpan at 18 to 43 inches depth. Permeability is slow.

Wabuska Hot Springs Lease Area

Physiography

The Wabuska Hot Springs area is west of the north-flowing East Walker River, northwest of Yerington, in Lyon County. The area is at the north end of the floor of Mason Valley, bounded on the north by the Desert Mountains, on the east by the Wassuk Range, and on the southwest by the Singatse Range.

Geology

The lease area is almost entirely underlain by Quaternary alluvial basin fill deposits. The rocks exposed in the Desert Mountains to the north are primarily Pliocene basalts, cut

by northeast-trending high-angle faults. The basalts overlie Tertiary andesite flows and related rocks and tuffaceous sedimentary rocks (Stewart and Carlson 1978). Jurassic (Middle Mesozoic) shale, sandstone, and volcanoclastic rocks crop out on the valley floor to the east of the lease area.

The Desert Mountains are unusual in that they trend to the east and were uplifted primarily by folding rather than faulting and tilting, which is more common in the Basin and Range province. Landslides are common on the south flank of the Desert Mountains, where the basalt cover has slid over the underlying poorly consolidated Tertiary rocks.

Seismicity

The US Geological Survey estimates that there is about a five percent chance of the lease area experiencing a peak bedrock acceleration of between 30 and 40 percent of the acceleration of gravity due to an earthquake within the next 50 years in the project region (USGS 2006a). This is a moderate bedrock acceleration. These estimates are for bedrock acceleration and do not account for amplification in unconsolidated sediments. Shaking intensity is likely to be stronger in areas underlain by unconsolidated sediments or areas with a shallow groundwater table. The area is in Seismic Zone 4 (the highest zone rating) of the UBC.

Mineral Resources

The lease area is in the Yerington mining district, which includes the entire Singatse Range, the buttes in Mason Valley, and the northwestern Wassuk Range. The ore bodies in the Yerington District are primarily contact metamorphic replacement deposits in limey sedimentary rocks and porphyry copper deposits in plutonic rocks. Limestone crops out about two miles northwest of Wabuska. In the 1910s, a kiln operated here to produce lime from limestone (Moore 1969).

Soils

The principal soil type within the lease area is Parran silty clay loam, which occurs on low terraces and in basins. The soil is very deep, nearly level, somewhat poorly drained, strongly alkaline, and formed in clayey alluvium. Permeability is very slow, and runoff is very slow, creating ponding. The hot springs themselves are in soil classified as Dithod clay loam, wet—a very deep, poorly drained alluvial soil. The soil is strongly alkaline. The Parran soil is bordered by Orizaba soil, another strongly saline and alkaline soil similar to Parran soil. The Orizaba series consists of very deep, somewhat poorly drained soils that formed in mixed alluvium. The Orizaba soils are on alluvial flats, lake plains, floodplains and beach plains. Slopes are 0 to 2 percent. Closer to the Desert Mountains is Malpais soil and soils of the Rawe-Malpais association. The Malpais series consists of very deep, well-drained soils that formed in alluvium and colluvium from mixed rock sources. Malpais soils are on alluvial fans and colluvial slopes bordering mountains. Slopes are 2 to 75 percent. The mean annual precipitation is about seven inches and the mean annual temperature is about 8 degrees Celsius (47 degrees Fahrenheit). Rawe soils are deep soils that formed on fan remnants. On the west side of

the lease area is Theon very gravelly sandy loam, which occurs on 8 to 30 percent slopes. The Theon series is very shallow and shallow, well-drained soils that formed in residuum and colluvium derived from volcanic rocks (USDA 2006b).

Gabbs Valley Lease area

Physiography

The Gabbs Valley lease area in the north end of the alkali flat that makes up the northwestern part of Gabbs Valley. The lease area is bounded on the east by the Monte Cristo Mountains, the north by the Big Kasock Mountains and the northern end of the Black Hills to the southeast.

Geology

The lease area is entirely underlain by Quaternary playa and alluvial deposits with sand dunes in the north. These deposits were eroded from the Big Kasock Mountains to the north, the Monte Cristo Mountains to the east, and to a minor extent from the Black Hills to the south. The Big Kasock Mountains and the Black Hills are made up of Triassic volcaniclastic and volcanic rocks that have been intruded by Cretaceous-Jurassic granodiorite. The western slope of the Monte Cristo Mountains is underlain by Mesozoic metavolcanic rocks, mainly andesites, and Cretaceous-Jurassic diorite (Stewart and Carlson 1978; Tingley 1998).

The Hot Springs Fault Zone has range-front faults bounding the entire west front of the Monte Cristo Mountains and the east front of Black Hills and includes piedmont and intrabasin faults in Gabbs Valley west of the Black Hills and the faults of Fissure Ridge. The 1954 Fairview Peak earthquake reportedly ruptured most of the short faults north of the border between Mineral and Nye Counties. Some of the faults are expressed as northeast- and southwest-facing scarps on upper Quaternary alluvial and Holocene basin-fill deposits at Black Hills and to the west, and along the southern Monte Cristo Mountains. The fault bounding the east front of the Black Hills exhibits right-oblique-normal displacement of a Mesozoic granodiorite pluton (USGS 2006b).

Seismicity

The US Geological Survey estimates that there is about a five percent chance of the lease area experiencing a peak bedrock acceleration of between 30 and 40 percent of the acceleration of gravity due to an earthquake within the next 50 years in the project region (USGS 2006a). This is a moderate bedrock acceleration. These estimates are for bedrock acceleration and do not account for amplification in unconsolidated sediments. Shaking intensity is likely to be stronger in areas underlain by unconsolidated sediments or areas with a shallow groundwater table. The area is in Seismic Zone 4 (the highest zone rating) of the UBC.

Mineral Resources

Because most of the lease area is underlain by playa and basin fill consisting of sandy or clayey deposits, there are few significant mineral resources within the lease area.

Historical information indicates a mercury property, west of Ramsey Spring, and some gold mining from a property four miles south of Rawhide Hot Springs (Tingley 1998).

Soils

In the northeastern part of the lease area, the soils on the western slope of the Monte Cristo Mountains are made up of the Unsel-Annaw-Izo association. Farther down the western slopes out onto the flat area the soil are the Luning-Hawsley-Bluewing and the Isolde-Hawsley associations (USDA 2006a).

The Unsel soils are on the fan remnants and fan skirts on the higher steeper slopes. The Annaw and Izo soils are on the lower (4,000 to 6,000 feet) alluvial fans, fan piedmonts, and fan skirts with slopes between 0 to 15 percent. The Izo soils are predominantly in the drainageways and on inset fans and fan skirts. The Unsel-Annaw-Izo association soils were formed in alluvium derived from mixed rocks. The Unsel soils are well drained with medium or high surface runoff and moderately slow permeability in the subsoil and rapid permeability in the lower part of the substratum. Annaw soils are somewhat excessively drained with slow to medium runoff and moderately rapid permeability. Izo soils are excessively drained with very low or low surface runoff and rapid permeability (high or very high saturated hydraulic conductivity) (USDA 2006b).

The Luning and Bluewing soils occur on fan aprons, fan skirts, inset fans, alluvial flats, alluvial fans, beach plains, and fan piedmonts with the Luning soils occurring on lesser (0 to 8 percent) slopes. The Luning soils also occur on sand sheets. The Bluewing soils occur on slopes of 0 to 8 percent but are as high as 30 percent on side slopes of deeply dissected fan-piedmont remnants. The Hawsley soils occur only on sand sheets. The Luning soils are very deep, somewhat excessively drained soils with low surface runoff and rapid permeability that formed in alluvium or eolian sand over alluvium derived from mixed rocks. The Hawsley soils are very deep, somewhat excessively drained soils with negligible to low surface runoff and very rapid permeability that formed in alluvium and water reworked eolian sand derived from mixed rocks. The Bluewing soils are very deep, excessively drained soils with slow runoff and very rapid permeability that formed in very gravelly, sandy alluvium derived from mixed rock sources. The Isolde soils occur on dunes and consist of very deep, excessively drained soils with negligible to low surface runoff and very rapid permeability that formed in eolian sand derived from mixed rocks (USDA 2006b).

All of these soils are used for rangeland and wildlife habitat.

The soils of the fans on the inset fans, alluvial flats, fan piedmonts, fan skirts, alluvial fans and alluvial plains on the southern side of the Bid Kasock Mountains belong to the Gynelle series, which are very deep, somewhat excessively drained soils with medium runoff and rapid permeability that formed in mixed alluvium from rhyolite, andesite and minor amounts of basalt and granite. The soils are mainly used for livestock grazing. Farther down slope lie the Wabuska soils on the on alluvial flats and lake plains with some Isolde sands (see description above) (USDA 2006a). The Wabuska soils formed in

loamy alluvium from mixed igneous and sedimentary rocks. The alluvium has been modified by sodium precipitated from upward moving ground water. These soils are somewhat poorly drained (the soil has a seasonal high water table at 36 to 60 inches) with very slow runoff and moderate permeability. The soils are used for rangeland and irrigated cropland (USDA 2006b).

In the southern part of the lease area on the other side of the playa the soils consist of Dedmount, Slaw, and Nuyobe soils sloping down to the playa floor (USDA 2006a). The Slaw and Nuyobe soils occur on alluvial flats, drainageways, lake plains, and low stream terraces with the Slaw also occurring on basin floors, floodplains and floodplain playas. The Dedmount soils occur on alluvial flats and dissected lake plains. The Dedmount soils formed in mixed alluvium and lacustrine sediments. These soils are very deep, moderately well drained with negligible to high runoff and slow permeability used mainly for livestock grazing and wildlife habitat. The Slaw soils formed in alluvium over lacustrine deposits derived from mixed rock sources. These soils are very deep, well drained with negligible to high runoff depending on slope and landform and slow permeability. These soils are occasionally flooded unless protected by flood control structures. Slaw soils are used mainly for livestock grazing and wildlife habitat. They are also used for limited irrigated cropland and for urban development. The Nuyobe soils formed in lacustrine sediments from mixed rock sources and volcanic ash. These soils are very deep, poorly drained with ponded or slow runoff and moderately slow permeability. The soils are suitable for rangeland and wildlife habitat (USDA 2006b).

In the southeastern part of the lease area, the Gynelle-Izo and Slaw-Isolde-Cirac associations occur below the rock outcrop on top of the northern end of the Black Hills. The Oricto-Gynelle-Izo association lies on the eastern slopes below the rock outcrop on the west side of Fissure Ridge. The Singatse-Hawsley association lies on the on the eastern slopes of the ridge (USDA 2006a).

The Gynelle, Slaw, Isolde, Singatse, and Hawsley soils are described above. The Izo soils occur on drainageways, inset fans, and fan skirts with slopes of 0 to 15 percent and are formed in recent alluvium derived from mixed rocks. These soils are very deep, excessively drained with very low or low surface runoff and rapid permeability (high or very high saturated hydraulic conductivity). Izo soils are used for rangeland and wildlife habitat. The Cirac soils occur on alluvial flats, lake plains, lagoons, fan skirts, inset fans and axial stream terraces with slopes of 0 to 4 percent. The Cirac soils formed from mixed alluvium are very deep and well drained, with slow runoff and moderately rapid permeability. The soil is suitable for rangeland (USDA 2006b).

Hawthorne Lease area

Physiography

The lease area is in west central Mineral County three to five miles west of the town of Hawthorne. The Hawthorne Ammunition Depot lies to the north and east. The lease area is on the lower eastern slope of the Wassuk Range north of Corey Creek. The lease

area ranges in elevation from 7,000 feet to 4,250 feet sloping down to the northeast. The northeast portion of the lease area is part of the southern Walker Lake Valley.

Geology

The lease area is entirely underlain by Quaternary alluvial deposits eroded from the Wassuk Range to the west. The Wassuk Range in the vicinity of the lease area is underlain by Jurassic/Cretaceous granitic rocks, which range in composition from granodiorite to granite and intrude the older diorite (Stewart and Carlson 1978; Tingley 1998).

The Wassuk Range Fault Zone is a long, prominent fault zone that bounds the east side of the Wassuk Range and of Anchorite Hills. Together the Wassuk Range and the Anchorite Hills define a west-tilted structural block. The Wassuk Range fault zone is generally considered to have predominately normal movement. The range-front faults juxtapose Quaternary piedmont-slope deposits against bedrock along the abrupt, precipitous front of the Wassuk Range that, in the vicinity of Mt. Grant (to the north of the lease zone), exceeds 6,500 feet of topographic relief (USGS 2006c).

Seismicity

The Wassuk Range Fault Zone has been active during Quaternary time and is considered to be currently active.

The US Geological Survey estimates that there is about a five percent chance of the lease area experiencing a peak bedrock acceleration of between 40 and 50 percent of the acceleration of gravity due to an earthquake within the next 50 years in the project region with higher accelerations to the south (USGS 2006a). This is a moderately high bedrock acceleration. These estimates are for bedrock acceleration and do not account for amplification in unconsolidated sediments. Shaking intensity is likely to be stronger in areas underlain by unconsolidated sediments or areas with a shallow groundwater table. The area is in Seismic Zone 4 (the highest zone rating) of the UBC.

Mineral Resources

Because most of the lease area is underlain by basin fill consisting of sandy or clayey deposits, there are few significant mineral resources within the lease area. The lease area is east of the Mt. Grant mining district. The eastern part of the district was closed to the pubic in 1927 as part of the Hawthorne Ammunition Depot withdrawn area. Many of these old workings in the withdrawn area were idle long before that time. The Big Indian Mine, outside the withdrawal boundary to the south, (west of the lease area) has not been active since before 1936. No activity was in evidence anywhere in the district in June 1989.

Soils

The principal soils in the lease area are the Bijora-Petspring association on the slopes and the Inmo soils on the lower flatter areas (USDA 2006a). The Bijora series consists of moderately deep, well-drained soils that formed in residuum on rock pediment

remnants and hills. The Bijora soils are on found on rock pediment remnants and hills with slopes of 8 to 30 percent. The Petspring series consists of very shallow, well-drained soils that formed in residuum and colluvium from highly weathered granodiorite on mountains, hills and pediments. The Petspring soils are found on mountain backslopes, hills, and rock pediment remnants with slopes of 15 to 75 percent. Both soils are well drained, with medium runoff and moderately rapid permeability. They are both suitable for rangeland and wildlife habitat. The Inmo soils consist of very deep, excessively drained soils that formed in alluvium derived from granitic, volcanic, and metamorphic rocks. They occur in alluvial fans, inset fans, fan skirts, fan piedmonts, beach plains, and in drainageways with slopes from 0 to 15 percent. These soils are nonflooded to frequently flooded. Inmo soils are used for rangeland and wildlife habitat (USDA 2006b).

In the northwestern part of the lease area, the higher slopes consist of Downeyville-Gabbvally association, with Itme association and Inmo association on the lower slopes and the flatter areas, respectively (USDA 2006a). The Downeyville and Gabbvally series consists of very shallow and shallow, well-drained soils that formed in residuum and colluvium derived from volcanic rocks. They are both found on hills, mountains, rock pediments, plateaus, and mesas with slopes of 2 to 75 percent. They are both well drained with very high surface runoff and moderate permeability. The soils are suitable for rangeland and wildlife habitat (USDA 2006b).

The Itme series consists of very deep, excessively drained soils that formed in alluvium from dominantly granitic or welded tuff rock sources. The Itme soils are found on fan piedmonts, alluvial fans, fan skirts and drainages with slopes of 0 to 15 percent. The soils are excessively drained, runoff is slow runoff, permeability is very rapid. The primary use is for rangeland (USDA 2006b).

Wilson Canyon Lease area

Physiography

The lease area is in the western edge of Mason Valley on the eastern slope of the northern Pine Grove Hills. The lease area is southwest of Wilson Canyon where the West Walker River cuts through the pass between the Singatse Range and the Pine Grove Hills.

Geology

The Pine Grove Hills are underlain by large masses of Cretaceous granodiorite that have been intruded locally by dikes and larger masses of granitic porphyry. These rocks form the lower slopes in the western part of the lease area. In the vicinity of the lease area, a thick succession of andesitic flows and breccias overlie the granitic rocks. Above these rocks, predominantly west-dipping Tertiary sedimentary strata overlie all of the older rocks on the northwestern and eastern flanks of the Pine Grove Hills. South of Wilson Canyon, these sedimentary rocks are probably more than 3,000 feet thick and are

composed mainly of channeled stream deposits with some interbedded lacustrine material (Tingley 1998).

Structurally, the Pine Grove Hills area forms a west-tilted fault block. The contact of Tertiary volcanic rocks and granodiorite exposed along the east flank of the Pine Grove Hills is highly sheared, brecciated, and altered. The structures exposed there suggest that this contact may represent the margin of a large volcanic center, or caldera, to the west (Tingley 1998). The Singatse Range fault zone is a predominately north-striking normal fault zone along the east side of the Singatse Range. This predominately north-striking range front fault bounds the east side of Singatse Range. The fault is continuous from near Wilson Hot Springs north across the lease area along the west edge of Mason Valley to west of Yerington and continues discontinuously to north end of the range. There is Quaternary alluvium generally in fault contact along the Singatse Range fault zone, with over 1,300 feet of Quaternary alluvium adjacent to the fault. The Singatse Range is a west-tilted mountain block that probably began tilting in Miocene. The westward tilting of the Mason Valley, related to down-to-the-east faulting along the Singatse Range fault zone, may be ongoing because the Walker River flows on the extreme west side of its Holocene floodplain, and Quaternary alluvium is westward-tilted adjacent to range front faults (USGS 2006b).

Seismicity

The Singatse Range Fault Zone has been active during Quaternary time and is considered to be currently active.

The US Geological Survey estimates that there is about a five percent chance of the lease area experiencing a peak bedrock acceleration of between 40 and 50 and 40 percent of the acceleration of gravity due to an earthquake within the next 50 years in the project region (USGS 2006a). This is a moderately high bedrock acceleration. These estimates are for bedrock acceleration and do not account for amplification in unconsolidated sediments. Shaking intensity is likely to be stronger in areas underlain by unconsolidated sediments or areas with a shallow groundwater table. The area is in Seismic Zone 4 (the highest zone rating) of the UBC.

Mineral Resources

The lease area is entirely mostly underlain by Quaternary playa and alluvial deposits. Mineralization within the Wilson district occurs in two general settings: skarn, replacement, and vein mineralization in Triassic and Jurassic metasedimentary and metavolcanic rocks; and vein mineralization following shear zones in granitic rocks. Most of the minerals occur on the western side of the Pine Grove Hills. Some old mines are indicated on the eastern slopes above the lease area. Minerals in the region include tungsten, molybdenite, lead-zinc-silver ore, and gold sliver bearing ore.

Soils

In the northern end of the lease area, the slopes on the east side of the Pine Grove Hills are topped by Theon rock outcrop. Downslope to the east and north are the Malpais and Cleaver soils. The Patna soils occur on flat valley floor (USDA 2006a).

The Theon soils occur on hills and mountains with slopes of 4 to 75 percent and are formed in residuum and colluvium derived dominantly from volcanic rocks and some small areas of granitic rocks. These soils are very shallow and shallow, well drained with medium to very high surface runoff and moderately slow permeability. The Malpais soils occur on alluvial fans and colluvial slopes bordering hills and mountain fronts on slopes of 2 to 75 percent. The Malpais soils formed in alluvium and colluvium from the Theon soils upslope. These soils are very deep and well drained, with medium or rapid runoff and moderately rapid permeability. The Cleaver soils occur on fan-piedmont remnants with slopes of 2 to 30 percent. The soils formed in alluvium primarily from basic igneous rock. The Cleaver soils are shallow to a duripan, well drained, with slow to rapid runoff and slow permeability. The Theon, Malpais, and Cleaver soils are used for rangeland and wildlife habitat (USDA 2006b).

The Patna soils occur on sand sheets and stable dunes on basin-floor remnants with slopes of 0 to 30 percent. They are formed in eolian sands over lacustrine deposits derived from mixed rocks. The Patna soils are very deep, somewhat excessively drained, with very low to medium surface runoff and moderately rapid permeability in the subsoil and rapid permeability in the substratum. Patna soils are used for rangeland, irrigated cropland, and wildlife habitat (USDA 2006b).

In the center of the lease area, the Malpais soils occur on the slopes below the Theon rock outcrop, as described above. Farther downslope occur the Patna, Otomo, and Perazzo soils (USDA 2006a).

The Otomo soils occur on fan remnants with slopes of 4 to 15 percent. They are formed in alluvium derived from mixed rocks. The Otomo soils are very shallow and shallow to a duripan, well drained, with low or medium surface runoff and moderately rapid permeability. The Perazzo soils occur on fan piedmonts with slopes of 0 to 15 percent. They are formed in alluvium from mixed rock sources. The soils are deep, well drained, with slow to rapid runoff and moderately slow permeability. Both the Otomo and the Perazzo soils are used for livestock grazing and wildlife habitat (USDA 2006b).

In the southern part of the lease area, below the Theon rock outcrop, the Perazzo and Tocan, Malpais and Cleaver form the lower slopes and flatter areas (USDA 2006a).

The Tocan soils occur on fan remnants and beach terraces with slopes of 0 to 8 percent. The soils are formed in alluvium derived from mixed rocks. The Tocan soils are very deep, well drained, with medium surface runoff and moderately slow permeability. The Tocan soils are used for rangeland and wildlife habitat. Some areas are used for cultivated crops and urban development (USDA 2006b).

3.4 WATER RESOURCES

This section is a description of the regulations that protect the water resources on public land and the water resources in the region of influence for the proposed action. The ROI for water resources is the CCFO planning area.

Policies and Plans

The US EPA has delegated to the state of Nevada the responsibility for regulating the quality of water within its borders. In Nevada, the State Environmental Commission (SEC) and the Nevada Division of Environmental Protection (NDEP) regulate water quality. Under Section 305(b) of the Clean Water Act, the state prepares biennial reports of the status of water quality under its jurisdiction (NDEP 2004). The BLM regulates activities that could affect water resources on public lands under the authority of FLPMA. In 2004, the BLM and NDEP also signed an updated memorandum of understanding to help achieve their common objectives in protecting water quality (BLM and NDEP 2004).

Nevada has compiled lists of designated uses for water bodies within their borders. In general, numeric standards are developed for the designated uses and for specific water bodies, and narrative standards are developed for all waters of the state. The state also has antidegradation policies that stipulate that water bodies having quality that is better than the standards must generally have the higher quality maintained.

State water management agencies monitor water quality to determine whether standards are being achieved. Section 303(d) of the Clean Water Act directs the states to compile a list of those waters that need additional measures beyond existing controls to achieve or maintain water quality to the standards (NDEP 2002). For each water body on the 303(d) list, a total maximum daily load (TMDL) must be developed. This is a calculation of the maximum quantity of a pollutant that can be added to a water body from all sources without exceeding the water quality standard for that pollutant. TMDLs help regulators devise measures to meet water quality standards by identifying and quantifying both point and nonpoint sources contributing to a pollution problem.

The CCFO CRMP identifies policies and establishes desired outcomes to protect watersheds and water resources (BLM 2001a). It also outlines standard operating procedures designed to protect watersheds and water resources from development activities.

Steamboat Lease Area

UClimate

Annual precipitation in Washoe County ranges from less than 5 inches at elevations of 3,800 to 5,500 feet, to as much as 30 to 35 inches at elevations of 8,000 to 9,000 feet (Bonham 1969).

Surface Water

The study area is within the Truckee River Hydrographic Basin and encompasses the Washoe Valley, Pleasant Valley, and Truckee Meadows subbasins. There are seven miles of perennial streams in the lease area. The principal surface water features in the region are Washoe Lake and Little Washoe Lake, neither of which is within the lease area. Steamboat Creek, which heads in the watershed of Pleasant Valley, flows north toward Truckee Meadows. There is a low topographic divide separating Washoe Valley from Pleasant Valley. Washoe Lake, south of the Steamboat Hills, is a terminal lake during dry periods, but when runoff is plentiful, it can overflow into Little Washoe Lake and then into Pleasant Valley. Browns Creek and streams farther south that drain the east slope of Mount Rose, west of Washoe City, flow to Washoe Lake. Jones Creek, which heads on the east slope of Mount Rose north of Browns Creek, drains to Pleasant Valley. Whites and Thomas Creeks drain north of the lease area, into Truckee Meadows. Relatively little runoff discharges from the Virginia Range east of Steamboat Creek into the Truckee Meadows subbasin.

One-hundred-year floodplains can be found in western Nevada, so geothermal leases near water resources have the potential to be within a 100-year floodplain.

Groundwater

Groundwater beneath the Steamboat lease area occurs in the basin fill, in bedrock fractures in the surrounding ranges, and in alluvial fans at the margins of the basin. The basin containing Washoe Lake is apparently hydraulically independent of the Reno basin, which contains Truckee Meadows. Pleasant Valley and Steamboat Valley are minor subbasins within the Reno basin. Recent groundwater studies indicate that the supply of groundwater in the Truckee Meadows basin, and in South Truckee Meadows in particular, is insufficient to meet currently anticipated needs (Widmer 2001; ECO:LOGIC Engineering 2002). Also, hot springs in the Steamboat area have been affected by past activities.

Hazen Lease Area

Climate

The Hazen lease area is in the Carson Desert, south of the Carson Sink. It is one of the warmest and driest areas of northern Nevada, with wide seasonal and daily variations in temperature and large variations in annual precipitation across the area. Average annual rainfall in the Carson Desert ranges from less than four inches in the Carson Sink to more than 16 inches in the Stillwater Range. Most precipitation falls between December and May, but there are short intense storms at other times of the year. Brief, violent windstorms are common in spring and early fall and redistribute large amounts of dust and sand. Evaporation far exceeds rainfall, averaging nearly six feet per year. The growing season is about 125 days (Morgan 1982).

Surface Water

The study area is in the Carson Desert subbasin of the Carson River Hydrologic Basin. There are 16 miles of perennial streams in the lease area. The Carson Sink is the lowest point in the terminal basin of the Carson Desert. Flow in the Carson River is regulated by Lahontan Reservoir releases. Most of the stored water is used for irrigation or is released for maintaining the wildlife preserves surrounding the Carson Sink. Recharge from irrigation seepage and irrigation return flows accounts for more than 150 times the estimated natural recharge from surrounding ranges. Groundwater levels increased by 45 to 60 feet between 1905 and 1930, and this has led to the development of extensive permanent saline marshland surrounding the Carson Sink.

One-hundred-year floodplains can be found in western Nevada, so geothermal leases near water resources have the potential to be within a 100-year floodplain.

The northwest part of the Hazen lease area contains low marshy lands and wetlands of the Fernley State WMA, which occupies the Fernley Sink, in the Fortymile Desert. The wetlands are fed primarily by irrigation drain water from farmland surrounding Fernley, to the west. The eastern half of the lease area is on higher ground, including the southwest portion of the Hot Springs Mountains. Surface drainage from these mountains is mainly toward the Fortymile Desert, except that east of the town of Darwin, the surface drainage is eastward, into the Carson Desert. The quality of the surface water in the Fernley WMA is poor, and the wetlands are subject to drying during droughts, such as occurred from 1987 to 1994.

Groundwater

The groundwater hydrology of the basin underlying the area is the result of its complex depositional history. This included periodic inundations by Lake Lahontan or smaller lakes, interspersed with dry periods in which sediments were reworked by winds and streams and throughout which volcanic material, including ash, was periodically deposited. Morgan (1982) has defined seven hydrologic units in the basin, based on their aquifer characteristics. These include primary aquifers (consisting of coarse sands and gravels), marginal aquifers (containing fine material but still able to produce water), and confining beds (consisting of substantial clay sediments). Maurer et al. (1994) identified three aquifer units beneath the agricultural area surrounding Fallon: a shallow water table aquifer, an intermediate, relatively freshwater aquifer, and a deep aquifer. Depth to the water table ranges from 1.5 feet or less to about 15 feet in most of the study area (Morgan 1982; US Soil Conservation Service 1975). Groundwater levels are slightly shallower on the northwest side, compared to the southeast side of the area, indicating the influence of agricultural recharge (Maurer et al. 1994). Confined groundwater is under artesian pressure in many areas and rises above the ground surface elevation in wells that screen confined aquifers. Groundwater fluctuations range within about six feet, generally tracking irrigation releases. Highest groundwater levels tend to occur in spring. Of the 370,000 acre-feet (af) released from Lahontan Reservoir annually from 1975 to 1992, the average annual inflow to the Carson Sink, Carson Lake, and the

Groundwater

Groundwater quality is expected to be poor in the vicinity of Carson Lake. Dissolved solids concentrations of 1,000 mg/L have been reported in groundwater from the intermediate aquifer about two miles north of Carson Lake (Maurer et al. 1994). Near Carson Lake, geothermal water rises along faults from depths of greater than 8,000 feet to depths of about 1,000 to 1,500 feet in the deep and intermediate aquifers (Maurer et al. 1994). Near Salt Wells, geothermal water was tapped in a well at a depth of 700 feet.

Lee Hot Springs Lease Area

Climate

The climate of the Lee Hot Springs lease area is not substantially different from that described above for the rest of the Carson Desert.

Surface Water

Most of the study area is within the Rawhide Flats subarea of the Central Hydrographic Region, which covers an area of over 157,000 acres (Nevada Division of Water Planning 2002). The Central Hydrographic Region is composed of a large number of independent internally drained basins throughout central Nevada. Surface drainage is generally toward Rawhide Flats. A small portion of the northwestern corner of the study area drains toward the northwest, into the Carson Desert hydrographic subbasin. There are no permanent surface water bodies in the study area. To the south of the study area Rawhide Flats contains a playa lakebed, which intermittently contains ponded water. In the northern part of the Rawhide Flats there are also some semi-isolated alkali flats, where surface water ponds and evaporates, leaving behind a residue of salts. There are 14 miles of perennial streams in the lease area. Lee Hot Springs is along an intermittent wash that drains south from the White Throne Mountains toward Rawhide Flats. The quality of surface water decreases in contact with alkaline soils on the basin floor or with evaporite deposits associated with the playa lake bed. However, runoff from the basin margins, which is generally rapid, can be of good quality. Springs on the basin margin are associated with the contact between the alluvial fans and the lakebed deposits of the basin floor, which are less permeable. However, hot springs may be associated with convection systems that bring heated water to the surface from depth.

Groundwater

Rawhide Basin is a typical isolated basin and range groundwater basin surrounded by block-faulted ranges. These basins are generally hydraulically independent of each other. Typically the groundwater in the basin fill aquifers is poor in quality because salts accumulate in the basin sediments when the inflow from the surrounding ranges evaporates.

North and South Aurora Lease Areas

Climate

The climate in the area of Aurora Crater is similar to the Carson Desert, with average rainfall of approximately 8 to 10 inches per year (USGS 1995). Runoff from the west-facing slopes of the ranges is slightly greater than that from the east-facing slopes.

Surface Water

The study area is in the East Walker Area of the Walker River Hydrographic Basin. The East Walker Area covers about 375,000 acres. There are no permanent water bodies in the study area.

There are 33 miles of perennial streams in the lease area. Rough Creek crosses through the northern portion of the North Aurora lease area. Bodie Creek, Mud Spring Creek, and Aurora Creek cross the South Aurora lease area. Surface water from the study area drains to Bodie Creek, west of Aurora Crater, and flows north to the East Walker River. Mud Spring Creek drains the north end of the study area, and several unnamed streams drain the south.

Groundwater

Little information is available regarding groundwater conditions in the study area. Groundwater occurs at shallow depths near the principal streams. Most of the study area is underlain by volcanic flows or ejecta deposits. It is likely that groundwater occurs in bedrock fractures and possibly in multiple distinct permeable water-bearing units separated by clay beds deposited between volcanic events. Water quality is likely to be good in upland portions of the study area. Upward circulation and mixing of poorer quality geothermal waters from depth may reduce the quality of groundwater.

Wabuska Hot Springs Lease Area

Climate

The climate in the study area is similar to that described above for the Carson Desert.

Surface Water

Wabuska Hot Springs is in the Mason Valley subbasin of the Walker River Hydrographic Basin. The Mason Valley subbasin covers an area of over 330,000 acres (Nevada Division of Water Planning 2002). There are five miles of perennial streams in the lease area. Mason Valley is drained by the north-flowing East Walker River, which drains to Walker Lake in Mineral County. The northern portion of Mason Valley is poorly drained and contains numerous wetlands, saline lakes, and alkali flats. Wabuska Hot Springs is in the center of this poorly drained area. The area is also traversed by numerous irrigation drainage canals.

One-hundred-year floodplains can be found in western Nevada, so geothermal leases near water resources have the potential to be within a 100-year floodplain.

Groundwater

Groundwater is at a shallow depth in the northern Mason Valley. Seasonal runoff from the Desert Mountains to the north and from surrounding uplands and water from irrigation drains recharge the basin fill. Upward convection of geothermal water mixes with the fresh recharge and comes to the surface at the hot springs. The groundwater is poor in quality from the accumulation of salts due to a high evaporation rate and poor drainage. Groundwater of higher quality can be found in the alluvial fans along the basin margin, in fractured bedrock, and in fresh springs that occur at the slope break where the range front meets the basin floor.

Hawthorne Lease Area

Climate

The climate of the Hawthorne lease area is not substantially different from that described above for the rest of the Carson Desert.

Surface Water

There are four miles of perennial streams in the lease area. Corey Creek and Powell Creek are immediately south of the lease area. They drain the Wassuk Range to the west. The Wassuk Range, in western Mineral County, is a north-northwest trending mountain range (USGS 2000). Nevada streamflow data shows that the east-facing slope of the range is an active area of flooding. The Wassuk Range has had many floods from 1965 to 1998 that affected US Highway 95 between Schurz and Hawthorne, and Nevada State Route 359 between Hawthorne and the Nevada-California state line. The July 30, 1984, flood on Corey Creek blocked US Highway 395, endangered Hawthorne's water supply, and damaged several Hawthorne homes and businesses. Flood characteristics of Corey Creek are similar to flood characteristics of many southern Nevada streams. Major floods in southern Nevada are caused primarily by severe summer thunderstorms.

Groundwater

Basin and Range aquifers underlie most of Nevada (USGS 2006e). The aquifers are formed of volcanic and carbonate rocks and unconsolidated to consolidated basin-fill deposits. The basin-fill deposits form the most productive aquifers and are generally in individual alluvial basins that are drained internally and are separated by low mountains. Within the Basin and Range Province, aquifers are not continuous or regional because of the complex faulting in the region. The principal aquifer type is basin-fill, which is primarily unconsolidated sand and gravel of Quaternary and Tertiary age. An estimated 1,760,000 af per year of freshwater was withdrawn from aquifers in the Basin and Range area during 1985. Withdrawals for irrigated agriculture accounted for almost 77 percent of the total. Public supply accounted for almost 18 percent of withdrawals. All other categories totaled less than six percent of fresh groundwater withdrawals. Future exploration, development, and production will also involve a site-specific groundwater analysis.

Gabbs Valley Lease Area

Climate

The climate of the Gabbs Valley lease area is not substantially different from that described above for the rest of the Carson Desert. There are 52 miles of perennial streams in the lease area.

Surface Water

Cold Springs and Rawhide Hot Springs are in the eastern portion of the lease area. There are over 30 spring mounds in the Cold Springs area, with no apparent upwellings (NBMG 2006a). There are several large pools, but no visible orifices. The water is stagnant, and the area is highly disturbed by cattle. Water drains into the lease area from the Monte Cristo Mountains to the north and east and the Black Hills and Fissure Ridge to the south and east.

Groundwater

The groundwater system is similar to the groundwater system described above for the Hawthorne lease area. Future exploration, development, and production will also involve a site-specific groundwater analysis.

Wilson Canyon Lease Area

Climate

The climate in the area of Wilson Canyon is similar to that of the Carson Desert.

Surface Water

There are eight miles of perennial streams in the lease area. The northwest corner of the lease area (Section 16) crosses the West Fork of the Walker River near the mouth of the canyon.

Groundwater

The groundwater system is similar to the groundwater system described above for the Hawthorne lease area. Future exploration, development, and production will also involve a site-specific groundwater analysis.

3.5 VEGETATION AND INVASIVE PLANT SPECIES

This section provides an overview of prominent vegetation in the vicinity of the CCFO. The ROI consists of all or portions of Churchill, Lyon, Carson City, Douglas, and Mineral Counties in Nevada. The CCFO specifically administers fluid mineral leases on lands managed by the USFS in the Humboldt-Toiyabe and Inyo National Forests, the BOR, the USFWS, and the DOD. The described vegetative resources provide context for analyzing the potential effects that could result from plan adoption and implementation, such as effects on fish and wildlife populations and habitats.

The planning area is on the western edge of the Great Basin, within the rain shadow of the Sierra Nevada Mountains. Topography ranges from relatively low elevation valley floors to higher mountain ranges near Steamboat and Aurora Crater. In addition, riparian and wetland communities are present throughout the CCFO management area. The elevation range of the these areas varies from about 4,200 feet in the dry alkali flats found in the easternmost lease areas to approximately 8,300 feet on Aurora Peak.

The Great Basin is characterized by Basin and Range topography, with rivers terminating in valleys because there is no outflow to the ocean. Precipitation usually occurs during the winter, generally as snow. The planning area receives anywhere from 4 to 13 inches per year, depending on elevation. Annual precipitation is about 8 inches, generally leading to an extremely dry landscape with few water resources. The lowest portions of valleys usually support salt-tolerant plant species, given that the water that ends up at these low areas leaves only by way of percolation and evaporation, resulting in significant salt and mineral accumulation. The edges of the valleys generally have deep alluvial deposits from the slow but constant erosion of the mountain ranges. The mountain ranges often have shallow lithic soils but support a greater diversity of plants due to the increased precipitation there.

Plant communities in the western region of the United States have evolved with fire, which plays a significant role in plant succession. Fire has influenced composition, structure, and landscape patterns of plant and animal habitat (Lyon et al. 2000). Since the West was settled, the frequency of fire has increased, thus altering the ecosystems of the region even more dramatically (Kilgore 1976, 1981). Grazing, fire suppression (by increasing the fuel loads), invasive plant species, and human-caused fires have all been deemed responsible for this shift (Brown and Davis 1973; Hobbs and Huenneke 1992). Many areas within the CCFO management typify this change in landscape. In addition, many significant wildfires have occurred throughout the area, and, as such, plant communities have not recovered from these frequent or intense fires. The result is the conversion of native plant communities to invasive fire-prone communities, which contain combustible annual plants, such as cheatgrass *(Bromus tectorum)* (BLM 1999).

3.5.1 Vegetation, Riparian Areas, and Noxious Weeds

A complex array of associated plant species leads to defining a plant community. Vegetation communities vary from salt-tolerant shrubs and grasses that inhabit the valley bottoms to pinyon and juniper in the higher mountain ranges near Steamboat and

Aurora Crater. These communities are indicators of environmental conditions, whether or not they are natural or human-caused. Plant communities also define the habitat for allied species, both animals and plants. For example, sage grouse and pronghorn are obligate sagebrush-dependent species (sage grouse). Accordingly, plant communities are the best tools for assessing ecosystem function and status. The CCFO supports a diversity of vegetation communities that may be generalized into eight principal categories: salt desert, low-elevation shrub-grassland, mid-elevation shrub, mountain shrub, pinyon-juniper woodland, forested vegetation, riparian/wetland, and other vegetation, including barren agricultural, barren/rock/lava, and urban (developed) (Table 3-1). These different vegetation communities are a result of elevation, moisture, soil substrate, aspect, and land use patterns (such as grazing abuse and fire suppression). In general, vegetation found in the proposed lease areas are typical of the Great Basin.

Invasive Species and Noxious weeds

These species can be found throughout the proposed lease areas. Nonnative invasive species are considered a limiting factor for the success of native plant communities. Problematic species include Russian knapweed, hoary cress or white-top, perennial pepperweed or tall whitetop, puncture vine, and yellow starthistle (SAIC 2000; USDA 1991).

Steamboat Lease Area

The Steamboat lease area is characterized by the Steamboat Hills and surrounding valleys, bordered on the west by the Sierra Nevada Mountains, which are more vegetated and dominated by Jeffrey pine, and on the east by the Virginia Range, which is more arid and covered by pinyon and juniper. Valley bottom vegetation is typically dominated by Wyoming big sagebrush. Other shrubs include four-wing saltbush and shadscale (BLM 1976a).

In addition, there is a relatively small amount of riparian habitat found within the Steamboat lease area. Riparian habitat typically contains Fremont cottonwood and willow tree species with shrubs, including basin big sagebrush and rubber rabbit-brush. Grasses include wild ryes, alkali sacaton, and salt grass (BLM 1976b). Efforts are ongoing to control tall whitetop *(Lepidium latifolium)* and other invasive species in this region.

The Steamboat lease area contains a population of the federally endangered Steamboat buckwheat, which is further discussed in the threatened and endangered species section.

Stillwater WMA resulting from irrigation seepage, canal seepage, and irrigation return flows has been estimated to be about 170,000 to 190,000 af (Maurer et al. 1994).

Groundwater quality tends to improve with depth. Shallow unconfined groundwater in the area contains dissolved solids concentrations averaging more than 16,000 milligrams per liter (mg/L). By comparison, the US EPA considers dissolved solids concentrations greater than about 1,000 mg/L to be unpotable. Groundwater from depths of greater than 30 feet contains dissolved solids concentrations in the range of 6,000 mg/L. Deeper groundwater appears to be connected with, and mixes with, thermal water circulating at greater depths. Total annual geothermal upflow beneath the Carson Desert is estimated to be as much as 4,000 af (Maurer et al. 1994). The mixing probably occurs in fault-fractured zones. Groundwater with temperatures ranging from 47 to 96 degrees Celsius (117 to 205 degrees Fahrenheit) indicates thermal mixing. Thermally mixed waters have an average dissolved solids concentration of about 4,000 mg/L (Morgan 1982). In other geothermal areas, thermal waters tend to be higher in dissolved salts than nonthermal waters, and the ratios of certain chemicals found in thermal waters, such as chloride and sodium, to fluoride and calcium found in nonthermal waters, tend to indicate where mixing is occurring. However, the chemical quality of the water is so strongly influenced by the dissolved solids from the playa evaporite deposits that the typical indicators may not be valid here.

Geothermal water circulates from a depth of about 10,000 feet into both the shallow and intermediate aquifers, affecting groundwater temperatures at depths of as little as 30 feet. About 1,400 to 2,500 af of thermal water upwell annually (Maurer et al. 1994).

Salt Wells Lease Area

Climate

The climate is similar to the Hazen lease area.

Surface Water

There are 49 miles of perennial streams in the Salt Wells lease area. On the east side of the Bunejug Mountains is the Salt Wells Basin, which is a terminal basin with a playa lake at its south end. Groundwater discharges to the surface within the playa, which extends about twelve miles along Highway 50, south of the town of Salt Wells. On the west side of the Bunejug Mountains, surface water drains to Carson Lake, another terminal lake, which receives much of its recharge from irrigation return flows from agricultural lands south of Fallon. Even though these are terminal basins, they are considered to be within the Carson Desert subregion of the Carson River Hydrographic Region.

One-hundred-year floodplains can be found in western Nevada, so geothermal leases near water resources have the potential to be within a 100-year floodplain.

Table 3-1
Major Vegetation Communities and Associated Subtypes Within the Proposed Geothermal Lease Areas

	Lease Area										
Vegetation Community/Subtype	**Totals**	**Steamboat**	**Hazen**	**Salt Wells**	**Lee Hot Springs**	**North Aurora**	**South Aurora**	**Wabuska HS**	**Gabbs Valley**	**Hawthorne**	**Wilson Canyon**
Salt Desert Scrub Community	**51,238**	**0**	**3,091**	**11,312**	**13,554**	**1,827**	**155**	**1,297**	**12,190**	**3,131**	**4,877**
Black greasewood	18,671	0	3,057	9,141	2,709	0	0	0	2,896	25	842
Salt desert scrub	28,949	0	34	2,171	10,645	0	0	1,283	9,294	2,513	3,007
Shadscale	1,450	0	0	0	0	407	0	14	0	0	1,028
Spiny hopsage	2,168	0	0	0	0	1,420	155	0	0	593	0
Low-Elevation Shrub-Grassland Community	**8,621**	**1,021**	**94**	**265**	**216**	**1,909**	**3,923**	**0**	**0**	**275**	**41**
Wyoming and Basin big sagebrush	737	553	86	0	0	0	98	0	0	0	0
Wyoming big sagebrush	3,207	0	0	0	0	1,219	1,726	0	0	262	0
Low sagebrush	2,462	0	0	0	0	690	1,771	0	0	0	0
Low sagebrush-Wyoming big sagebrush	1,056	0	0	0	0	876	180	0	0	0	0
Rabbitbrush	468	468	0	0	0		0	0	0	0	0
Bunchgrass	688	0	8	265	216	0	148	0	0	10	41
Desert grassland	3	0	0	0	0	0	0	0	0	3	0
Mid-Elevation Shrub Community	**5,538**	**99**	**0**	**0**	**0**	**0**	**5,425**	**0**	**0**	**14**	**0**
Mountain big sagebrush	5,425	0	0	0	0	0	5,425	0	0	0	0
Bitterbrush	113	99	0	0	0	0	0	0	0	14	0
Mountain Shrub Community	**9**	**0**	**0**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**0**
Mountain shrub	9	0	0	0	0	9	0	0	0	0	0
Pinyon Pine Community	3,506	151	0	0	0	332	3,023	0	0	0	0

Table 3-1
Major Vegetation Communities and Associated Subtypes Within the Proposed Geothermal Lease Areas *(continued)*

	Lease Area										
Vegetation Community/Subtype	**Totals**	**Steamboat**	**Hazen**	**Salt Wells**	**Lee Hot Springs**	**North Aurora**	**South Aurora**	**Wabuska HS**	**Gabbs Valley**	**Hawthorne**	**Wilson Canyon**
Forested Vegetation Community	**48**	**0**	**0**	**0**	**0**	**0**	**48**	**0**	**0**	**0**	**0**
Forest - Unspecified	10	0	0	0	0	0	10	0	0	0	0
Aspen	38	0	0	0	0	0	38	0	0	0	0
Riparian and Wetland Community	**7,543**	**9**	**0**	**7,503**	**0**	**31**	**0**	**0**	**0**	**0**	**0**
Riparian	31	0	0	0	0	31	0	0	0	0	<1[1]
Marsh/Wetland	7,503	0	0	7,503	<1[2]	0	0	0	0	0	0
Wet meadow	9	9	0	0	0	0	0	0	0	0	0
Other Vegetative Communities	**21,862**	**171**	**1,668**	**2,539**	**657**	**10**	**115**	**1,874**	**13.861**	**799**	**168**
Barren/Rock/Lava	17,810	0	176	1,051	657	10	115	1,874	13,861	66	0
Urban	774	41	0	0	0	0	0	0	0	733	0
Agriculture	3,278	130	1,492	1,488	0	0	0	0	0	0	168
Total Vegetation	**97,187**	**1,272**	**3,854**	**21,619**	**14,227**	**4.995**	**12,691**	**3,171**	**26,052**	**4,219**	**5,087**

[1]Area contains small, isolated riparian areas but, due to GIS constraints that limit detection to areas greater than one acre, riparian areas exist within Wilson Canyon.

[2]Area contains small isolated wetlands but, due to GIS constraints that limit detection to areas greater than one acre, wetlands exist below Lee Hot Springs.

Hazen Lease Area

The Hazen lease area is within an area of low-rolling, arid terrain covered predominantly with Russian thistle and greasewood. Greasewood habitat typically contains big greasewood, green molly, quailbush, and red sage. Russian thistle, halogeton, and cheatgrass are common noxious weeds in greasewood habitats. Additionally, a portion of the area contains wetland habitats. Portions of the Fernley WMA are within the Hazen lease area and are managed for wildlife habitat by NDOW.

Salt Wells Lease Area

The area containing the Salt Wells lease area has little topographic relief, ranging from valleys to relatively small rolling mountains. This salt desert shrub community is largely dominated by shadscale. Other vegetation communities are typical of those in the Great Basin region. In general, vegetation in the valley bottoms consists of salt-tolerant shrubs and grasses. The Salt Wells area includes a portion of Carson Lake and associated wetland vegetation.

Lee Hot Springs Lease Area

Vegetation communities are typical of those found in the Great Basin Region. The Lee Hot Springs area vegetation consists predominantly of salt-tolerant shrubs (also known as salt desert scrub) and grasses. Plant communities of salt desert scrub can vary greatly in species composition and biomass, depending on the level of salinity in the soils. Little vegetation may exist on the most saline areas, and, as soil conditions improve, a greater diversity of shrubs, perennial grasses, and some forbs may occur. Potentially occurring species in this area include black greasewood, spiny hopsage, budsage, four-wing and Gardner's saltbush, shadscale, and winterfat. Herbaceous plant coverage is generally sparse in this plant community, but important grasses include Indian ricegrass, saltgrass, galleta, squirreltail, Great Basin wildrye, bluejoint, and alkali sacaton (Tueller 1994). As salinity increases, sites are dominated by winterfat, shadscale, Gardner's saltbush, and black greasewood (Bunting et al. 2002). Greasewood also occupies the less arid sites. Biological soils are also a critical component of the salt desert shrub community, providing soil stability and nutrient input into the ecosystem (Mayland et al. 1966; West and Skujins 1977). Livestock and grazing feral horses have affected extensive areas, particularly during the first half of the twentieth century (Pellant and Reichert 1984). While slightly altered sites usually have relatively intact shrub components with invasive annuals in low amounts, severely altered sites typically have lost the shrub component dominated by invasive annual grasses and forbs (Bunting et al. 2002). The salt desert shrub community typically occurs in a mosaic with the low-elevation shrub community, which has greater biomass production, and thus, greater fire potential. Fire that starts in the low-elevation sites, particularly where Wyoming big sagebrush dominates, spreads to salt desert shrub communities (Bunting 2002).

A small wetland (less than one acre) also occurs below Lee Hot Springs and is considered to be a significant ecological component of the otherwise arid lease area.

North and South Aurora Lease Areas

The North and South Aurora lease areas generally range from valley bottoms to rugged mountain areas. The Borealis soils series in this area support native vegetation, consisting of a forest canopy of singleleaf pinyon and an understory of desert bitterbrush, green ephedra, bottlebrush, squirreltail, Indian ricegrass, and Wyoming big sagebrush. Jeffrey pine, red fir, Utah juniper, and quaking aspen are also likely to occur in the area.

Wabuska Lease Area

The lease area is dominated by black greasewood and shadscale, except for the sloughs that hold Walker River overflows. The sloughs do not hold water yearlong. Also, lowland riparian is found in the southern portion of the lease area.

Gabbs Valley Lease Area

Topography in this lease area is largely characterized by dry alkali flats with an elevation of approximately 4,200 feet. Most of the area is barren, though dominant vegetation includes saltbrush and greasewood. A small portion of the lease area is used for agricultural purposes.

Hawthorne Lease Area

Topography in this lease area ranges from approximately 4,200 feet in the north to 6,000 feet in the southwestern corner. The vegetation community is largely salt desert scrub interspersed with spiny hopsage and shadscale. Small isolated patches of greasewood, bitterbrush, grass, and barren areas are also scattered throughout this lease area.

Wilson Canyon Lease Area

Topography in this lease area is largely flat, with elevations occurring from about 4,300 to 4,500 feet. The northeastern and western portions of the lease area have comparatively steeper slopes. Vegetation is largely dominated by salt desert scrub, including shadscale and greasewood. Isolated patches of grass also exist. A small portion of the lease area is also in agricultural production. Isolated riparian areas (less than one acre) also exist throughout the lease area and are considered significant ecological components.

3.6 FISH AND WILDLIFE

This section provides an overview of the biological resources, general wildlife and their habitats (mammals, big game, raptors and migratory birds, reptiles, and amphibians), and fisheries in the vicinity of the CCFO. The ROI consists of all or portions of Churchill, Lyon, Carson City, Douglas, and Mineral Counties in Nevada. The CCFO specifically administers fluid mineral leases on lands managed by the USFS in the Humboldt-Toiyabe and Inyo National Forests, the BOR, the USFWS, and the DOD. The described biological resources provide context for analyzing the potential effects that could result from plan adoption and implementation, such as effects on populations and habitats.

About 200 wildlife species occur within the management area including big game, carnivores, upland game birds, raptors, migratory birds, reptiles, and amphibians.

3.6.1 Wildlife, Fisheries, and Migratory Birds

Described in this section are the general wildlife and migratory birds occurring in the proposed leasing areas, including a variety of game and nongame species typical of the Great Basin. Several of the proposed lease sites are within a major migratory bird flyway and, as a result, have a large variety of migratory birds, including waterfowl and shorebird populations. There are no fisheries in the proposed leasing areas. Federally listed species and BLM sensitive species are discussed in Section 3.7.

Various wildlife species are used to indicate the functionality of the ecosystems in the proposed lease sites and surrounding areas. The USFS uses the term management indicator species. In the proposed lease areas the mule deer and sage grouse have been identified as indicator species.

Habitat

Vegetative communities that provide wildlife habitat in the CCFO Management Area are generally dominated by low-to-moderate growing shrubs interspersed with some native bunchgrasses and forbs (see Section 3.5.1, Vegetation, Riparian Areas and Noxious Weeds). Shrubs are primarily big, low, and black sagebrush; black greasewood, rabbitbrush, shadscale, Bailey's greasewood, spiny hopsage, and four-winged saltbrush. Native perennial grasses include needle grasses, bottlebrush squirreltail, and Indian ricegrass. Large portions of the CCFO Management Area have burned with mixed severity within the last 35 to 100 years. Pinyon pine usually grows on the higher elevation sites in the pinyon-juniper woodlands it occupies, in the elevations from about 5,000 to 7,000 feet. The pine woodland community consisting of lodgepole pine, western white pine, and whitebark pine at elevations above 7,000 feet is a unique community because these species are not commonly found in the Great Basin. Rock outcrops occurring throughout the CCFO Management Area at varying elevations also provide habitat for wildlife.

Mammals

About 53 mammal species have been known to occur in the CCFO, including 23 small mammal species, 14 bat species, 4 rabbit species, 10 carnivore species, and 2 big game species (Appendix E).

Big Game

Mule deer and pronghorn antelope are the big game species occurring within the CCFO.

Mule deer use riparian areas along the creeks and drainages of the CCFO but are generally concentrated in spring, summer, and fall on the aspen glades draining the mountain riparian zones (Wasley 2004). Summer range generally extends along the north-south axis of mountain ranges in the field, beginning at about the 4,600-foot elevation and continues upward, including about 393,378 acres. Mule deer winter range is generally concentrated at the lowest elevations within the CCFO and includes approximately 777,310 acres. Winter range occurs in four geothermal lease areas (Table 3-2). Total winter range for all lease areas combined is about 30,600 acres in the Steamboat, North and South Aurora, and Wabuska lease areas.

Table 3-2
Acres of Mule Deer Winter Range within Geothermal Lease Areas of the BLM Carson City Field Office

Lease Area	Lease Cluster Area (Acres)[1]	Winter Range (Acres)
Steamboat	3,809	2,470
North Aurora	5,085	5,525
South Aurora	24,199	20,162
Wabuska	3,173	2,470
Total	**36,266**	**30,627**

[1]Represents acres available in full section.

Once the vegetation that was so instrumental to mule deer populations through most of the twentieth century in Nevada began to lose its vigor, it resulted in the declines observed in the 1970s (Wasley 2004). The century-long grazing practices further contributed to the population declines by reducing diversity and productivity on many of Nevada's rangelands (Wasley 2004). Invasive weeds, assisted by fire, took over more of the deer's habitat, and pinyon and juniper also has encroached into mule deer habitats at unprecedented rates. Nevada's rapidly expanding human population, as well as roads, mines, houses, and the resulting traffic have also impose an ever-increasing burden on mule deer populations (Wasley 2004).

Drought conditions have also negatively affected the quantity and quality of forage, which has compounded conditions that have resulted in observed increases in deer mortality. The weakened condition of Nevada's mule deer became readily apparent after a catastrophic die-off in the winter of 1992-1993. Still stuck in a drought cycle, mule

deer populations remain low, despite limitations on the harvest of does, restrictions on the harvest of bucks, and removal of predators. However, favorable climatic conditions, such as summer rain, would reduce stress on the mule deer and would help them derive nutrients and energy from browse; habitat treatments would restore young vigorous browse and an intact native plant community.

Table 3-3 lists the geothermal lease areas and acreages where pronghorn antelope occur. About 67,700 acres of pronghorn habitat is distributed within the Salt Wells, North and South Aurora, Wasbuska, and Gabbs Valley lease areas. During the 1990s, the state's population of pronghorn fluctuated, roughly in direct proportion to mule deer population changes. Live trapping and transplanting, along with habitat improvement projects, primarily guzzlers (small, artificial water developments that trap and store runoff), help maintain pronghorn population and distribution. Their preferred shrub/grassland habitat consists of lower growing (less than 24 inches), well-spaced shrubs with plentiful forbs on rolling to flat slopes at low to moderate elevations. Fawn predation is likely to be higher where shrubs are overgrown. Improvements in grazing practices and management of livestock distribution can also improve the suitability of rangeland for pronghorns (USDA 2002).

Table 3-3
Acres of Pronghorn Antelope Year-Round Range within Geothermal Lease Areas of the BLM CCFO

Lease Area	Lease Cluster Area (Acres)[1]	Year-Round Range (Acres)
Salt Wells	20,026	8,372
North Aurora	5,085	5,085
South Aurora	24,199	24,199
Wabuska	3,173	3,173
Gabbs Valley	26,347	26,347
Total	**78,830**	**67,716**

[1]Represents acres available in full section.

Carnivores

The role of carnivores, particularly large-sized carnivores, in nature is not well researched, yet they influence organisms that are distantly removed, ecologically and taxonomically, from the original sources of predation. Carnivores in the CCFO include black bear, mountain lion, bobcat, gray fox, badger, striped skunk, long-tailed weasel, ringtail, and raccoon. Black bears are known to occur in the montane foothills and urban interface areas as well as the higher elevation areas. Mountain lions and bobcats are generally secretive and nocturnal, occurring in the more remote rocky areas of the CCFO at all elevations. Long-tailed weasels are more typically found in the higher montane areas of the CCFO. In general, gray fox, badger, striped skunk, ringtail, and coyote are found in a broad range of habitats along the urban interface.

Migratory Birds

Migratory birds are afforded protection under the federal Migratory Bird Treaty Act (15 USC § 701-718h). Under the MBTA, active nests (nests with eggs or young) of migratory birds may not be harmed, nor may migratory birds be killed directly or indirectly by project activities.

Raptors known to occur in the CCFO include turkey vulture, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, American kestrel, prairie falcon, merlin, Swainson's hawk, red-tailed hawk, and golden eagle. Owl species include western screech, great horned, long-eared, short-eared, and burrowing owl. Only turkey vultures, sharp-shinned hawks, kestrels, red-tailed hawks, golden eagle, western screech owl, and great horned owl have been documented as nesting in the CCFO.

The USFWS developed a list of birds of conservation concern (BCC) in 2002, based primarily on migratory birds (USFWS 2002). This list prioritizes bird species for conservation purposes derived from conservation assessment scores (quantitative and qualitative) by geographic area and is used as a barometer of the condition of the avifauna in the US (USFWS 2002). General patterns of population numbers vary; whereas some species are relatively common but undergoing sharp declines in overall population numbers, other are rare and may actually be increasing in numbers in some locations. More commonly species are becoming increasingly rare and declining. Most of the changes observed in species declines are the result of habitat loss due to human alteration and destruction (Askins et al. 1990; USFWS 1995; Samson et al. 1998; Askins 2000). The CCFO within the BCC Region 9 (Great Basin) deemed three raptor species to be priorities for conservation actions (Table 3-4). These include Swainson's hawk, golden eagle, and prairie falcon.

About 89 species of nongame migratory birds occur in the CCFO. Of these, five species in the CCFO are included on the USFWS BCC list (USFWS 2002) and include Lewis' woodpecker, loggerhead shrike, Virginia's warbler, Brewer's sparrow, and sage sparrow (Table 3-4).

Table 3-4
Bird Species of Conservation Concern Potentially Occurring in the BLM CCFO

Common Name	Scientific Name
Swainson's hawk	*Buteo swainsoni*
Bald eagle	*Haliaeetus leucocephalus*
Golden eagle	*Aquila chrysaetos*
Peregrine falcon	*Falco peregrinus*
Greater sage grouse	*Centrocercus urophasianus*
Lewis's woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovicianus*
Virginia's warbler	*Vermivora virginiae*
Brewer's sparrow	*Spizella breweri*
Sage sparrow	*Amphispiza belli*

Source: USFWS 2002

Steamboat Lease Area

Wildlife resources in the Steamboat lease area are typical of the flat valley bottoms of the Great Basin. Habitats such as salt desert shrub, greasewood, and shadscale support a variety of upland desert species. The area is bordered on the west by the Sierra Nevada Mountains, which are more vegetated and dominated by Jeffrey pine, and on the east by the Virginia Range, which are more arid and covered by pinyon and juniper. In addition, there is a small amount of riparian habitat within the Steamboat lease area that may support riparian wildlife species. A number of different migratory bird species depend on riparian habitats for breeding and nesting areas.

Mule deer is the major big game species found in this area. The southern portion of the Steamboat lease area where leasing is proposed (T17N R19E section 12; T17N R20E sections 8, 17, 18, and 20; and T18N R19E section 30) has been identified as a deer winter area (Figure 3-2). The carrying capacity of deer winter range is often considered critical to the deer herds in the western United States because the amount of accessible range for deer is restricted due to snow, and the forage available may not be abundant or nutritious enough to support the animals. As a result, NDOW considers this habitat to be of key importance to deer populations (Washoe County 2000). The quality of deer habitat in the lease area is decreasing annually, due to habitat fragmentation and wildfire resulting from increased human disturbance and development. Section 8 (T17N, R20E) has unburned vegetation left, but fires in 1985 and 2001 have burned all the way around it. Section 12 (T17N R 20E) burned in 2000. Washoe Hill in Section 18, over which US Highway 395 passes, burned in 1985. Prior to the burns, wintering deer would pass back and forth readily across US Interstate Highway 395. Since the burns and installation of a "Jersey wall" (a three-and-a-half-foot-high concrete wall, with vertical plastic vanes adjusted to deflect headlight glare from oncoming vehicles), deer use has been minimal. The Jersey wall provides a virtually impassable barrier to deer, and they can get around it only at the top of Washoe Hill in the southeast corner of Section 13 in T17N R19E or at the bottom of the hill in Section 18 in T17N R18E. The wall was constructed to reduce the number of automobile collisions.

Hazen Lease Area

This area contains both upland and wetland habitats. A large portion of the Hazen noncompetitive lease area is within the Fernley State Wildlife Management Area. Wildlife in this area range from upland game and nongame species, such as coyote and kangaroo rat, to wetland species, such as waterfowl and migratory shore birds. It is unknown whether the wetlands contain nesting sites for migratory birds, but it is likely. NDOW has identified the Fernley WMA as containing wetland, wildlife, and recreational resources (NDOW 2002). No deer winter range occurs in the lease area.

Salt Wells Lease Area

This area contains both upland and wetland wildlife species, as described above. It also includes a portion of Carson Lake, which contains important wetland habitats. As a

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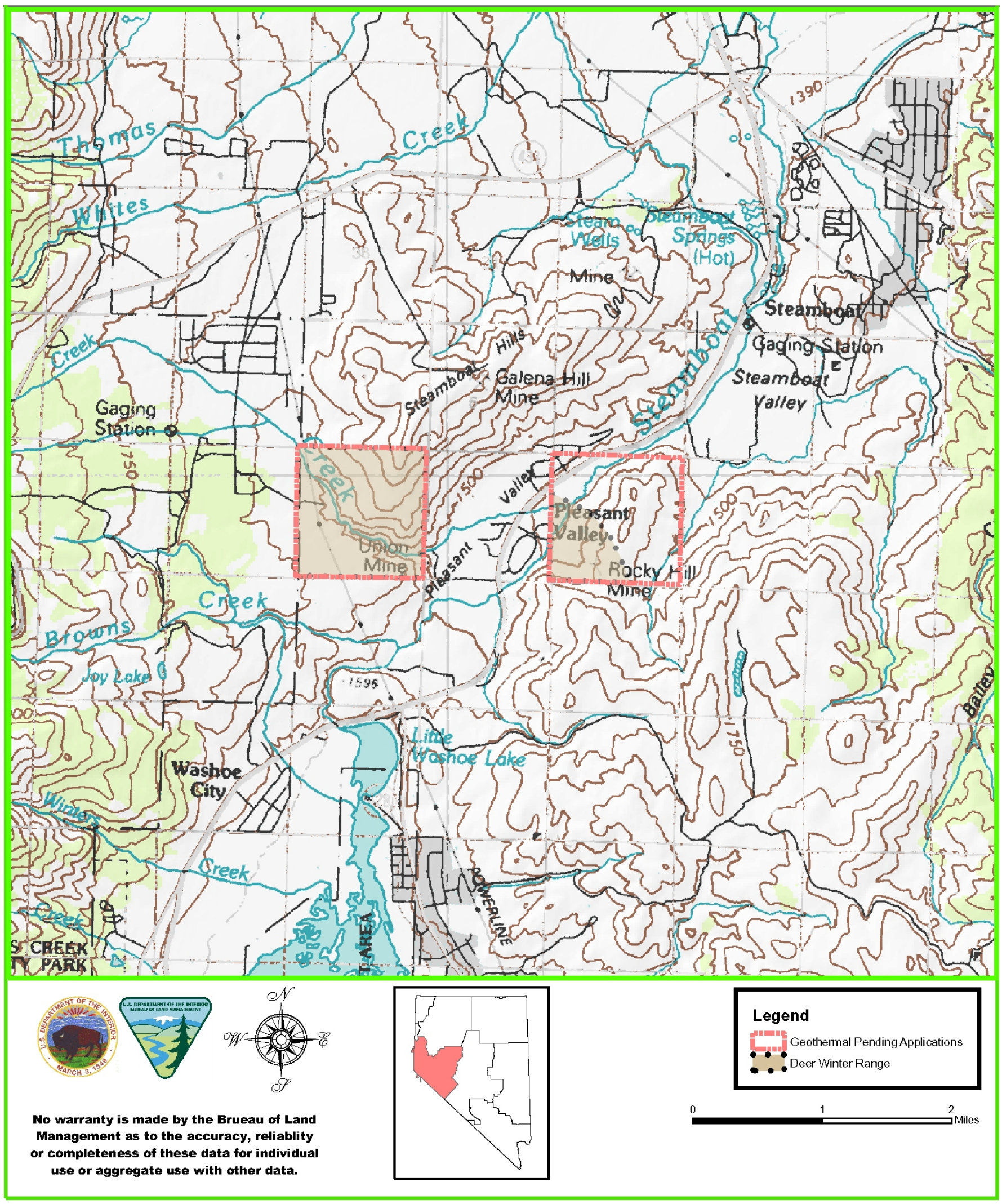

Deer Winter Range in the Steamboat Area

Carson City Field Office, Nevada

Figure 3-2

result, migratory birds are common to this area. No deer winter range occurs in the lease area (Table 3-2), about 41 percent of which contains year-round pronghorn habitat (Table 3-3).

Lee Hot Springs Lease Area

This area is predominantly upland desert habitat, such as salt desert scrub, as described above. Wildlife in this area consists of upland species adapted to dry conditions with limited vegetative cover. No deer winter range occurs in the lease area.

North and South Aurora Lease Areas

Wildlife in this area ranges from big game species to shrews, bats, weasels, cats, rodents, and rabbits. This area contains antelope summer range habitat. About 5,500 acres of deer winter range has been identified in the North Aurora lease area, and about 20,200 acres of deer winter range occurs in the South Aurora lease area (Table 3-2 and Figures 3-3 and 3-4). The entire extent of these two lease areas is also considered year-round pronghorn habitat (Table 3-3).

Wabuska Lease Area

The area is dominated by black greasewood and shadscale, except for the slough areas that hold Walker River overflows. Water from the overflows does not remain yearlong. Common mammal species include coyote, black-tailed jackrabbit, and Harris' antelope ground squirrel; raptors include golden eagle and red-tailed hawk. The sloughs attract a wide variety of game and nongame waterfowl and shorebirds. The only trees in the area are some cottonwoods several miles east. The Mason Valley WMA is several miles to the southeast of the proposed lease area. About 2,500 acres of deer winter range occurs in the lease area (Table 3-2 and Figure 3-5), and all of the lease area is considered year-round pronghorn habitat (Table 3-3).

Gabbs Valley Lease Area

The area's dominant vegetation cover type is largely salt desert scrub, but most areas are barren, consisting of rock and lava. Smaller areas are dominated by patches consisting of black greasewood. Common mammal species include coyote, black-tailed jackrabbit, and Harris' antelope ground squirrel; raptors include golden eagle and red-tailed hawk. There are no areas of deer winter range, but the entire lease area is year-round pronghorn habitat (Table 3-3).

Hawthorne Lease Area

The area's dominant vegetation cover type is largely salt desert scrub with patches of spiny hopsage and shadscale. Small and isolated patches of less than 75 acres are dominated by black greasewood, bitterbrush, and bunchgrasses. Areas that are barren rock and lava also occur. Common mammal species include coyote, black-tailed jackrabbit, and Harris' antelope ground squirrel; raptors include golden eagle and red-tailed hawk. There are no areas of deer winter range or other important big game habitat.

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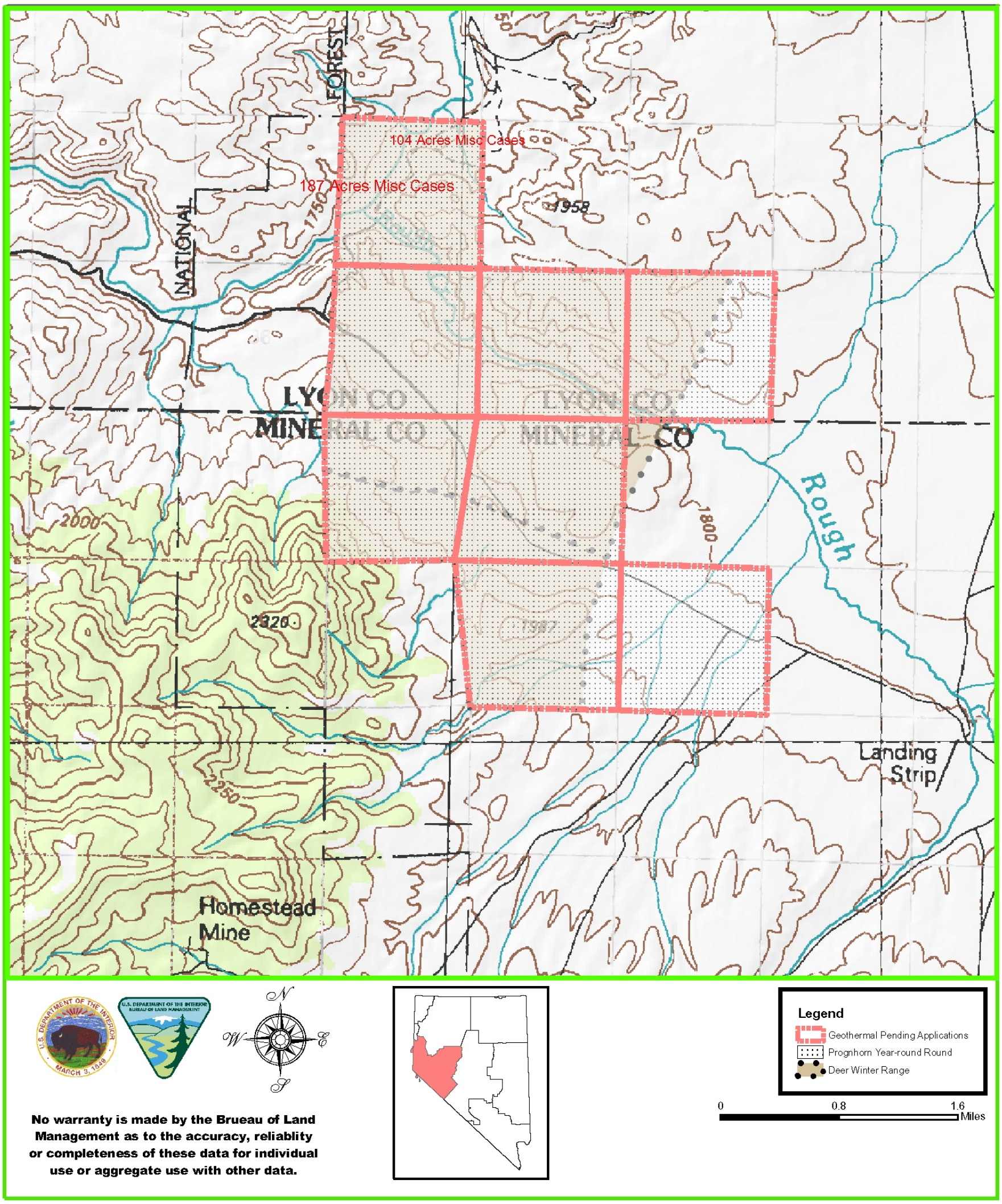
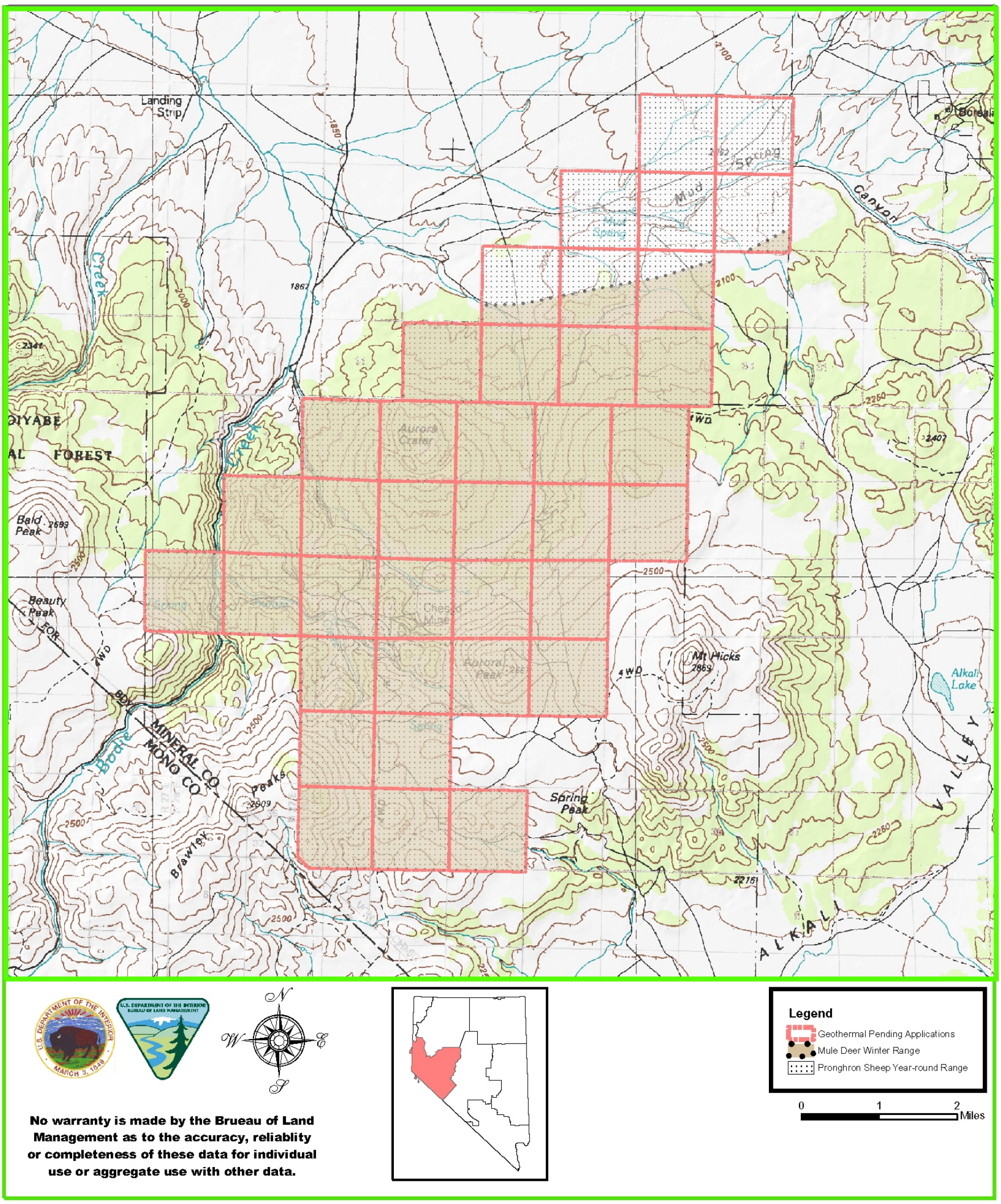


Mule Deer Winter Range and Pronghorn Year-round Range North Aurora Lease Area

Carson City Field Office, Nevada

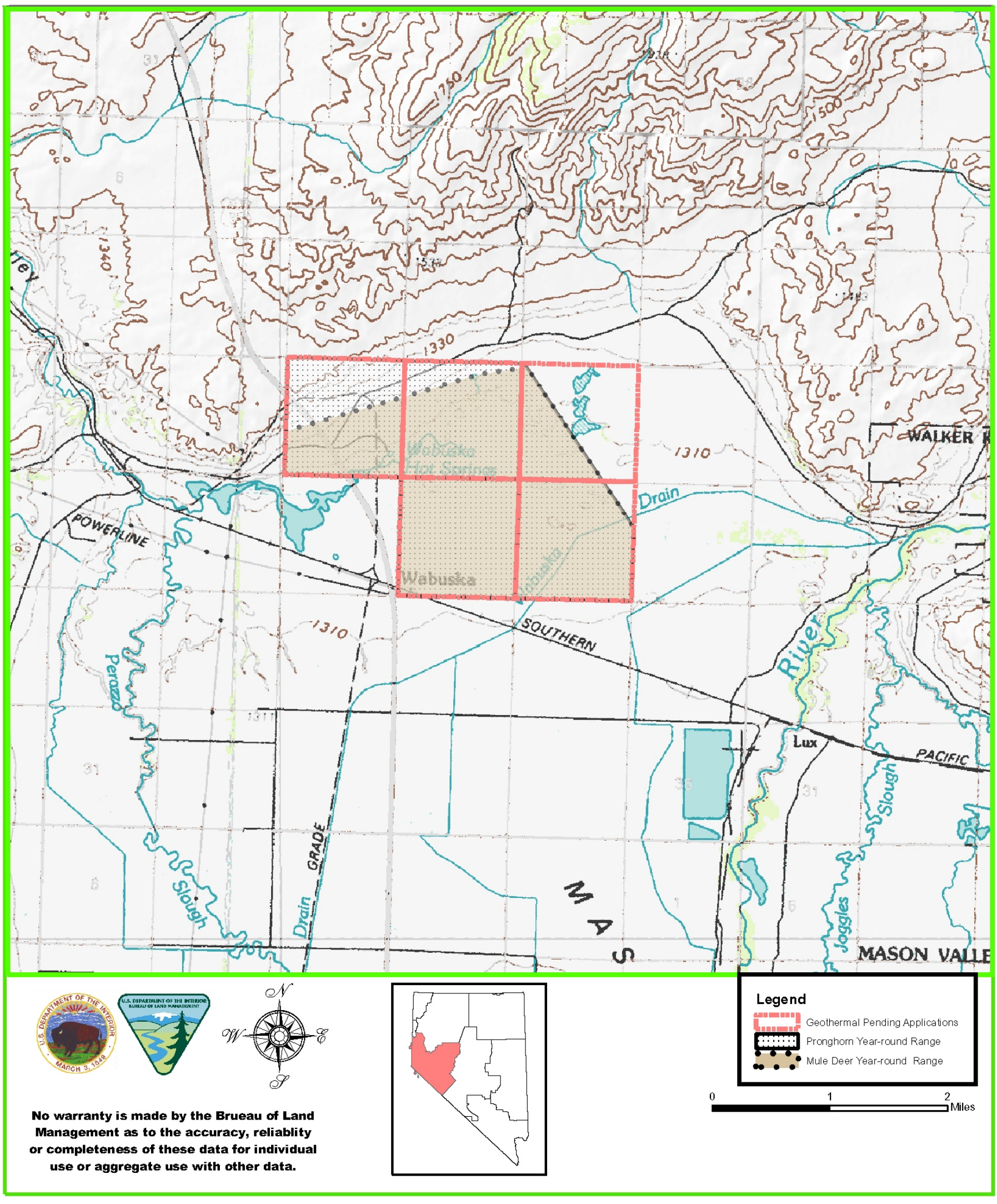
Figure 3-3



Mule Deer Winter Range and Pronghorn Year-round Range in the South Auroa Lease Area

Carson City Field Office, Nevada

Figure 3-4



Mule Deer Winter Range and Pronghorn Year-round Range in the Wabuska Lease Area

Carson City Field Office, Nevada

Figure 3-5

Wilson Canyon Lease Area

This area is largely dominated by salt desert scrub and shadscale with black greasewood occurring to a lesser extent. A few areas are also used for agriculture. Over the past few years Wilson Canyon has become more popular for recreation. With this increased use has come increased pressure, particularly along the Walker River corridor, where vegetation has been trampled and destroyed, and soils have eroded and washed into the river. Common mammal species include coyote, black-tailed jackrabbit, and Harris' antelope ground squirrel; raptors include golden eagle and red-tailed hawk. There are no areas of deer winter range, but the area provides desert bighorn sheep habitat.

3.7 SPECIAL STATUS SPECIES

This section provides an overview of threatened, endangered, and special status species, and their habitats in the vicinity of the CCFO management area. The ROI consists of all or portions of Washoe, Churchill, Lyon, Storey, Carson City, Nye, Douglas, and Mineral Counties in Nevada and portions of Alpine, Plumas, and Lassen Counties in California. The CCFO specifically administers fluid mineral leases on lands managed by the USFS in the Humboldt-Toiyabe and Inyo National Forests, Reclamation, the USFWS, and the DOD. The described special status species provide context for analyzing the potential effects that could result from plan adoption and implementation, such as effects on populations and habitats.

Special status species are those identified by federal, state, or local 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 Nevada Natural Heritage Program (NNHP). Also considered in this section are federal species of concern, that the USFWS identifies as needing management consideration but that are not afforded protection under federal laws, such as the ESA. (Species lists and correspondence with USFWS are included in Appendix E.) The BLM maintains a list of species status species that it considers when making management decisions and assessing environmental impacts. Sensitive species considered in this document and their potential for occurrence in the project area are presented in Table 3-5.

3.7.1 Federally Listed Endangered and Threatened Species, and BLM and USFS Sensitive Species

The USFWS has identified two federally listed endangered and threatened species, and one candidate potentially occurring in the proposed lease areas or as being affected by geothermal leasing activities. A list of federally listed endangered and threatened species that may occur in the Steamboat, Hazen, Soda Lake, and Salt Wells lease areas was initially obtained from the USFWS in September 2001 and is being updated. In a letter dated June 3, 2002, the USFWS identified listed species that may occur in the Lee Hot Springs, South Aurora, and Wabuska lease areas; these species were the Steamboat buckwheat *(Eriogonum ovalifolium* var. *williamsiae),* Lahontan cutthroat *(Oncorhynchus clarki henshawi),* and bald eagle *(Haliaeetus leucocephalus),* potentially occurring in the Steamboat, North and South Aurora proposed lease areas, respectively.

The BLM maintains a list of special status species that it considers when making management decisions and assessing environmental impacts. The species that may occur within the proposed lease areas were initially identified through a search of the Nevada Natural Heritage Program database (NNHP 2002), two USFWS letters (2001, 2002), and comments to the draft EA provided by BLM resource personnel, USFWS, and USFS. These species are presented in Table 3-5 below.

Table 3-5
Federally Listed Endangered and Threatened Species and Sensitive Species that May Occur in the Geothermal Lease Areas within the BLM Carson City Field Office

Common Name	Scientific Name	Status FederalP[2]/State[3]/BLM[4]/FS[5]	Lease Area[1]
Federally Listed Endangered or Threatened Species			
Steamboat buckwheat	*Eriogonum ovalifolium* var. *williamsiae*	E/E/S/E	1
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	T/S3/S/T	5
Bald eagle	*Haliaeetus leucocephalus*	T/S1B/S/T	All
Southwestern willow flycatcher	*Empidomax trailli extimus*	E/S1B/S/E	1,5
BLM, USFS Special Status Species and Federal Species of Special Concern			
Plants			
Bodie Hills rockcress	*Arabis bodiensis*	FSC/S2/NC/S	5
Bodie Hills draba	*Cusickiella quadricostata*	FSC/S2/NC/S	5
Mono County phacelia	*Phacelia monoensis*	FSC/S3/NC/S	5
Lavin's egg milkvetch	*Astragalus oophorus* var. *lavinii*	FSC/S2/N/S	5
Galena Creek rockcress	*Arabis rigidissima* var. *demota*	--/S2/--/S	1
Altered andesite buckwheat	*Eriogonum robustum*	FSC/S2S3/N/--	1
Steamboat monkeyflower	*Mimulus ovatus*	--/S1S2/--/--	1
Charleston angelica	*Angelica scabrida*	FSC/S2/N/S	1,5
Rosy King's sandwort	*Arenaria kingii* ssp. *Rosea*	FSC/S2/--/S	1,5
Eastwood milkweed	*Asclepias eastwoodians*	FSC/S2/N/S	1,5
Clokey milkvetch	*Astragulus aequalis*	FSC/S2/N/S	1,5
Funeral milkvetch	*Astragulus funereus*	FSC/S2/NC/S	1,5
Scorpion milkvetch	*Astragulus lentiginosus scorpionis*	FSC/S3/--/S	1,5
Half-ring pod milkvetch	*Astragulus mohavensis* var. *hemigyrus*	FSC/S2S3(CE)/SC/S	1,5
Lee Canyon milkvetch	*Astragulus oophorus* var. *clokeyanus*	FSC/S2/S/S	1,5
Spring mountain milkvetch	*Astragulus remotus*	FSC/S2/N/S	1,5
Toquima milkvetch	*Astragulus toquimanus*	--/S2/N/S	1,5
Upswept moonwort	*Botrichyium ascendens*	FSC/S1/--/S	1,5
Dainty moonwort	*Botrichyium crenulatum*	FSC/S1/N/S	1,5
Mohave crypantha	*Crypantha tumulosa*	--/S2/--/S	1,5
Goodrich biscuitroot	*Cymopterus goodrichii*	FSC/S1/N/S	1,5
Arid draba	*Draba arida*	FSC/S2/--/S	1,5
Star draba	*Draba asterophora* var. *asterophora*	--/S1/--/S	1,5
Jaeger draba	*Draba jaegeri*	FSC/S2/--/S	1,5
Serpentine draba	*Draba oreibata* var. *serpentina*	FSC/S1/--/S	1,5
Charleston draba	*Draba paucifructa*	FSC/S1S2/--/S	1,5
Nevada willowherb	*Epilobium nevadense*	FSC/S2/N/S	1,5
Mono buckwheat	*Eriogonum ampullaceum*	--/S1/--/S	1,5
Toiyable buckwheat	*Eriogonum esmeraldense toiyabense*	--/S2/--/S	1,5
Clokey buckwheat	*Eriogonum hermannii clokeyi*	--/S2/N/S	1,5
Barrel cactus	*Ferocactus cylindraceus lecountei*	--/S4/--/S	1,5
Clokey greasebush	*Glossopetalon clokeyi*	FSC/S2/--/S	1,5
Smooth dwarf greasebush	*Glossopetalon pungens* var. *glabron*	FSC/S1/NC/S	1,5
Alpine goldenweed	*Tonestus alpinus*	FSC/S2/--/S	1,5
Spring Mountain goldenweed	*Ericameria compacta*	--/S2/--/S	1,5
Sierra Valley ivesia	*Ivesia aperta* var. *aperta*	FSC/S1/NC/S	1,5
Charleton ivesia	*Ivesia cryptocaulis*	FSC/S2/--/S	1,5

Table 3-5
Federally Listed Endangered and Threatened Species and Sensitive Species that May Occur in the Geothermal Lease Areas within the BLM Carson City Field Office *(continued)*

Common Name	Scientific Name	Status Federal[2]/State[3]/BLM[4]/FS[5]	Lease Area[1]
Jaeger ivesia	*Ivesia jaegeri*	FSC/S2S3/NC/S	1,5
Webber invesia	*Invesia webberi*	FC/S1(CE)/SC/S	1,5
Dune penstemon	*Penstemon arenarius*	FSC/S2S3/N/S	1,5
Bicolored beardtongue	*Penstemon bicolor* var. *bicolor*	FSC/S2/N/S	1,5
Rose-colored penstemon	*Penstemon bicolor* var. *roseus*	FSC/S3/N/S	1,5
Death Valley beardtongue	*Penstemon fructiciformis* ssp. *amargosae*	FSC/S2/NC/S	1,5
Marsh's bluegrass	*Poa abbreviate marshii*	--/S1/--/S	1,5
Tahoe yellowcress	*Rorippa subumbellata*	FC/S1(CE)/S/S	1,5
Williams cornblear	*Polyctenium williamsii*	--/S2(CE)/SC/S	1,5
Clokey Mountain sage	*Salvia dorrii* var. *clokeyi*	FSC/S3/N/S	1,5
Clokey silene	*Silene clokeyi*	FSC/S2/--/S	1,5
Low sphaeromeria	*Spharomeria compacta*	--/S2/--/S	1,5
Few-flavored streptanthus	*Streptanthus oliganthus*	FSC/S2/NC/S	1,5
Charleston kittentails	*Synthris ranunculina*	--/S2S3/--/S	1,5
Charleston ground daisy	*Towsendia jonesii* var. *tumulosa*	FSC/S3/N/S	1,5
Rollins clover	*Trifolium leibergii*	FSC/S2/N/S	1,5
Invertebrates			
Wong's springsnail	*Pyrgulopsis wongi*	FSC/S1/N/--	5
Hardy's aegialian scarab beetle	*Aegialia hardyi*	FSC/S1/N/--	4
Sand Mountain aphodius scarab	*Aphodius* sp.	FSC/--/--/--	4
Sand Mountain serican scarab	*Serica psammobunus*	FSC/S1/N/--	4
Sand Mountain blue butterfly	*Euphilotes pallescens arenamontana*	FSC/S1/N/--	4
Nevada viceroy	*Limenitis archippis lahontani*	FSC/--/N/--	2
Reptiles and Amphibians			
Columbia spotted frog	*Rana luteniuentris*	FC/S2S3/S/S	1,5
Birds			
Yellow-billed cuckoo	*Coccyzus americanus*	FC/S1B/S/SIW	1,2,3,5,7,8
Western burrowing owl	*Athene cunicularia hypugea*	FSC/S3B//--P	All
Northern goshawk	*Accipiter gentilis*	FSC/S3/P/S	1,5
Sage grouse	*Centrocercus urophasianus*	FSC/S4/N/--	5,6,7,8
Mountain quail	*Oerortyx pictus*	--/S3/N/S	1,5
Flammulated owl	*Otus flammeolus*	--/S4B/N/S	1,5
White-headed woodpecker	*Picoides albolarvatus*	--/S3/--/S	1,5
Three-toed woodpecker	*Picoides tridactylus*	--/S4/--/S	1,5
Great gray owl	*Strix nebulosa*	--/SAN/--/S	1,5
California spotted owl	*S. occidentalis occidentalis*	FSC/S1N/C/S	1,5
Mammals			
Pygmy rabbit	*Brachylagus idahoensis*	FSC/S3/-/S	All
North American wolverine	*Gulo gulo*	FSC/SH/--/S	5
Fisher	*Martes pennanti*	FSC/S2S3/--/S	5,8

Table 3-5
Federally Listed Endangered and Threatened Species and Sensitive Species that May Occur in the Geothermal Lease Areas within the BLM Carson City Field Office *(continued)*

Common Name	Scientific Name	Status Federal[2]/State[3]/BLM[4]/FS[5]	Lease Area[1]
Fletcher dark kangaroo mouse	*Microdipodops megacephalus nasutus*	FSC/S2/--/--	5
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	FSC/S3B/N/S	All
Pacific Townsend's big-eared bat	*C. townsendii townsendii*	FSC/S3B/N/S	All
Spotted bat	*Euderma maculatum*	FSC/S1S2/S/S	All
Small-footed myotis	*Myotis ciliolabrum*	FSC/S3B/N/--	All
Long-eared myotis	*M. evotis*	FSC/S4B/N/--	All
Fringed myotis	*M. thysanodes*	FSC/S2B/N/--	All
Long-legged myotis	*M. volans*	FSC/S4B/N/--	All
Yuma myotis	*M. yumanensis*	FSC/S4B/N/--	1,2,4,5,6
Pallid bat	*Antrozous pallidus*	--/S3B/--/--	3

Source : USFWS 2001, 2002 and comments to draft EA, Nevada Natural Heritage Program 2002, and USFS comments to draft EA

Notes:
[1]Lease area
1 = Steamboat lease area
2 = Hazen lease area
3 = Salt Wells lease area
4 = Lee Hot Springs lease area
5 = North and South Aurora lease areas
6 = Wabuska lease area
7 = Hawthorne lease area
8 = Wilson Canyon lease area

[2]Federal status:
E = Endangered under the ESA
T = Threatened under the ESA
FC = Candidate species under the ESA
FSC = Species of Concern (there is no regulatory status associated with this designation)

[3]Nevada state status
S1 = Critically imperiled due to extreme rarity, imminent threats, and or biological factors
S2 = Imperiled due to rarity and/or other demonstrable factors
S3 = Rare and local throughout its range, or with very restricted range, or otherwise vulnerable to extinction
S4 = Apparently secure, though frequently quite rare in parts of its range, especially at its periphery
A = Accidental (causal or stray) within the state, usually far outside its normal range, seen infrequently and irregularly
B = Breeding status within the state, rank for breeding occurrences only
CE = Critically endangered – species threatened with extinction, whose survival requires assistance because of overexploitation, disease or other factors or because their habitat is threatened with destruction, drastic modification or severe curtailment (NRS 527.260-.300).
H = Historical occurrence(s) only, presumed still extant and could be rediscovered
N = Nonbreeding status within the state; rank for nonbreeding occurrences only

[4]BLM status
S = Nevada special status species – USFWS listed, proposed or candidate for listing, or protected by Nevada state law
N = Nevada special status species – designated sensitive by state office
P = Proposed Nevada special status species – designated proposed Sensitive by state office
C = California special status species (see definitions S and N).

[5]Forest Service status - (Applies to USFS lands in the Steamboat and North and South Aurora lease areas)
S=Region 4 sensitive species

The USFWS also listed 30 species of concern, including 12 mammal species, 8 bird species, 1 reptile species, 4 invertebrate species, and 5 plant species (Table 3-5). Candidate species and species of concern receive no legal protection under the ESA but could be proposed for listing in the future. The USFWS encourages consideration of

these species in planning projects with a federal nexus in order to assist in conservation efforts and to help prevent the need for future listing actions. Federal species of concern are not listed in Table 3-5, and are not discussed herein. Species lists and correspondence with USFWS are included in Appendix E.

Bald eagle is the only federally threatened species that could occur in all lease areas. Most bald eagles that would occur are wintering or migrant birds, and these birds are most likely to occur in areas where waterfowl or calf-after birth is present. Presently, the bald eagle is under consideration for delisting from the ESA, as some evidence indicates that the populations in the lower 48 states have recovered and remain stable or are increasing (64 FR 36453-36464).

State sensitive species include those considered sensitive by the NNHP.

The BLM maintains a list of sensitive status species that it considers when making management decisions and assessing environmental impacts. Sensitive species considered in this document and their potential for occurrence in the project area are presented in Table 3-5. This list includes 11 plants, 6 invertebrates, 5 birds, and 11 mammals.

There are no designated critical habitats on public land within the CCFO.

Steamboat Lease Area

Steamboat buckwheat is a federally listed endangered plant (51 FR 24669) and has also been placed on the Nevada list of Critically Endangered plants (NRS 527.260-.300). The natural occurrence of this species is limited to land at Steamboat Hot Springs. The global habitat for the Steamboat buckwheat covers less than 250 acres, all located at the intersection of US 395 and the Mt. Rose Highway. Specifically, the buckwheat occurs in portions of sections 28, 29 and 33 of T18N R20E. The subpopulation is fragmented into an estimated seven colonies. Habitat for this species is under multiple ownership (Knight 1993), and the BLM owns approximately 98 acres of the total population (BLM 1983). Out of this, 40 acres were designated as an area of critical environmental concern (ACEC). This ACEC is in close proximity to the proposed Steamboat lease area.

The southwestern willow flycatcher is a federally endangered species (58 FR 39495-39522, 60 FR 10693-10715) that could occur in riparian areas, particularly on public lands within this lease area, which is also managed by the USFS. This migratory songbird has suffered a century of steady decline (USFWS 1993, 1995; Center for Biological Diversity 2006). Strictly dependent on dense willows, cottonwoods, and other species found along southwestern rivers and streams, the flycatcher has lost more than 90 percent of its habitat to a combination of livestock grazing, dams, water withdrawal, and urban and agricultural sprawl (USFWS 1993; Marshall 1995). As its habitat is fragmented, the flycatcher is also made more vulnerable to nest parasitism by brown-headed cowbirds and nest predation by other species (USFWS 1993; Marshall 1995; Center for Biological Diversity 2006).

Fewer than 1,000 breeding pairs of the southwestern willow flycatcher remain throughout its range. Nine years of nearly rangewide surveys (1993-2001) found a total of only 986 flycatcher territories spread across southern California, Arizona, New Mexico, and southern Colorado, Utah, and Nevada (Center for Biological Diversity 2006). Those breeding areas that support the largest number of flycatchers are in peril from fires, water projects, livestock grazing, and replacement of native habitats by introduced plant species (USFWS 1993; Center for Biological Diversity 2006).

Surveys have also shown that the breeding sites are widely scattered and isolated, and most sites include fewer than five breeding pairs (USFWS 1993; Marshall 1995). Because most flycatcher populations are isolated, there is often little hope that populations will be rescued by immigration from other populations (Center for Biological Diversity 2006).

The status of yellow-billed cuckoo has changed from no status in 1979 to a candidate for federal listing at the present (65 FR 8104-8107, 66 FR 38611-38626). Yellow-billed cuckoos inhabit large groves of cottonwood trees. The species probably no longer inhabits Nevada, although there is suitable cuckoo riparian habitat on BLM-managed lands in the CCFO, including riparian habitat in this area.

The Altered andesite buckwheat inhabits dry, shallow, highly acidic (pH 3.3-5.5) gravelly clay soils mainly of the Smallcone Series, derived from weathering of hydrothermal sulfide deposits formed in andesite, or sometimes in rhyolitic or granitoid rocks, forming mostly barren yellowish to orange brown patches on ridges, knolls, and steep slopes on all aspects, on all but the most xeric sites supporting a sparse, stunted relict woodland of yellow pines (*Pinus ponderosa* and/or *P. jeffreyi*) and pinyon pine (*P. monophylla*), with an equally sparse understory codominated with *Arenaria nuttallii fragilis, Ericameria parryi,* or *E. nauseosa, Elymus elymoides,* or *Poa secunda.* Other normally mesic-montane conifer taxa, such as white fir, western white pine, and lodgepole pine, are occasionally present (NNHP 2001).

The pygmy rabbit *(Brachylagus idahoensis)* is a Nevada BLM Special Status Species, designated by the State Director. This species could be present within the lease area (USFWS 2005). This species typically inhabits dense stands of big sagebrush growing in deep loose soils (NatureServe 2005).

The lease area provides day and night roosting habitat for bat species identified in Table 3-5. Woodlands, caves, and rocky areas are important elements needed to support these sensitive species.

Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area. Common breeding species include the red-tailed hawk *(Buteo jamaicensis),* prairie falcon *(Falco mexicanus),* American kestrel *(F. sparverius),* golden eagle *(Aquila chrysaetos),* northern harrier *(Circus cyaneus),* great horned owl *(Bubo virginianus),* and long-eared owl *(Asio otus).* Other less common breeders that may be

found locally include the ferruginous hawk *(Buteo regalis)* and burrowing owl *(Speotyto cunicularia)*. Nesting habitats are found in Utah juniper, quaking aspen, and volcanic ledges and buttes. Prey species are more likely to be available for a wide range of raptors when plant communities are structurally diverse and support mixtures of grasses, forbs, and shrubs.

Hazen Lease Area

The yellow-billed cuckoo is the only federally listed species (candidate) known to potentially occur in riparian areas within this area.

The lease area provides habitat for pygmy rabbit, day and night roosting habitat for bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.

Salt Wells Lease Area

The yellow-billed cuckoo is the only federally listed species (candidate) known to potentially occur in this area.

The lease area provides habitat for pygmy rabbit, day and night roosting habitat for nine bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.

Lee Hot Springs Lease Area

No federally listed endangered, threatened, or candidate species are known to occur in this area.

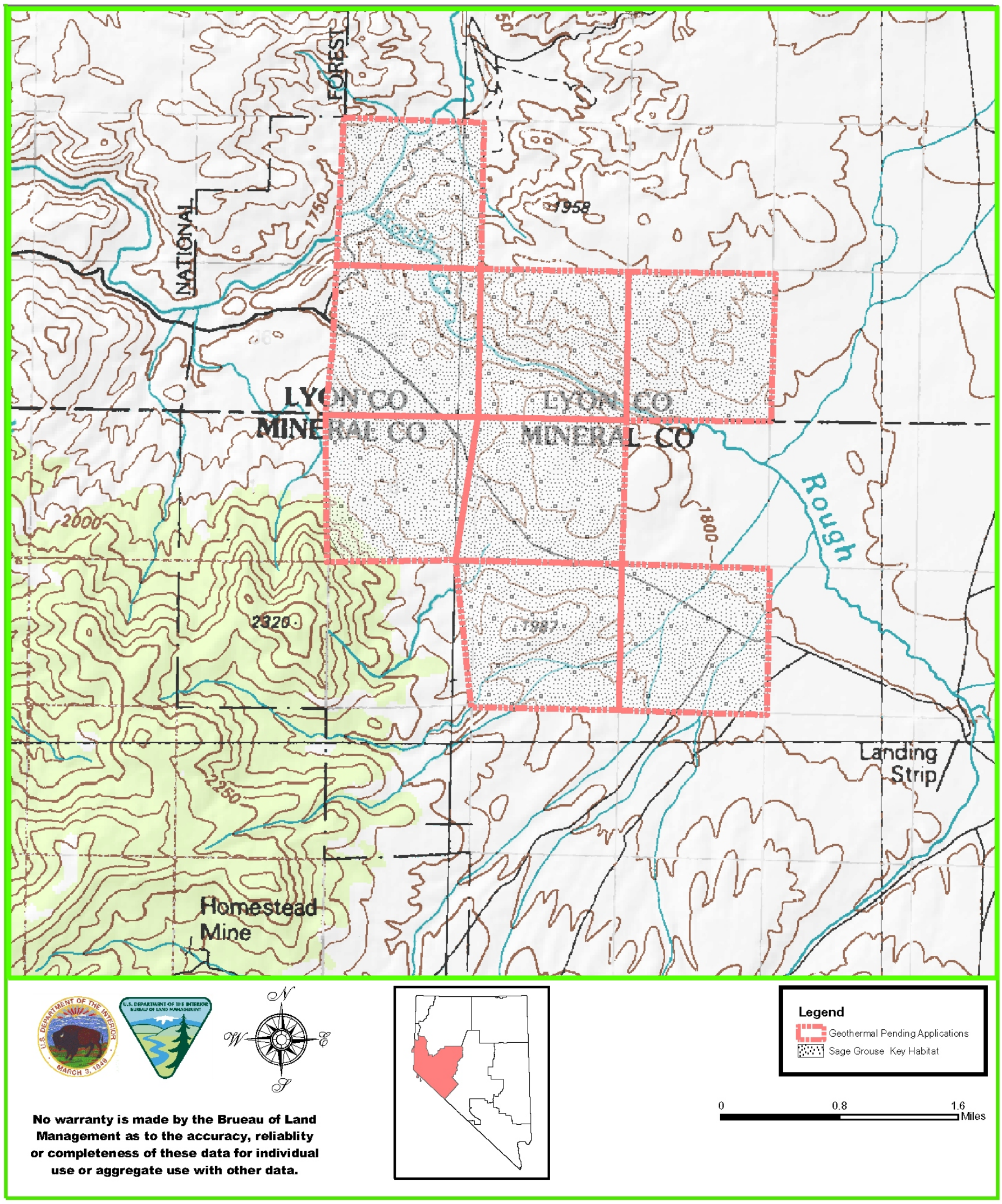
The lease area provides habitat for pygmy rabbit, day and night roosting habitat for eight bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.

North Aurora Lease Area

The yellow-billed cuckoo is the only federally listed species (candidate) known to potentially occur in this area.

All of the 5,154 acres of North Aurora lease area is within the Mount Grant Sage Grouse Population Management Unit (Figure 3-6). The area contains key habitat for sage grouse, including lek site(s) (territorial breeding ground).

The lease area provides habitat for pygmy rabbit, day and night roosting habitat for eight bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.



Sage Grouse Key Habitat in the North Aurora Lease Area

Carson City Field Office, Nevada

Figure 3-6

South Aurora Lease Area

A portion of the proposed lease area is within the watershed for Bodie Creek, which contains potentially suitable habitat for Lahontan cutthroat trout. As such, the area may be necessary for the species' recovery. The Walker River Recover Implementation Tram will be evaluating areas within this basin, which could support the Lahontan cutthroat trout, although a self-sustaining population is not currently present in the project area.

The southwestern willow flycatcher is a federally endangered species that could occur in riparian areas, particularly on public lands within this lease area, which is also managed by the USFS. The yellow-billed cuckoo is the only other federally listed species (candidate) known to potentially occur in this area, and it could also occur in riparian areas suitable for supporting southwestern willow flycatcher.

All of the 24,199 acres of South Aurora lease area are within the Mount Grant Sage Grouse Population Management Unit, and a portion is known as a sage grouse early brood/nesting area (Figure 3-7). The area contains key habitat for sage grouse including one lek site in the Mud Springs area. A lek is a traditional site that is used year after year by males of certain bird species for communal display as they compete for female mates. Three additional leks are known to occur within one mile south of Aurora Peak on the south end of the lease area.

The lease area provides habitat for pygmy rabbit, day and night roosting habitat for eight bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.

In addition the USFS has identified three sensitive plant species known to occur in the area. These species are the Lavin's egg milkvetch *(Astragalus oophorus),* Bodie Hills draba *(Cusikiella quadricostata),* and Mono phacelia *(Phacelia monoensis).*

Wabuska Lease Area

No federally listed endangered, threatened, or candidate species are known to occur in this area. Approximately 61 acres of Wabuska lease area are within the Pine Nut Sage Grouse Population Management Unit). The area contains key habitat for sage grouse (Figure 3-8).

The lease area provides habitat for pygmy rabbit, day and night roosting habitat for eight bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.

Gabbs Valley Lease Area

No federally listed endangered, threatened, or candidate species are known to occur in this area.

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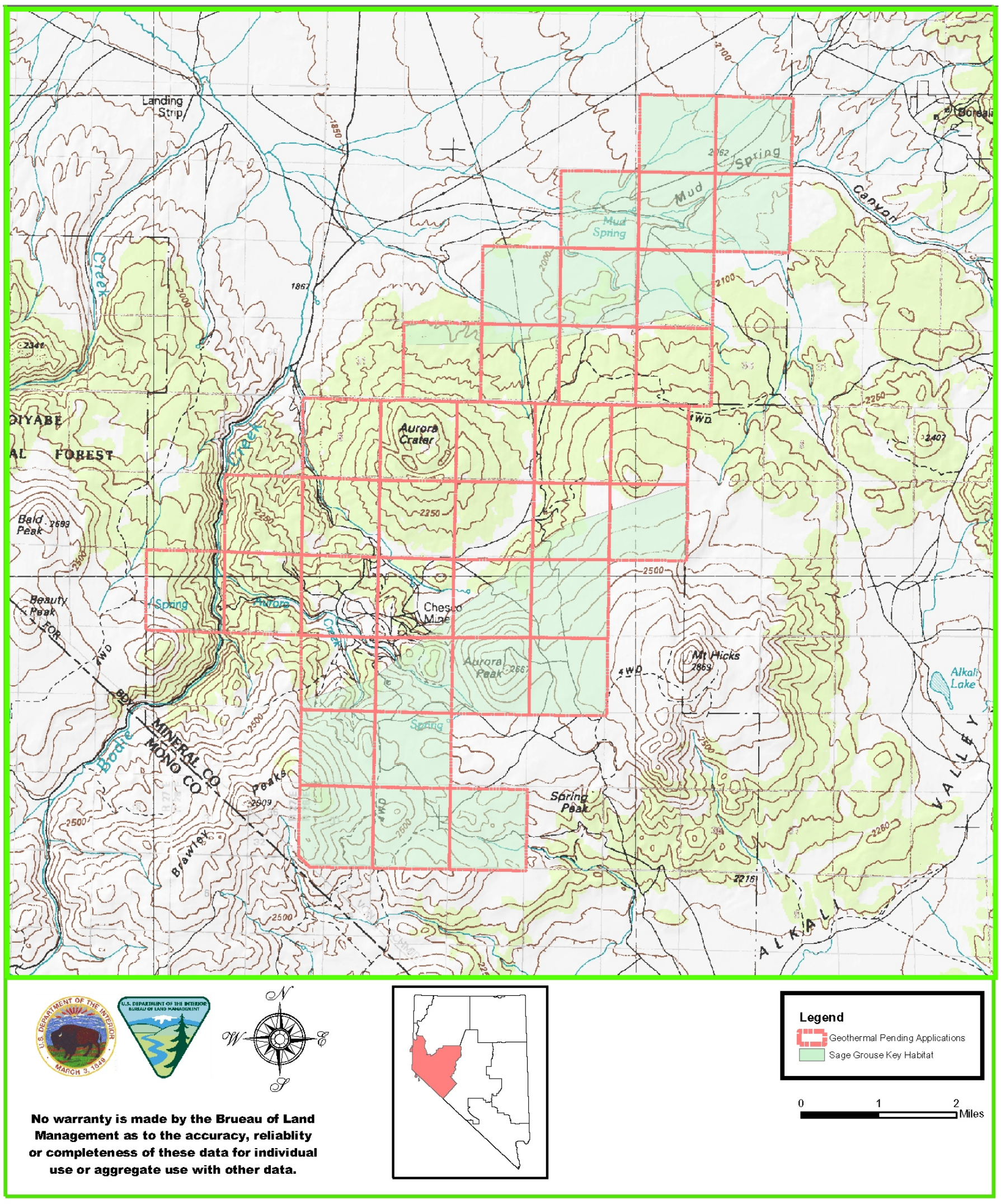
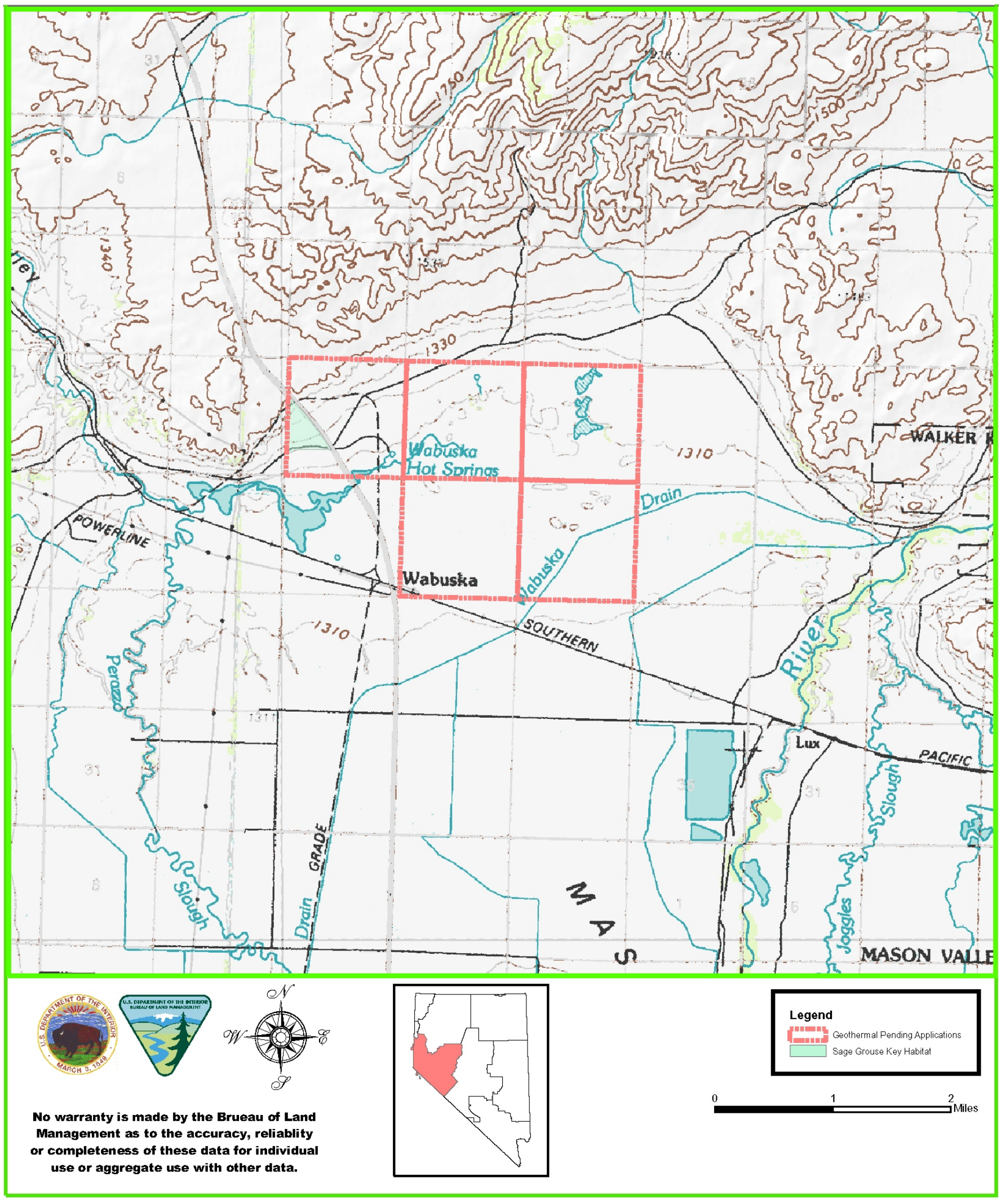


Sage Grouse Key Habitat in the South Aurora Lease Area

Carson City Field Office, Nevada

Figure 3-7



Sage Grouse Key Habitat in the Wabuska Lease Area

Carson City Field Office, Nevada

Figure 3-8

The lease area provides habitat for pygmy rabbit, day and night roosting habitat for seven bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.

Hawthorne Lease Area

The yellow-billed cuckoo is the only federally listed species (candidate) known to potentially occur in this area.

Approximately 3,178 acres of the Hawthorne lease area is within the Mount Grant Sage Grouse Population Management Unit. The area contains key habitat for sage grouse (Figure 3-9).

The lease area provides habitat for pygmy rabbit, day and night roosting habitat for seven bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.

Wilson Canyon Lease Area

The yellow-billed cuckoo is the only federally listed species (candidate) known to potentially occur in this area. Potential impacts would be the same as described for the Steamboat area.

Approximately 5,154 acres of Wilson Canyon lease area are within the Desert Creek/Fales Sage Grouse Population Management Unit. The area contains key habitat for sage grouse (Figure 3-10).

The lease area provides habitat for pygmy rabbit, day and night roosting habitat for seven bat species identified in Table 3-5, and raptor habitat, including burrowing owl. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the lease area.

Lee Hot Springs Lease Area

Vegetation communities are typical of those found in the Great Basin Region. The Lee Hot Springs area vegetation consists predominantly of salt-tolerant shrubs (also known as salt desert scrub) and grasses. Plant communities of salt desert scrub can vary greatly in species composition and biomass, depending on the level of salinity in the soils. Little vegetation may exist on the most saline areas, and, as soil conditions improve, a greater diversity of shrubs, perennial grasses, and some forbs may occur. Potentially occurring species in this area include greasewood, spiny hopsage, budsage, saltbush, winterfat, basin wildrye, and Indian ricegrass.

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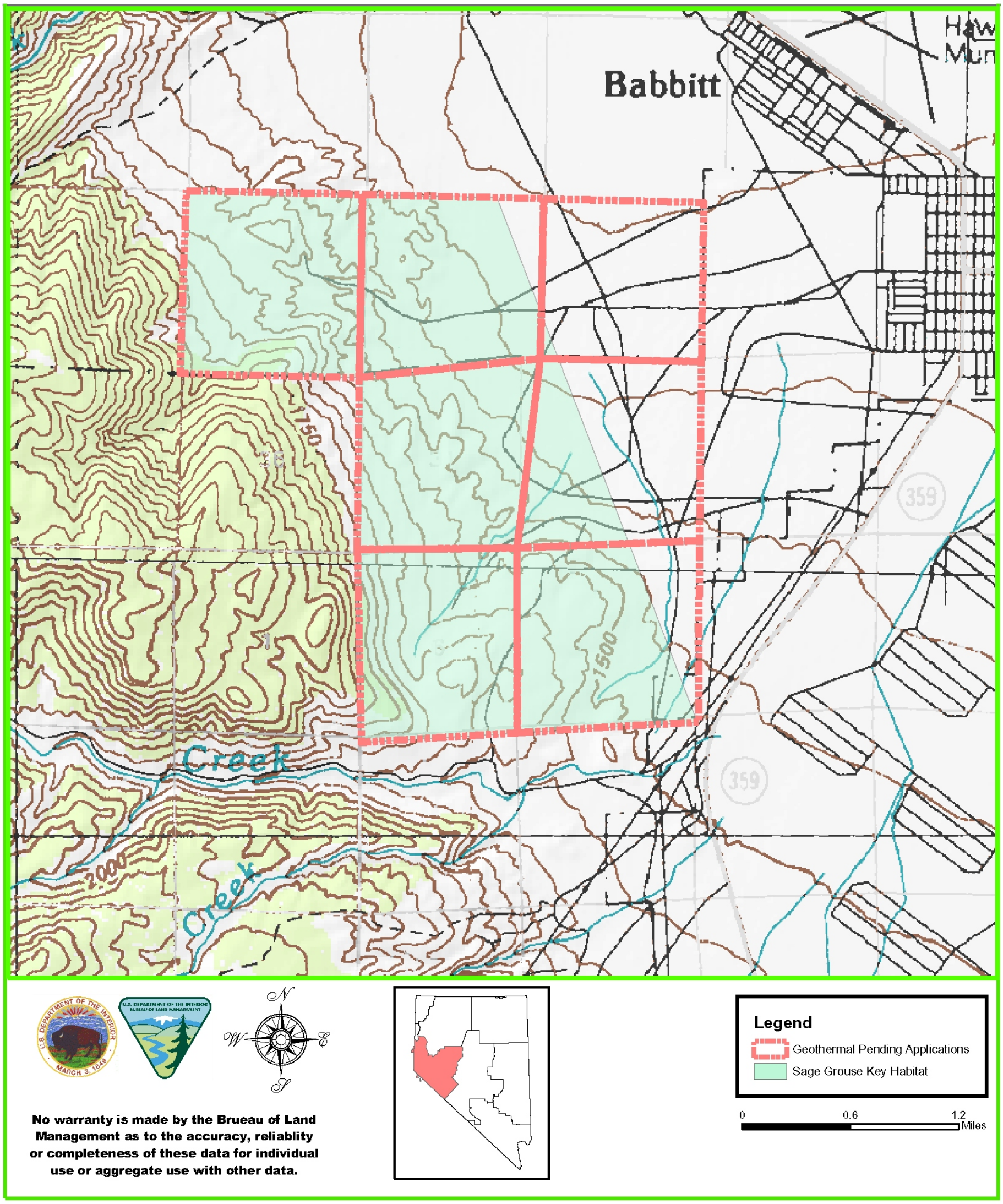
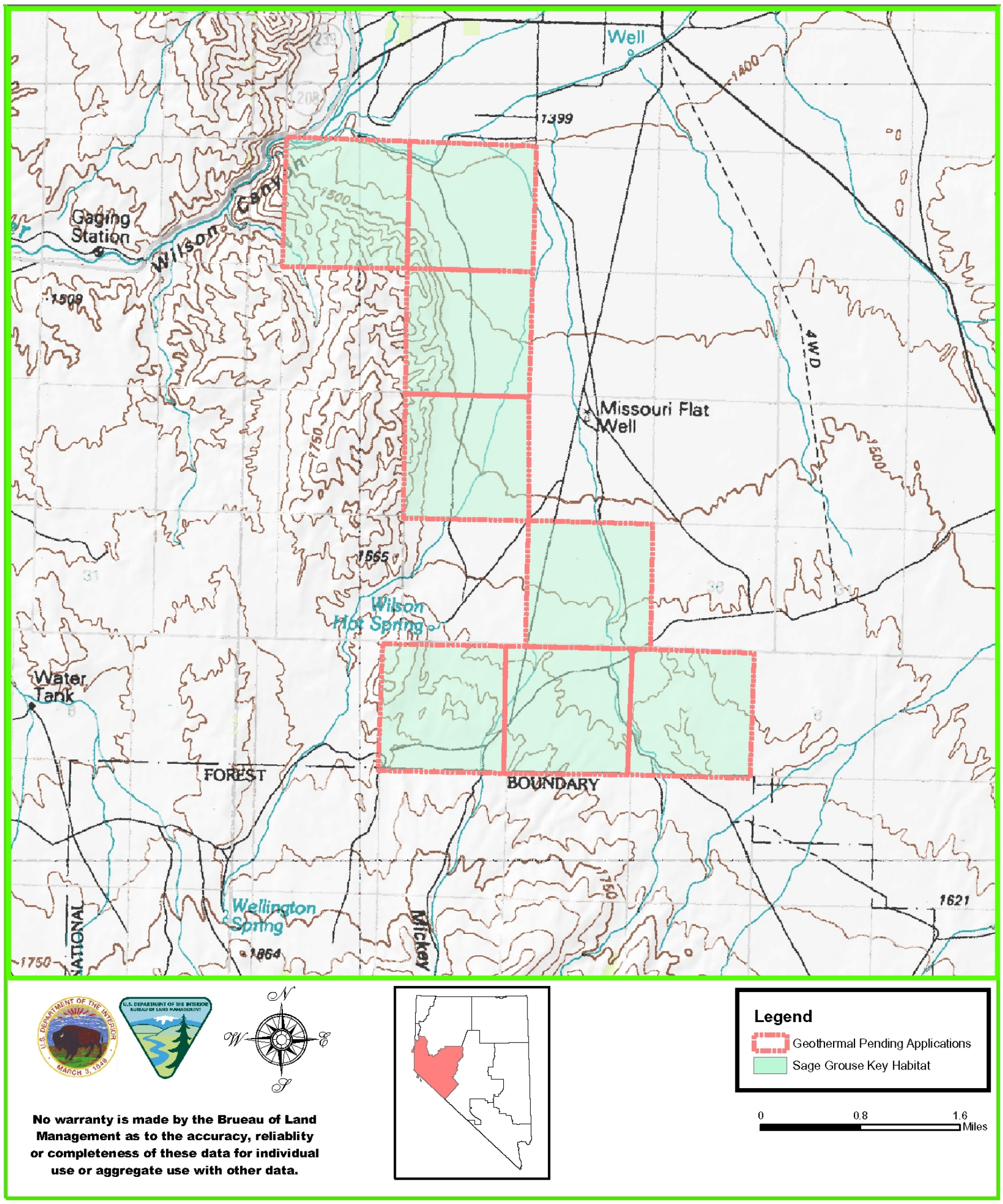


Sage Grouse Key Habitat in the Hawthorne Lease Area

Carson City Field Office, Nevada

Figure 3-9



Sage Grouse Key Habitat in the Wilson Canyon Lease Area

Carson City Field Office, Nevada

Figure 3-10

3.8 CULTURAL, NATIVE AMERICAN, AND PALEONTOLOGICAL RESOURCES

The cultural resources of the planning area have an important role in the Native American, archaeological, and public communities in the region. Prehistoric sites, such as the Grimes Point Petroglyph Site and Hidden Cave, which are listed on the NRHP, have national recognition, while numerous others, including Stillwater Marsh, Spirit Cave, Sunridge, Vista, and the Hungry Wash sites, continue to contribute significant information to scientific inquiry and to provide vital connections to the traditional knowledge and practices of the aboriginal peoples who still call the area home. In fact, the foundations of much of western Great Basin prehistory and ethnology were developed in the planning area. The ROI for cultural resources is the entire CCFO planning area.

While sites in the region played a seminal role in the development and understanding of regional prehistory, the historical record has proved just as rich. Regional historic-era developments, initially peripheral to emigrant goals in California, became nationally important with the discovery of the Comstock Lode in 1859. The planning area is crossed by historic-era corridors that carried people, mail, and goods from eastern cities to growing mining, agricultural, and commercial centers of California, and later to the mining towns and agricultural settlements of western Nevada. The Pony Express Trail, the Overland Stage Route, and portions of the California Trail, each a publicly accessible component of western United States history, pass through the planning area. The trails and associated segments are of national significance, are managed and protected under the National Trails System Act and continue to provide recreational opportunities for those who live in and visit the planning area.

The *Cultural Resource Overview, Carson District, West Central Nevada* (Pendleton et al. 1982) presents a detailed background of regional prehistoric and historic-era research and sites. Although this 1982 overview provided an almost complete inventory of prehistoric and historic sites found within the Carson City BLM District and a comprehensive history of research, more than two decades have passed since its publication. Since that time, archaeological studies have focused on Hidden Cave (Thomas 1985) and the broad territory of the Stillwater Marsh, Carson Sink, and surrounding ranges (Kelly 1985; Raven and Elston 1989, 1991; Zeanah et al. 1995; Zeanah 1996; Kelly 2001). These studies have made significant contributions to anthropological research and theory, while providing the initial framework for resource management tools for federal, state, and local agencies. It is highly likely that projects undertaken within the planning area, which encompasses Stillwater Marsh, the Carson Sink, the Carson Valley, and the Truckee Meadows, will continue to reveal a wide range of information with scientific and cultural value.

Prehistoric Cultural Resources

The CCFO is rich in prehistoric archaeological sites, with rock shelters, caves, petroglyphs (rock carvings), hunting blinds, quarries, and open-air occupation and temporary camps among the archaeological site types represented. The size, location,

and complexity of these sites vary with changes in resource availability, population, and environment that have occurred in the region since its initial occupation.

The archaeological patterns observed in the planning area parallel those over much of the western Great Basin and are discussed below within this broad framework, although generalized patterns often obscure regional variation (Beck 1999; Hockett 1995). The planning area encompasses a large area that is hydrologically, biologically, and topographically varied. This variation is addressed within regional frameworks developed for the Truckee Meadows and Carson Valley (Elston 1986; Hester 1973), the northern Sierran Front (McGuire 2002), and the Carson Desert (Heizer and Krieger 1956; Grosscup 1960; Elston et al. 1988; Thomas 1982, 1985). In addition, a number of authoritative overviews and reports summarize the history of archaeological research in western Nevada (Bloomer et al. 1999; Delacorte 1997; Elston 1982, 1986; Grayson 1993; Kelly 1985, 2001; McGuire 2002; Pendleton et al. 1982; Raven and Elston 1988, 1989; 1991; Thomas 1985; Zeanah et al. 1995; Zeier et al. 2002). The following generalized chronological discussion and synthesis are drawn from these studies.

Terminal Pleistocene/Early Holocene. The planning area has been used by people at varying intensities since the end of the Pleistocene 12,000 to 14,000 years ago. The Terminal Pleistocene and Early Holocene (TP/EH) archaeological record is typically marked by various forms of leaf-shaped, lanceolate, and often fluted points, and various stemmed points, that make up the "Western Pluvial Lakes Tradition" of Bedwell (1970, 1973). These points have been associated with radiocarbon assays dating to approximately 13,000 to 7,000 Before Present (BP) (see Willig and Aikens 1988). Two tool complexes are associated with this time period—Clovis and Stemmed. Clovis, or Clovis-like, complexes include small to large fluted and square-based spear points, large bifaces, heavy core-tools, backed scrapers, burins (a flint tool with a beveled point), and gravers (cutting or shaving tool). In the planning area, Clovis artifacts have been found at Washoe Lake along the Sierran Front and at the Harvey Site northeast of Fernley (Tuohy 1968, 1985). Stemmed point complexes, perhaps slightly more recent than Clovis, are more common and have a wider geographic distribution. Milling equipment, although occasionally present in TP/EH components, is rarer than in later time periods. Noteworthy is the association of the Spirit Cave burial with this time period (Tuohy and Dansie 1997; 9415 ± 25 BP) and the recovery of a sagebrush bark fishing line dated to 9,660 ± 70 BP at Pyramid Lake (Tuohy 1988). This line and several net sinkers recovered from similar-aged components suggests that the Pyramid Lake fishery, and by extension those at Stillwater and along the Carson River, were important during at least part of the TP/EH.

The adaptive strategy pursued by these early inhabitants of the Great Basin has been described as Paleoarchaic (Jones and Beck 1999) or Pre-Archaic (Elston 1986). Both labels emphasize similarities to the generalized Archaic strategies of the later Holocene. Site density is relatively low, probably due to low populations and high residential mobility (Elston 1986, 2002; Elston and Zeanah 2002; Willig and Aikens 1988). Sites of this period are found in diverse environments but are often situated to take advantage of

shallow lake/marsh systems. During this time, the diversity of obsidian source locations manifest in Great Basin Stemmed-series projectile points is higher than during any subsequent period (Jones et al. 2003; McGuire 2002), suggesting that the foraging ranges of their makers were comparatively large.

Post-Mazama Period. The eruption of Mt. Mazama in central Oregon, and the coincident ash-fall found throughout the Great Basin, provide an important time marker circa 7,000 BP. Archaic strategies first appeared at about this time. Tool assemblages became much more diverse, with intensive use of bifaces and scrapers and a variety of grinding implements. Settlements began to move away from lake shores to more limited "sweet spots." Similar to TP/EH components, however, these kinds of sites may have been produced within a settlement framework of comparatively brief, generalized occupations by residentially mobile, band-like foragers.

The Post-Mazama tradition has been identified in the northwestern Great Basin primarily by the presence of northern side-notched projectile points. This point form tends to be distributed in an arc across the Columbia Plateau and the northern Great Basin. Although they are relatively rare in the planning area, northern side-notched projectile points have been reported from shoreline components at Pyramid Lake (Tuohy 1988).

Recent research suggests that a variety of corner-notched, contracting-stemmed, and lanceolate dart points similar to "Martis" variants may also date to the Post-Mazama period (Hildebrandt and King 2002). Post-Mazama components typically contain a diffuse but varied assortment of hunting and processing tools typical of high residential mobility. These foragers may have included within their ranges lakeshores and marshes (Sampson 1985) and other well-watered valleys in the region (Milliken and Hildebrandt 1997; O'Connell 1975; O'Connell and Inoway 1994; Rosenthal 2000).

Noting the diversity of projectile point types with hydration values indicative of Post-Mazama sites, Milliken and Hildebrandt (1997) and Grayson (1993) speculate that well-watered areas along the Sierran Front may have served as refuges for geographically disparate populations at the height of mid-Holocene warming.

Early Archaic Period. Evidence of Early Archaic cultural activity in the western Great Basin is widespread, represented by various split-stem projectile points (e.g., Gatecliff, Bare Creek, Martis). In addition to these are numerous flake tool scrapers, bifacial knives, heavy core tools, and, for the first time, abundant ground and battered stone milling equipment. Although few exclusively Early Archaic sites have been investigated, nearly every major cave deposit and many open-air sites contain at least some Early Archaic material (Elston 1982; Pendleton et al. 1982; Beck 1995). Even more numerous in the region are hundreds of small Early Archaic upland camps. The Sierran and Eastern Front manifestations of this adaptation included the initiation of a specialized flaked stone industry focusing on basalt, traditionally known as Martis (Elston et al. 1994). Obsidian source variability remained high during this period, implying

geographically wide-ranging populations. However, unlike earlier periods, this pattern may have resulted more from long-distance logistical hunting forays than from high residential mobility.

As suggested by the above, the Early Archaic period witnessed an across-the-board increase in archaeological site density, a pattern that accelerates in the subsequent Middle Archaic period. Ameliorating climatic conditions at the end of the Middle Holocene may have played a role in this transition, although it is not immediately clear how local environmental changes might have affected specific plant and animal resources. The increased archaeological visibility may also be due to increasing population densities.

In the Great Basin, there is a documented increase in the ratio of large to small mammal remains in archaeological components dated to between 4,500 and 1,000 BP (Hildebrandt and McGuire 2002; McGuire et al. 2003). This trend is thought to represent the rise of logistical settlement systems and, in addition to its obvious subsistence implications, may have been fueled by a prestige effect garnered by males participating in long-range hunting activities (Hildebrandt and McGuire 2002). To support such activity, females may have adopted a foraging strategy directed at the intensive exploitation of locally available and often lower-ranked plant, small animal, and fish resources wholly in contrast to the strategies employed by males (McGuire et al. 2003). Notwithstanding the ultimate cause, the Early Archaic period witnessed the initial rise of settlement hierarchies in this region of the Great Basin, corresponding to the archaeological equivalents of base camps, field camps, and task stations.

Middle Archaic Period. As previously mentioned, the Middle Archaic period in the western Great Basin witnessed the accelerated elaboration of logistically well-organized adaptive behavioral patterns, marked by increasing cultural complexity (Elston 1982, 1986; Thomas 1982). This is manifested in the archaeological record through an amazing richness and variety of textiles and other perishable remains, an explosive increase in rock art, and an increasing range of site types. In the western Great Basin, the Middle Archaic is characterized by its distinctive and elaborate material culture, long distance trade and exchange relationships, and overall settlement complexity.

Middle Archaic times also saw the continued development of an unprecedented phase of biface manufacture associated with major basalt, obsidian, and other toolstone quarries (Elston and Raven 1992; Gilreath and Hildebrandt 1995; Hall 1983; McGuire 2002; McGuire and Bloomer 1996). The sizes, locations, and assemblages of Middle Archaic sites suggest that they served many different purposes, with use as long-term residential bases, smaller serially reoccupied camps, communal hunting/butchering localities (Pendleton and Thomas 1983), quarries and stone-working camps (Bloomer 1997), and hunting and gathering stations. Large settlements of Middle Archaic age have been reported throughout western Nevada, and Middle Archaic to Middle-Late Transition villages also appear in the Humboldt and Stillwater marshes at this time (Livingston 1986; Raven and Elston 1988). Overall, obsidian source diversity actually

decreases during this time, suggesting long-distance logistical targeting of a few key source locations (McGuire 2002).

A specialized focus on the long-range logistical procurement of large game continued into the Middle Archaic period. Abundant plant remains and carefully fashioned, well-used milling equipment also attest to the rising importance of vegetal resources, though not to the extent or intensity witnessed in later times. In sum, Middle Archaic adaptations throughout the western Great Basin (building on changes initiated during the Early Archaic) may have been less residentially mobile, at least compared to the more free-ranging settlement patterns of earlier times. However, expansive exchange networks and long-range, logistically organized forays by male hunting parties appear to have undergone continued elaboration during this period.

Late Archaic Period. Most researchers now agree that the period between 1,300 and 700 BP was a time of profound cultural change in the western Great Basin induced by severe drought, population increases, resource imbalances, ethnic displacements, changes in technology, social conflict, or some combination of these.

In keeping with the adaptive changes witnessed during the Middle Archaic Period, Late Archaic occupations in the western Great Basin show increasing settlement centralization (Clay 1996; Rosenthal 2000) and subsistence intensification, and a decrease in the area over which groups foraged. Late Archaic deposits marked by Rose Spring and Eastgate-series projectile points are ubiquitous throughout the region and occur in a wider range of settings than do earlier sites. Coinciding with these changes in settlement pattern are numerous technological shifts. House structures become smaller and less substantially built (McGuire 2002), caches are fewer and less elaborate, and many types of perishable artifacts seem to all but disappear from the record (Elston 1982, 1986; Pendleton et al. 1982). The bow and arrow also replace the atlatl (a device used for throwing a spear or dart) as the principal weapon during the Late Archaic, contributing to a major reorganization of flaked stone technologies. Bifaces decrease significantly in size, abundance, and morphological formality and are often simply replaced by numerous flake tools. Activity at major obsidian and basalt quarries shows a concomitant decline (Gilreath and Hildebrandt 1995; McGuire 2002), with the bulk of Late Archaic artifacts fashioned of local stone often derived from inferior sources that were ignored in earlier times (Elston 1986; Kelly 1985; Moore and Burke 1992). Ground stone milling equipment shows a similar trend toward unshaped artifacts that were rarely cached. On balance, the shift to more expedient technologies—disposable tools that were less adaptable to varied circumstances—suggests that Late Archaic populations were less mobile and foraged more intensively over a limited area, obviating the need to transport or cache more reliable and specialized tools. The Stillwater Marsh cemeteries, dating primarily to the Late Archaic times, attest to the centralized use of the marsh area. In sum, Late Archaic settlement-subsistence adaptations appear to have decreased dramatically in the area over which groups foraged, coinciding with a marked increase in settlement centralization and resource intensification, but with little change in social organization.

Terminal Prehistoric Period. Terminal Prehistoric occupation of this region of the western Great Basin is generally thought to be associated with the arrival of Numic-speaking peoples who entered the area from a homeland near the southern Sierra Nevada (Bettinger and Baumhoff 1982; Delacorte 1995; Madsen and Rhode 1994).

With respect to settlement patterns, Late Archaic villages in the Humboldt and Stillwater Marshes, the Truckee and Humboldt River drainages, and all along the northern Sierran Front and Honey Lake Valley are abandoned at this time or have only thin veneers of Terminal Prehistoric material. There is, in fact, a generally sparse archaeological record from this time. Where they occur, Terminal Prehistoric habitation sites are often situated in entirely different locations than previous settlements. Sites and components dating to this time often have a stand-alone quality: They are usually represented by a single house structure found in an isolated context, not tied to larger middens or residential complexes. With regard to house construction techniques, they are very informal, often leaving no more than shallow, circular zones of soil discoloration suggestive of very short-term, single- or several-season occupations. Their floor assemblages are correspondingly low-density, but heterogeneous, reflecting a range of male- and female-related domestic and subsistence-related tasks consistent with a family band occupation.

Aside from a shift to desert side-notched and Cottonwood-series projectile points, and an apparent de-emphasis on the use of locally available Sutro obsidian, none of these changes in settlement strategies seem to have been accompanied by significant changes in technology, raw material use patterns, or size of the areas over which people foraged. But if settlement patterns are any indication, Terminal Prehistoric socioeconomic organization underwent a major transformation. Earlier band-like groups residing in large villages seem to have been replaced by family or household units living in independent camps, much like those reflected in the ethnographic record. Logistical resource procurement out of centralized villages was replaced simultaneously by a strategy in which independent households moved from one resource area to the next, making more intensive use of the landscape.

Historic-Era Cultural Resources

The historic-era cultural resources that document continued Native American use and Euro-American expansion into the area are organized into themes considered to be of regional or statewide importance. These themes include land use, transportation and communication, commerce and industry, government and politics, people, and social organizations (Bernstein and James 1989). These thematic models are further subdivided into more specific themes (Bernstein and James 1989), of which exploration and early settlement, mining, commercial overland transportation, agriculture, railroads, ethnicity, and Native American themes are commonly addressed by archaeological sites in the planning area.

The historic period began in the region with early exploration activities by Euro-American trappers and explorers that ventured into western Nevada beginning in the

1820s. When they arrived, these Euro-Americans encountered Washoe and Northern Paiute peoples. In 1827 Jedediah Smith traversed the area with a small group of men (Brooks 1977), in 1830 Peter Skene Ogden trapped the Carson Sink and Carson River on behalf of the Hudson Bay Fur Company, and in 1844 John C. Fremont's expedition passed through the region during his search for the legendary Buenaventura River, naming the Walker and Carson Rivers on his way (Zeier and Reno 2002).

Beginning with the Bartleson-Bidwell Party in 1841, western immigration followed a variety of trail systems based on the information provided by the explorers. In 1848, with the discovery of gold in California, a flood of emigrants swept through the region along various routes of the California Trail, many of which were eventually expanded into road and railroad networks. These travel routes are included in the Transportation theme.

The discovery of placer gold deposits near Dayton in 1859 initiated exploration of the Virginia Range, and subsequent discoveries, including the Comstock Lode, led to a surge in mining and associated development in the region. The extraction and processing of the Comstock Lode and other mines required food and fuel. Fuel was obtained by cutting down forests, and food was provided by local farming and ranching and overland transport of goods. Trading posts, towns, ranches, and farms developed to fulfill the growing needs of travelers, miners, and residents. These developments forever altered the Native resident's ways of life, as their traditional territories were exploited and claimed by Euro-Americans. In response, a few of the Native Americans occasionally raided emigrant parties and settlements. Military forts were established in the region to help protect the emigrants and the new Euro-American communities.

Numerous toll roads and the Pony Express and Overland Stage Routes, which provided the only expedient communication between the east and west, transected the planning area in the early 1860s. These transportation systems were in part replaced, or at very least altered, by the completion of the Central Pacific Railroad in 1868 that realigned the settlement and transportation network along the rail line.

With the decline of the initially prominent mining activity during the late nineteenth century due to exhausted ore bodies and falling silver prices, agriculture gained importance in the region's economy. In 1903, the Newlands Reclamation Project was begun, diverting water from the Truckee and Carson Rivers to irrigation reservoirs. This water facilitated further agricultural developments in the region, while starving Pyramid and Winnemucca Lakes fisheries, a primary source of income for the local Native Americans.

On the social front, Reno's "divorce industry" was initiated by the divorce of Mr. and Mrs. William Elles Corey in 1906 (Hardesty 1982), and gambling was legalized in 1931. During World War II, the Civil Aviation Administration and Army Air Corp began the construction of four airfields in Nevada as part of the Western Defense Program to ward off a western US military attack by the Japanese. One of these airfields was built in

Fallon in 1942. The Navy took control of the Fallon airfield in 1943, and in 1944 it was officially commissioned as the Naval Air Station Fallon (Toll 2004).

Native American Resources

Native American resources are defined under various authorities, including FLPMA, the American Indian Religious Freedom Act (AIRFA), EO 13007, the Native American Graves Protection and Repatriation Act (NAGPRA), and the NHPA. Under these authorities, the BLM has the responsibility for managing Native American resources by, in part, considering them in land use planning and environmental documentation and mitigating, where possible, impacts on places or resources important to contemporary Native Americans and federally recognized tribes.

Slight differences in definitions among the authorities notwithstanding, these resources can be generally defined as places or resources associated with cultural practices or beliefs of a living community that are rooted in a tribal community's oral traditions or history, and are important in maintaining the continuing cultural identity of the community. In practice this means identifying, evaluating, and managing ethnohistoric sites, traditional use areas, sacred and ceremonial sites, and traditional cultural properties (TCPs). These categories are elaborated on below.

Since tribal heritage resources are defined culturally by the people and groups that value them, these resources can be identified and managed only in consultation with the people infusing them with cultural value. In the final analysis and decision-making, the BLM has the legal authority to determine how these resources will be managed and what, if any, mitigation will be used to avoid undue and unnecessary impacts on these resources.

In the 1820s, British and American fur trappers began penetrating the Great Basin, which includes northern and western Nevada. In 1830, Peter Skene Ogden, the first documented non-Indian to enter the planning area, found it inhabited by people speaking either Washoe or Northern Paiute languages (Fowler 1992; d'Azevedo 1986). While there is no direct way to determine when the people first occupied the area, it is clear that by 1830 they were well established and had been in the area for many years. By the 1850s, land acquisitions, ecological changes, and cultural disruptions caused by non-Indians immigrating into the planning area were curtailing traditional lifeways of the Washoe and Northern Paiute to the extent that they were becoming dependent on non-Indian communities (Malouf and Findlay 1986). The first reservations for the Northern Paiute were identified and occupied in 1859 at Walker Lake and Pyramid Lake (although they were not established by Congress until 1874, and the first Washoe reservation was established at Woodfords in 1887 [Clemmer and Stewart 1986]). Between 1887 and 1930, Northern Paiute and Washoe groups had their reservation lands allotted to individuals and families with at least 50 percent (335,000 acres) of reservation lands passing to non-Indians (Clemmer and Stewart 1986). The last Northern Paiute reservation was established at Bridgeport in 1972 and the last Washoe reservation was established in Susanville in 1923 (Clemmer and Stewart 1986). Both the Washoe and

Northern Paiute had land claims adjudicated through either the Federal Indian Claims Commission or the Federal Court of Claims. These settlements were accepted by the tribes decades ago, and there are no outstanding claims to be adjudicated.

The concept of *Spirit Power* (*Wegeléyu* in Washoe; *Puha-* in Northern Paiute) and its impact on places, people, or events provides the basis for understanding the nature and distribution of places important to Washoe and Northern Paiute people in the planning area. As described in Fowler (1992 and d'Azevedo 1986) the Washoe and Northern Paiute both believe that the universe is a living thing, in which everything has differing amounts of *Spirit Power*. The amount or intensity of *Spirit Power* can change through time and across space in ways that cause events, or allow individuals or groups to do things. Important events happen at particular places because those places have more *Spirit Power* than others. Important people arise because they have high *Spirit Power* relative to others, and important groups arise because they have relatively high *Spirit Power*. Conversely people and places can lose *Spirit Power* and fall into obscurity. *Spirit Power* can also be dangerous, and ordinary people do not casually seek it (Fowler 1992). It can come to people against their wishes and transform them into either good or evil shamans.

The belief in *Spirit Power* is also the basis for the tribal argument that all lands and resources are sacred. While this argument is meaningful to tribes, it is rarely useful in land use planning. Therefore, to the preparers of this EA have focused on places where ethnographic literature and past consultation suggest that high levels of *Spirit Power* have created especially significant places and resources and that these need specific management attention. These places include ethnohistoric sites, traditional use areas, and sacred sites. There is obvious overlap in the site types, and a place can be reasonably put into any or all of them. However, in this EA, each place or resource is placed in only one category.

Ethnohistoric Sites: Tribal ethnohistoric sites are most familiar to non-Indians because they are similar to the kinds of site generally considered to be of historic interest. Ethnographic sites may include those that could also be considered sacred or ceremonial and ethnohistoric. This is because these sites are primarily defined by their prominence in living oral history and are recognized by elders as most important for physically mapping tribal history and culture. Ethnohistoric sites where positive events occur have high positive *Spirit Power,* and places where negative events occur have high negative *Spirit Power*. Places with positive *Spirit Power* are good places to be, while places with negative *Spirit Power* are to be avoided.

As summarized in Bengston (2003) for the Northern Paiute and in d'Azevedo (1986) for the Washoe, important ethnohistoric sites include those that are sacred or used for habitation, trails, ceremonial locations, battle sites, and burials.

Traditional Use Areas: Any traditional lifeway, such as ranching, or ethnographic lifeway that depends directly on natural resource extraction, will over time develop places that are particularly important for their resources and history of resource extraction.

Eventually, these areas assume significant roles in defining and maintaining the traditional lifeway. These traditional use areas become even more significant when the traditional lifeway is threatened by uncontrollable external changes. Contemporary tribal identity and lifeways are developed and maintained by intergenerational use of traditional use areas.

In contrast with many other types of tribal heritage resources, associated with general tribal activities, traditional use areas can be associated with—some argue even owned by—individuals. In addition, what non-Indians regard as identical resources in identical places (e.g., any piñon tree or grove is the same as any other) may in fact be very different because they have varying amounts of *Spirit Power* and may be used by a particular family or individual because of a special connection, through *Spirit Power,* between the place and the person.

As summarized in Bengston (2003) for the Northern Paiute and d'Azevedo (1986) for the Washoe, important traditional use areas include pinion gathering locations, basketry material sites, medicinal plant and mineral gathering sites, and group hunting (rabbit, antelope, or sheep drives) and fishing locations.

Sacred Sites: As defined in EO 13007, sacred site means any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion.

As summarized in Bengston (2003) for the Northern Paiute and d'Azevedo (1986) for the Washoe, important sacred sites include sacred geography—places that figure prominently in tribal mythology, such as origin locations, or prominent geographic points, such as mountain peaks, waters, especially lakes, rivers, and hot springs, and ceremonial sites.

Sacred Geography: Mountain ranges incorporate mountain peaks and caves and these allow mountains to gather and hold *Spirit Power* and are important tribal heritage resources throughout the planning area. Mountains are the source of most major waters. Mountains host resources, such as piñon, that are essential to survival. All mythological origin points and creation sites of the region are found at mountain peaks (Fowler 1992). Shamans, doctors and others seeking supernatural power would find it in mountain caves, and ordinary people went to caves to leave offerings soliciting supernatural help (Fowler 1992). Mountain peaks considered most sacred to Northern Paiute include Job's Peak and Mount Grant (Bengston 2003). Washoe sacred peaks include Mount Como (d'Azevedo 1986).

Waters: Since *Spirit Power* flows through the earth and all living things, water (also a scarce resource in a desert ecosystem) is sacred to both the Northern Paiute and Washoe (Fowler 1992; d'Azevedo 1986). Water figures prominently in origin stories and

other mythology. Lakes, rivers, major springs, and especially hot springs are centers for shamanistic, medicinal, and ceremonial activities. Shamans, mythological heroes, and mythological villains travel along water *(Spirit Power)* networks and use them to communicate with the spirit world. People also make offerings at springs and other waters to gain favor with spirit beings (Fowler 1992).

Water babies are small very powerful spirit beings who inhabit deep water sources, such as major springs, rivers, and lakes (Fowler 1992). They are a source of power for doctors and shamans but can hurt ordinary people (Fowler 1992). Water babies make water flow and an active water source will dry up if they abandon it (Fowler 1992). As water baby habitat, Lake Tahoe and Pyramid, Walker, Soda, and Mono Lakes are sacred, as are the Truckee, Carson and Walker Rivers (Fowler 1992). Because the water in hot springs is heated deep within the earth, hot springs are water baby habitat and thus considered sacred by both tribes. Marshes and small seeps and springs are too shallow to support water babies and are generally not considered to be strong *Spirit Power* sources.

Ceremonial Sites: Among both the Washoe and Northern Paiute (d'Azevedo1986; Fowler 1992; Bengston 2003) there are places with high *Spirit Power* where shamans and healers do their work and where ordinary people go to connect with the supernatural (Bengston 2003). Such places include rock art sites, caves and springs where individuals gain *Spirit Power*, dance sites, doctor (or medicine) rocks, hot and cold springs, and places where objects have been ritually placed (Bengston 2003). Some of these places contain physical evidence of use, others do not. Shamanistic rock sites are of particular importance to both Northern Paiute and Washoe and are used as prayer/offering places to seek medicinal relief or supernatural favors (Fowler 1992). The rocks themselves usually have numerous cupules pecked into them and have small offerings (coins, bullets, notes, buttons, etc.) left on or near them.

Among the ceremonial sites recorded for the Northern Paiute and Washoe are rock art sites, which have been of interest to archaeologists for decades.

Traditional Cultural Properties: The term TCP was coined in National Register Bulletin 38 to refer to a property that may be eligible for inclusion on the National Register because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and that are important in maintaining the continuing cultural identity of the community." This was further clarified in a 1992 amendment to the NHPA that stated, "properties of traditional religious and cultural importance to an Indian tribe may be determined to be eligible for inclusion on the National Register." Although the term TCP is not found in the NHPA or its implementing regulations, it has become important for determining eligibility and compliance with Section 106 of the NHPA.

There are regulatory limitations on the National Register eligibility (such as a property having to be a definite location of human activity, with discernible exact boundaries, and be at least 50 years old) that limit its value in a general planning context. Because of this,

the concept of TCP is used here only when tribes have specifically identified a resource as a TCP. This is not to say that the resources discussed here are not eligible for the National Register and thus not subject to Section 106 of the NHPA; they may well be eligible even if not identified as a TCP by a tribe and subject to Section 106.

Cultural Resources in the Study Area

There are 174 historic properties within the planning area listed on the NRHP. The vast majority of these properties are associated with the early commercial and residential development of Reno and Carson City. Only eight listed properties fall within lands managed by the BLM CCFO. These are generally sites, stations, and linear features associated with transportation corridors, such as the Churchill-to-Sand Spring Toll Road and the Pony Express Route. Portions of the Silver Terrace Cemeteries in Virginia City and portions of the Newlands Project also fall on BLM-managed lands. Prehistoric archaeological sites are also listed on the NRHP and include the Grimes Point and East Walker River petroglyph sites. The Stillwater Marsh historic property includes a large area with components of prehistoric, historic, and traditional significance; however, the BLM manages very little of the Stillwater Marsh property.

Although a significant portion of the planning area has been subjected to some level of cultural resources inventory and reconnaissance, most previously inventoried lands are those suitable for development in valley bottoms and along transportation and river corridors. A statistical list of eligible, unevaluated, and ineligible properties is not maintained for the planning area, and quantitative archaeological sensitivity modeling has not been conducted for most of the variable geography of BLM-managed lands in western Nevada. It is possible, however, to make some general statements regarding the archaeological and cultural sensitivity in the planning area.

Prehistoric and historic cultural resources may be present throughout the planning area, and it is difficult to predict where NRHP-eligible sites will be located. Sites of unique significance might include well-preserved homesteads or town sites, traditionally important rock art locations, or scientifically valuable archaeological deposits. Their unique character may result in the identification of cultural or conservation uses that preclude further local development, but these cases are likely to be rare. In most cases, conflicts with NRHP-eligible sites may be addressed through permit-specific mitigation measures involving local avoidance or archaeological and historical data recovery.

Prehistoric Resources

Prehistoric sites are often associated with modern marshes, streams, and other freshwater sources, such as the Carson, Truckee, and Walker Rivers, but also occur along the margins of extinct water bodies. For example, pluvial Lake Lahontan inundated much of the planning area during the Late Pleistocene and early Holocene and resulted in resource distributions much different than observed today. The distribution of prehistoric sites is also associated with relatively recent changes in local geography. For example, pinyon arrived in the planning area during the Late Holocene (1490 BC to present), and Late Archaic to Terminal Prehistoric archaeological sites are

found within and adjacent to extensive pinyon resource areas in the middle elevations of most mountain ranges in the region. Pinyon resources supported large prehistoric populations in Carson Valley, Dixie Valley, Smith Valley, Stillwater Marsh, and the Truckee Meadows. Sites of the pinyon zone are most often associated with relatively permanent tributary streams on mountain slopes. The ridgelines of the prominent north-south-trending mountain ranges that rise above the planning area often have traditional significance to native populations. Prehistoric rock-ring habitation and hunting features are found even at the highest elevations. Prehistoric sites are also concentrated in areas where raw materials were available for use in technological and trading systems. Quarry and stone tool production areas are found around volcanic outcrops of obsidian and basalt and in the vicinity of geothermally altered silicate rocks; people collected three kinds of stone materials for making tools (obsidian, sinter [a calcium-containing material, such as travertine], and basalt) from Sutro and Steamboat sources. Other sources of raw material have been documented in the fans of Dixie Valley, Hungry Valley, and in the Salt Wells basin.

Prehistoric site density is highest in areas of perennial water, such as the well-watered basins in the western planning area; in general, areas of prehistoric use also correspond to areas of historic-era and modern development. Site density is reduced in the generally dry basins of the eastern and southern planning area. In these areas, such as Gabbs, sites will undoubtedly be found, but they will generally be associated with logistical use of local resources, and large habitation sites will be rare. In general, sites will be found around spring sources and along the intersection of the mountain-front and broad coalesced alluvial fans that ring the valleys. Sites will be rare on broad open fans, open playas, and areas of large active dune fields. On the other hand, incongruously large sites are often found in areas of stabilized dunes and sand sheets where productive seed plants are found even some distance from water sources.

Historic Resources

Historic-era archaeological sites in the planning area are often associated with exploration, emigration, and transportation routes that crossed the major valleys during the late nineteenth and early twentieth centuries. There are no portions of such routes recorded within any of the lease areas in the proposed action. Historic-era sites associated with general transportation are generally found along roadways, many of which have developed into major transportation corridors in modern times. Historic-era sites and features are also common in areas that experienced or supported the mining boom of the late 1800s. These will be present within and adjacent to mining districts and prospect areas in mountain ranges throughout the planning area. They include town sites, agricultural outposts (e.g., sheep and cattle camps, orchards, irrigation features), homesteads, and mining and prospecting features. The historic mining town of Aurora, situated on the Bridgeport Ranger District, is listed on the NRHP.

The Newlands Project, initially authorized in 1903, is an irrigation effort to support agriculture in Churchill, Lyon, Storey, and Washoe Counties (USBOR 2006). It extends from Lake Tahoe on the California/Nevada border and along the Truckee and Carson

Rivers. Specific features have been listed on the NRHP, including the Carson River Diversion Dam along the Carson River and in the vicinity of Fallon, the Lahontan Dam and Power Station along the Carson River and also in the vicinity of Fallon, and the Derby Diversion Dam along the Truckee River and in the vicinity of Sparks (NV SHPO 2006; USBOR 2006). Portions of the Truckee Canal, running from Derby Diversion Dam to the Lahonton Reservoir, are within the Hazen lease area, but this is not one of the NRHP-listed features of the Newlands Project. It is unknown if the Truckee Canal or the entire Newlands Project have been evaluated for inclusion on the NRHP.

Native American Resources

The BLM has initiated consultations with local Native Americans to identify the presence of Native American resources within the proposed lease areas. At this time, no responses have been received. As such, the presence of traditional cultural resources or other sacred sites within the planning area is unknown, and it must be assumed that Native American resources exist within the CCFO planning area.

There are several Indian Reservations within the CCFO planning area, as follows (Nevada Department of Transportation 2003):

- Carson Indian Colony (Washoe);
- Fallon Indian Reservation (Paiute-Shoshone);
- Fallon Colony (Paiute-Shoshone);
- Dresslerville Indian Colony (Washoe);
- Pyramid Lake Indian Reservation (Paiute);
- Reno/Sparks Indian Colony (Paiute, Shoshone, and Washoe);
- Walker River Indian Reservation (Paiute);
- Stewart Indian Colony (Washoe);
- Yerington Indian Reservation/Campbell Ranch (Paiute); and
- Yerington Indian Colony (Paiute).

The Lee Hot Spring lease area is directly adjacent to the north of the Walker River Indian Reservation. The Paiute tribe associated with this reservation is federally recognized. As such, the CCFO must maintain a government-to-government relationship with the reservation. The Salt Wells lease area is directly adjacent to the south of the Fallon Indian Reservation. This reservation is also associated with a federally recognized Paiute-Shoshone tribe and, as such, maintains a government-to-government relationship with the CCFO.

Paleontological Resources

Vertebrate fossils such as dinosaurs, mammals, fishes and reptiles, and uncommon invertebrate fossils may be collected only by trained researchers under BLM and USFS

permit. Collected fossils remain the property of all Americans and are placed with museums or other public institutions after study. Common invertebrate fossils such as plants, mollusks, and trilobites may be collected for personal use in reasonable quantities, but may not be bartered or sold. Petrified wood may be collected up to 25 pounds plus one piece per person per day, with a maximum of 250 pounds per person per year. Permits are required for pieces over 250 pounds. Petrified wood may not be traded, bartered or sold without permit. Cave resources, including plant, animal and geologic features, are federally protected and may not be altered, damaged or removed.

There are no paleontological resources known to occur in the lease areas with the exception of the Wilson Canyon lease area. Numerous fossils, including vertebrate fossils, and petrified wood have been found in the Wilson Canyon, along the river in the vicinity of the lease area. Other fossils have been found in the hills to the west of the lease area. Some may be present in the southern part of the lease area.

3.9 LIVESTOCK GRAZING

The BLM manages livestock grazing in allotments within the district. This section describes grazing resources and regulations in the region of influence for the proposed action. The ROI for grazing resources is the allotments within proposed geothermal lease areas.

The BLM manages grazing under the authority of the Taylor Grazing Act of 1934, FLPMA (1976), and the Public Rangelands Improvement Act of 1978. Under this management, ranchers may obtain permits for an allotment of public land on which a specified number of livestock may graze. The number of permitted livestock on a particular allotment is determined by how many animal unit months (AUMs) that land will support. The BLM operates a program to stabilize or improve the ecological condition of the allotments. This program includes proper management of livestock grazing and such improvements as fences and water developments. Six lease areas overlap eight grazing allotments, totaling about 50,800 acres that are available for grazing (Table 3-6).

Table 3-6
Grazing Allotments and Available AUMs within Proposed Geothermal Leasing Areas

Lease Area	Lease Cluster Area (Acres)[1]	Allotment Name	Total Area of Grazing Allotment (Acres)	Approximate Acres within Lease Areas Available for Grazing	Approximate AUMs within Lease Areas
Hazen	5,765	Truckee-Virginia	21,369	4,275	204
Salt Wells	20,028	Salt Wells	58,611	7,023	106
Lee Hot Springs	14,508	Bass Flats	46,789	1,007	35
		Horse Mountain	63,043	13,498	643
South Aurora	24,199	Nine Mile	25,665	1,329	121
Wabuska	3,173	Adriance Valley	31,790	3,170	167
Gabbs Valley	26,347	Philips Well	70,431;	1,945	41;
		Pilot/Table Mountain	512,449	18,505	284
Total	**94,020**		**830,147**	**50,752**	**1,601**

Hazen Lease Area

This lease area includes approximately 4,275 acres of the Truckee-Virginia Grazing Allotment, which supports 204 AUMs between November and April.

Salt Wells Lease Area

This lease area includes approximately 7,023 acres within the Salt Wells Grazing Allotment and supports 106 AUMs. Permits for these three allotments allow grazing between November and April.

Lee Hot Springs Lease Area

This lease area includes the Bass Flat and Horse Mountain grazing allotments. The lease area includes approximately 1,007 acres of the Bass Flat allotment, supporting 35

AUMs, and approximately 13,498 acres of the Horse Mountain allotment, supporting 643 AUMs. Grazing is permitted on the Bass Flat allotment between November and April and on the Horse Mountain allotment between January and March.

South Aurora Lease Area

This lease area includes approximately 1,329 acres of the Nine Mile Grazing Allotment, which supports 121 AUMs, and grazing is permitted in October, November, April, and May.

Wabuska Lease Area

This lease area includes approximately 3,170 acres of the Adriance Valley Grazing Allotment, which supports 167 AUMs year-round.

Gabbs Valley Lease Area

This lease area includes the Phillips Wells and Pilot-Table Mountain grazing allotments. The lease area includes approximately 1,945 acres of the Phillip Wells allotment, supporting 41 AUMs, and approximately 18,505 acres of the Pilot-Table Mountain allotment, supporting 284 AUMs. Grazing is permitted on the Phillips Wells allotment between December and March and yearlong on the Pilot-Table Mountain allotment.

3.10 WILD HORSES AND BURROS

In this section are described the regulations that protect wild horses and burros on public land and the setting of the herd management areas (HMAs) and wild horse territories (WHTs) in the ROI for the proposed action. The BLM manages wild horses and burros in HMAs, and there are approximately 103 HMAs in Nevada. In addition to HMAs and WHTs for horses, the Marietta Wild Burro Range (NV316) southeast of Hawthorne, is the nation's only formally recognized wild burro range. It was dedicated in 1991, contains approximately 85 burros, and covers 68,000 acres (BLM 2002b).

The CCFO manages 15 HMAs, and all but one of which, the Marietta Wild Burro Range, is for horses (BLM 2001a). The HMAs are scattered throughout the field office. When compared to project location maps, the Lahontan HMA (NV306) is identified as being near the proposed geothermal lease areas (BLM 2001a). However, none of the proposed geothermal lease areas are within any HMAs.

The USFS Bridgeport Ranger District of the Humboldt-Toiyabe National Forest administers the Powell Mountain WHT, which is approximately 10 miles south of Hawthorne. The territory consists of 111,000 acres of National Forest land on the south end of the Wassuk Mountain Range and overlaps portions of the North and South Aurora lease areas. The Powell Mountain WHT is managed for an appropriate management level of 29 horses.

The territory is situated between Anchorite Pass and Buller Mountain, and the topography is mountainous. There are four major vegetation communities within the territory: sagebrush, pinyon-juniper, meadows, and playas. The sagebrush type is dominated by Great Basin sagebrush. Pinyon-juniper type is characterized by the single leaf pinyon pine and Utah juniper. The meadow type is confined to small areas of accessible water or snowmelt accumulation, producing a grass dominated community. The playa type is an alkali sink community consisting of alkali tolerant plants, such as saltbrush, goosefoot, and greasewood. Wildlife present within the territory include deer, antelope, badgers, jackrabbits, and coyotes. Livestock grazing is permitted within the territory.

The primary responsibilities of the BLM and the USFS under the Wild Free-Roaming Horse and Burro Act of 1971 are to preserve and protect wild horses and burros and to manage for healthy rangelands (BLM 2002b). Under the act, the BLM and the USFS were directed to identify herd areas where horses and burros were located. The BLM and Forest Service inventoried and mapped these herd areas in the first few years following passage of the act. Through the BLM and the USFS planning process, the areas where wild horses are managed as a component of the public lands are designated as the aforementioned HMAs and WHTs (BLM 2002c; USFS 2006).

3.11 VISUAL RESOURCES

This section is a description of the regulations that protect the aesthetic quality of public land and the visual resources of land in the region of influence for the proposed action. The ROI for visual resources includes the areas within and surrounding proposed geothermal lease areas.

Policies and Plans

In accordance with FLPMA, the BLM is entrusted with the multiple use management of natural resources on public lands, which contain many outstanding qualities, including scenic landscapes. In managing the public lands for multiple uses, the BLM is constrained by the legal mandate to "protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values…and provide for…human occupancy and use" (BLM 2006a).

The BLM is responsible for ensuring that the scenic values of public lands are considered before allowing uses that may have negative visual impacts. The BLM addresses this through its Visual Resource Management (VRM) system. The VRM system involves two stages—the visual resource inventory stage (described in BLM Handbook H-8410-1, *Visual Resource Inventory*) and then the visual resource contrast rating stage (described in BLM Handbook H-8431-1, *Visual Resource Contrast Rating*) (BLM 2006a). The inventory stage involves identifying the visual resources of an area. The results of the visual resource inventory become an important component of BLM's Resource Management Plan (RMP) for an area because the RMP establishes how the public lands will be used and allocated for different purposes. The visual values of an area are used in the RMP process to assign VRM classes with management objectives to an area's visual resources. The four VRM classes and management objectives consist of the following:

- Class I Objective—To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention;
- Class II Objective—To retain the existing character of the landscape. The level of change to the characteristic landscape should be low;
- Class III Objective—To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate; and
- Class IV Objective—To provide for management activities that require major modification of the character of the landscape. The level of change to the characteristic landscape can be high.

The CCFO CRMP identifies the lands with VRM classes in the CCFO management area. Only BLM land in the Highway 395 South area is both affected by the proposed action and is designated with a VRM Class. This area has 1,570 acres of VRM Class III

and 991 acres of VRM Class IV designations, which are described below under the Steamboat lease area.

According to BLM policy, interim VRM classes can be adopted if no VRM classes are assigned to BLM lands. For the purpose of this document, all BLM lands in the vicinity of leasing areas are assumed to have a VRM Class III designation in order to have a standard against which project actions can be assessed (Knight 2006).

The analysis stage involves determining whether potential visual impacts from proposed surface-disturbing activities or developments would conform to management objectives established for the area, or whether project design adjustments would be required. The visual contrast rating process used for this analysis involves comparing the project features with the major features in the existing landscape from key observation points using the basic design elements of form, line, color, and texture. The four design elements and guidance for assessing contrast are described as follows (BLM 2006c):

- Form—Contrast in form results from changes in the shape and mass of landforms or structures. The degree of change depends on how dissimilar the introduced forms are to those continuing to exist in the landscape.
- Line—Contrasts in line results from changes in edge types and interruption or introduction of edges, bands, and silhouette lines. New lines may differ in their subelements (boldness, complexity, and orientation) from existing lines.
- Color—Changes in value and hue tend to create the greatest contrast. Other factors, such as chroma, reflectivity, color temperature, also increase the contrast.
- Texture—Noticeable contrast in texture usually stems from differences in the grain, density, and internal contrast. Other factors, such as irregularity and directional patterns of texture, may affect the rating.

Using the analysis as a guide, attempts can be made to reduce visual impacts caused by a project. Once every attempt has been made to reduce visual impacts, BLM managers can decide whether to accept or deny project proposals.

Steamboat Lease Area

The Steamboat lease area is in the Washoe Valley of Washoe County. Human settlements and roads disrupt the natural impression of this area. Washoe Lake and the snow-capped peaks of the Sierra are the main accentuating features of Washoe Valley. The backdrop of the valley is composed of the Jeffrey pine-covered Sierra Nevada Mountains to the west and the pinyon- and juniper-covered Virginia Range, five miles to the east. The Sierra Nevadas are green with lush vegetation, and the Virginia Range supports only vegetation adapted to arid climates (BLM 1974d). The Steamboat Hills are the visually dominant landscape feature in this part of the Truckee

Meadows. BLM land in the Highway 395 South area is part of the Steamboat lease area and has a VRM Class III designation (BLM 2001a).

According to the Washoe County Scenic Resources Map in the Conservation Element of the Washoe County Comprehensive Plan, the scenic resources closest to the Steamboat lease area are Mt. Rose to the west and Washoe Lake Dunes to the south (Washoe County 1991). The Steamboat Specific Plan of the Washoe County Comprehensive Plan contains hillside development regulations to enhance visual qualities by minimizing impacts on existing trees and vegetation (Washoe County 2001).

The Mount Rose Highway (State Route 431), a scenic byway southwest of the proposed action, climbs Mount Rose Summit to the 8,911-foot pass, the highest in the state. It then descends into the Lake Tahoe Basin (Nevada Commission on Tourism 2006).

Hazen Lease Area

With the exception of the Steamboat, North and South Aurora lease areas, the geothermal lease areas are in the Great Basin, which can be described as expansive. The often barren, but frequently colorful, elongated, and steep mountain ranges provide unobstructed panoramic views of the Great Basin area. The mountain ranges parallel sun-saturated, brush-strewn valley floors interspersed with barren, bleached alkali playas (BLM 1974a). Higher elevations support sagebrush, juniper, and pinyon pine. This vegetation provides visual diversity and contrasting darker color along ridgelines in the distant background. Vegetation on the valley floor grows low and evenly and primarily consists of monochromatic desert brush (US Navy 2000). Although the areas are sparsely populated, fences, utility lines, roads (paved and dirt), historic trails, trailer houses, mines, and road signs are present (BLM 1974a). A major highway construction project is in progress, which will widen Alternate Highway 50 to four lanes in the Hazen lease area.

The form, line, color, and texture of the Great Basin landscape are influenced by the arid climate. The hills are gold and brown, and the blue sky can be dotted with fluffy clouds and thunder clouds at times. Sunlight is a dominating element in the area, and whirling winds create dust funnels (US Navy 2000; BLM 1974a).

The Hazen lease area is northwest of Fallon. There are no protruding mountain ranges or expansive valleys northwest of Fallon. Russian thistle and greasewood are scattered across low-rolling pebble-paved terrain (BLM 1974a). No BLM VRM classes have been established for this area.

Salt Wells Lease Area

The Salt Wells lease area is characteristic of the Great Basin environment described above. The lease areas are south of Fallon and immediately east of Carson Lake. Much of the shadescale-covered land south of Fallon is desolate, and the bordering mountains are small and smooth (BLM 1974a). No BLM VRM classes have been established for this area.

Lee Hot Springs Lease Area

The Lee Hot Springs lease area is characteristic of the Great Basin environment described above. The lease area is immediately northwest of the Fallon Naval Air Station. Green trees, grasses, and herbs distinguish this area from the rest of the landscape (BLM 1974a). No BLM VRM classes have been established for this area.

North and South Aurora Lease Areas

The North and South Aurora lease areas are mostly in the Humboldt-Toiyabe National Forest. The lease land is on the edge of the forest. The forest contains big sage and black sage-dominated valley bottoms that merge into a backdrop of steep rugged mountains. Numerous springs and creeks are found in the mountains, which are covered with pinyon, Jeffrey pine, red fir, and juniper (BLM 1974c). No BLM VRM classes have been established for this area.

Portions of the project area are in the Humboldt-Toiyabe National Forest. In the *Land Resource Management Plan* for the Toiyabe National Forest, the management of visual resources is addressed (USDA 1986). One of the goals is to manage the forest landscape with sensitivity to visual quality. Also, maintaining or creating an environment that is visually pleasing and that resembles a natural setting is one of the vegetation management objectives.

The Humboldt National Forest and the Toiyabe National Forest were combined in 1997 to create the Humboldt-Toiyabe National Forest (US Forest Service 2006). At the time the two forests were combined, each had its own forest plan completed in 1986. The plans are being revised and combined into one plan for the new combined forest. The new plan will reflect resource and social changes that have occurred around and on the forest. It is scheduled to be approved by the Forest Supervisor in October 2007.

Wabuska Lease Area

The Wabuska lease area is characteristic of the Great Basin environment described above. The lease area is in the area of the Desert Mountains. The mountains, some of which rise 2,000 feet above the desert floor, are treeless (BLM 1974a). No BLM VRM classes have been established for this area.

Wilson Canyon Lease Area

This lease area is in Lyon County and south of Wilson Canyon. The area is characteristic of the Great Basin environment described above. West Walker River flows through Wilson Canyon in the Singaste Range. The lease area is in the foothills and Missouri Flat. Gullies and washes draining the mountains to the west are visible.

Sensitive receptors in the area include individuals who recreate in the area. Recreation in the area includes motorized sports. Most of this area is undeveloped and Nevada State Route 208 is the closest roadway. No BLM VRM classes have been established for this area.

Hawthorne Lease Area

This lease area is in Mineral County and is characteristic of the Great Basin environment described above. Walker Lake is north of the lease area, and immediately west of the lake and lease area is the Wassuk Range. Rocky exposed mountains and scattered short vegetation are visible in this area. No BLM VRM classes have been established for this area. However, visually sensitive areas include the Walker Lake Recreation Area.

Sensitive receptors in the area include members of the Walker River Indian Reservation, individuals who recreate in the area, and motorists on major roads. Hawthorne and Babbitt are northeast of the lease area. Recreation in the area includes motorized sports. Most of this area is undeveloped and can be viewed by traveling on Nevada State Route 359, which is a north-south trending roadway to the east of this area.

Gabbs Valley Lease Area

CCFO manages geothermal lease areas northeast of the Walker Indian Reservation and Nevada State Route 839 in Mineral County and west of Gabbs in western Nye County. This area is in Gabbs Valley next to Fissure Ridge and Black Hills, and the terrain is composed of sand dunes and alkali flats. Sensitive receptors include individuals who recreate in the area. Most of this area is undeveloped. No BLM VRM classes have been established for this area.

3.12 RECREATION AND SPECIAL DESIGNATIONS

This section is a description of the recreational features, uses, and special designated areas within the lease areas covered by this EA. Recreation in the region is governed by the BLM, the National Park Service, and the USFS. Recreational and specially designated areas within each lease area are described below. Specially designated areas include ACECs, back country byways, national trails, and WSAs. The ROI for recreation and special designations is the entire CCFO planning area.

Steamboat Lease Area

The Steamboat lease area is between Carson City and Reno to the north and northeast of Washoe Lake. Jones Creek and Steamboat Creek pass through the lease area. There are no national, state, or community parks within the lease area. There are no known specially designated areas within the lease area.

Typical casual/dispersed uses in these lease areas include day hiking, nature study, walking, OHV use, and horseback riding (Callan 2002).

Hazen Lease Area

The Hazen lease area is in Lyon County east of Fernley. There are no national or state parks in the area of the geothermal leasing lands. There are no known specially designated areas within the lease area.

The closest recreation opportunities are found at the Gold Club of Fernley, which borders the east side of lease area N77646. Typical casual/dispersed uses in these lease areas include four-wheel drive off road vehicle use for pleasure, birdhunting, and OHV use and horseback riding. One BLM permitted event in this area is a horseback riding and buggy driving endurance ride (Callan 2002).

Salt Wells Lease Area

The Salt Wells lease area is on the northeastern quarter of both Carson Lake and Carson Lake Pastures, as well as northeast of the lake. There are no national, state, or local parks within the lease area. There are no known specially designated areas within the lease area.

The closest recreational area is Grimes Point on the north side of US Highway 50, approximately one mile west of lease area N77722. An annual mountain bike race is held in April/May in the Grimes Point area (Callan 2002). Typical casual/dispersed uses in the Salt Wells lease area include four-wheeling for pleasure. Every year, several BLM permitted OHV races pass through the area, including the Valley Off-Road Racing Association event in July, Best In The Desert in September, the Horse Endurance Ride in October, and Pony Express Re-Ride in June.

Lee Hot Springs Lease Area

The Lee Hot Springs lease area is south of Carson Lake and north of the Walker River Indian Reservation. There are no national, state, or local parks within the lease area. There are no known specially designated areas within the lease area.

The only specific features that may attract recreational users on the lease area are Allen Springs, Lee Hot Springs, Flat Top Cave No. 1, Russell Pass, and Russell Spit.

Lee Hot Springs is identified on a popular hiking information Web site, www.trails.com, as being one of the best hot springs in Nevada. The Web site describes the springs as having a reduced flow compared to the past. Whereas the flow used to be high enough to support a pool that was used for bathing, it now is reduced to a small source. The visual setting is described as picturesque and primitive (Trails.com 2006).

North Aurora Lease Area

The north half of the North Aurora lease area is in Lyon County, and the south half is in Mineral County. There are no national, state, or local parks within the lease area. There are no known specially designated areas within the lease area.

The area is crossed by Rough Creek, a tributary of East Walker River, and one road. The northwestern portion of the area is crossed by smaller unimproved roads and East Walker River.

The East Fork of the Walker River is being evaluated for Wild and Scenic River designation under the Humboldt-Toiyabe Forest Plan Revision process. The USFS Wild and Scenic River Eligibility Report designated East Walker River as being eligible for wild and scenic river status for its recreational value, specifically related to its fishing opportunities for the blue ribbon trout (USFS 2005). If this designation is afforded to the river, its recreational uses would be protected within a quarter-mile buffer on either side of the river (Fechner 2006).

The southeastern portion of the area is also crossed by two unimproved roads. Aside from Walker River and Rough Creek, no specific features on the site are likely to attract recreational users. Recreation associated with the river, creek, and unimproved roads in this area can include hiking, bird watching, nature photography, and mountain biking.

South Aurora Lease Area

The South Aurora lease area is in northwestern Mineral County. There are no national, state, or local parks within the lease area. There are no known specially designated areas within the lease area, but several tributaries of the East Walker River cross the site. Although the East Fork of the Walker River is being evaluated for Wild and Scenic River designation under the Humboldt-Toiyabe Forest Plan Revision process, tributaries are not afforded special protections in this plan (Fechner 2006).

Topography in the lease area is highly variable and includes peaks, a crater, springs and creeks. Four-wheel drive trails crisscross the lease area. Recreation associated with springs and unimproved roads in this area can include hiking, bird watching, nature photography, mountain biking, and OHV use. Specific features within the lease area that may attract recreational users are shown in Table 3-7.

Table 3-7
Potentially Recreational Features within South Aurora Lease Area

Feature	Serial Number
Aurora Crater	Various
Mud Spring	N74252
Aurora Peak	N79883
Unnamed Springs	N79884, N79885, N74251
Aurora Creek	Various
Mud Spring Canyon	Various
Cheseo Mine	Various

BLM-permitted events include a dual sport motorcycle ride in June and buggy (OHV) rallies in August and September.

Wabuska Lease Area

The Wabuska lease area is just north of Mason Valley Wildlife Management Area and west of the Walker River Indian Reservation. There are no national, state, or local parks within the lease area. There are no known specially designated areas within the lease area.

The Mason Valley Wildlife Management Area is very popular with the public and includes recreation opportunities such as hunting, fishing, bird watching, nature photography, and hiking (Bull 2002). The lease area also includes the Wabuska Hot Springs and several alkali flats and dry lakes.

Typical casual/dispersed uses in this lease area include four-wheeling for pleasure, OHV riding, birdwatching, and hunting (Callan 2002). There are no state parks in the area of the geothermal leasing lands (Nevada Division of State Parks 2002).

Gabbs Valley Lease Area

Approximately 80 percent of the Gabbs Valley noncompetitive lease area is in the eastern portion of Mineral County, and the remaining approximately 20 percent is in the western portion of Nye County. There are no national, state, or local parks within the lease area. There are no known specially designated areas within the lease area.

Most of the lease area is an alkali flat. Recreation associated with springs and unimproved roads in this area can include hiking, bird watching, nature photography,

mountain biking, and OHV use. Specific features within the lease area that may attract recreational users are shown in Table 3-8.

Table 3-8
Potentially Recreational Features within Gabbs Valley Lease Area

Feature	Serial Number
Hot Well	N76822
Sand Dunes	N76824, N76826
Cold Springs	N76827
Rawhide Hot Spring	N76827
Mud Windmill	N79706

Hawthorne Lease Area

The Hawthorne noncompetitive lease area is southwest of the city of Hawthorne. There are no national, state, or local parks and no known specially designated areas within the lease area.

Aside from the several four-wheel drive trails that crisscross the lease area, no specific features have been identified that may attract recreational users. Recreation associated with trails in this area can include hiking, bird watching, nature photography, mountain biking, and OHV use.

Wilson Canyon Lease Area

The Wilson Canyon noncompetitive lease area is in Lyon County and overlaps Wilson Canyon/Walker River to the north. It is bounded by the Toiyabe National Forest on the south. The BLM manages the north side of Walker River, and the USFS manages the south side. There are no national, state, or local parks and no known specially designated areas within the lease area.

Wilson Canyon is a popular location for camping, fishing, hiking, picnicking, and OHV use (BLM 2005). The main land use on both sides of the Walker River at Wilson Canyon is OHV use. The USFS is developing a travel management plan, which is expected to designate OHV routes within the Wilson Canyon area (Fechner 2006). Features surrounding the lease area that may attract recreational users include Wilson Hot Spring, approximately an eighth of a mile north of N77602, and Missouri Flat Well, approximately half a mile east of N77600.

3.13 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The lease areas are within four Nevada counties: Churchill, Mineral, Lyon, and Washoe. The four counties represent the ROI for socioeconomic resources and environmental justice. The economies of these counties could be affected by geothermal leasing, so demographic, economic, and social data are presented for these counties and for the city of Reno, where applicable. Reno is the largest city in Washoe County and in the region described. The most recent data available at the time of this analysis is supplied for each topic.

Socioeconomic resources include population, employment, income, housing, earnings, and schools. Population is the number of residents in the area and the recent change in population growth; employment data takes into account labor sectors, labor force, and statistics on unemployment; income information is provided as an annual total by county and as per capita income; housing includes numbers of units, ownership, and vacancy rate; earnings-by-industry provides a measure of the health of local business activity; school enrollment and capacity are important considerations in assessing the effects of potential growth.

Population

Between 1990 and 2000 the population in Churchill, Lyon, and Washoe Counties increased, while the population of Mineral County declined by 21.7 percent. Lyon County experienced the largest increase (72.5 percent) (Table 3-9). Washoe County, which includes the Reno-Sparks metropolitan statistical area, had the largest population in both 1990 and 2000, with a large portion of the population (53.2 percent) within the Reno metropolitan statistical area. Mineral County is the least populous county within the project area, with a total population of 5,071 in 2000 (US Census 1990a, 2000a).

Since the 2000 census, the population of Churchill, Lyon, and Washoe Counties continued to increase, while the Mineral County population decreased an additional 8.7 percent between 2000 and 2005. Washoe County population increased 14.6 percent and Churchill County increased by 10.9 percent, while Lyon County experienced the greatest increase (41.6 percent) between 2000 and 2005 (NSBDC 2006a).

Table 3-9
Population

	1990	2000	2005	% Change 1990-2000	% Change 2000-2005
Churchill County	17,938	23,982	26,585	33.7%	10.85%
Lyon County	20,001	34,501	48,864	72.5%	41.63%
Mineral County	6,475	5,071	4,629	-21.7%	-8.72%
Washoe County	254,667	339,486	396,844	33.3%	14.55%
Reno metropolitan statistical area	133,850	180,480	206,735	34.8%	34.8%

US Census Bureau 1990a, 2000b; NSBDC 2006a

The source of much of the population growth in Churchill, Lyon, and Washoe Counties has been from in-migration. By 2024, the population of Churchill County is projected to grow by 10,737 (an annual average increase of 2.1 percent), and Lyon County is expected to grow by 33,037 (an annual average increase of 3.6 percent). Mineral County is expected to continue to experience a decline in population from 2005 to 2025 of 2,211 (an annual average decrease of 2.5 percent). The population of Washoe County is expected to increase by 109,645 (an annual average increase of 1.4 percent) (NSBDC 2006b).

Employment and Economy

In 2005 Washoe County had the largest labor force (207,825) and highest employment rate (96.0) of the four project area counties. Mineral County had the smallest labor force (2,073) in 2005, with 94.1 percent employment, and Lyon County, with a labor force of 20,183, had the highest unemployment rate of 5.3 percent. Churchill County, with a labor force of 12,415, had an unemployment rate of 4.2 percent.

Between 2000 and 2005, labor force, employment, and unemployment declined in Mineral County (by 11.9, 9.6, and 37.4 percent, respectively). During this period unemployment decreased by 30.9 percent in Churchill County, and unemployment increased by 14.2 percent in Washoe County. The largest increase in labor force and employment between 2000 and 2005 occurred in Lyon County, at 12.6 percent and 13.3 percent (BLS, undated).

As shown in Table 3-10, between 2001 and 2004, the employment in the agriculture sector decreased in each of the four project area counties. The largest decreases in employment in Churchill County was in the manufacturing sector (18.2 percent) and in Lyon County it was in the transportation/communications/utilities sector (11.8 percent). Churchill County experienced a large 18.3 percent growth in total employment between 2001 and 2004, whereas total employment in Churchill, Lyon, and Washoe Counties increased by only a small amount over this period. The largest increase in employment in Churchill and Lyon Counties was associated with mining (271.1 percent and 35.5 percent). While employment in the mining sector also increased in Washoe County (8.8 percent) the largest increase was in construction (24.3 percent). There were also large increases in employment in the construction sector in Churchill and Lyon Counties (55.7 and 21.2 percent). The largest increase in Mineral County was in the services sector (6.9 percent).

In 2004 services (4,925) and government (3,234) employed the most workers in Churchill County, and the highest employment in Lyon County was in services (3,378), trade (2,614), and manufacturing (2,459). In Mineral County, the largest employment sectors were government (603 employees), services (217 employees), and trade (214 employees). Services and trade had the highest employment levels in Washoe County (111,087 and 39,488), with government, finance/insurance/real estate, and construction also employing a substantial portion of the labor force (26,626, 24,890 and 23,538) (BEA 2006a).

Table 3-10
Sector Employment

	Agriculture	Mining and Extractive Industries	Construction	Manufacturing	Transportation/ Communications/ Utilities	Wholesale and Retail Trade	Finance/ Insurance/ Real Estate	Services	Government	Total Employment
Churchill County										
2001	702	38	867	720	649	2,098	2,148	3,920	3151	16,547
2004	676	141	1350	589	873	2,551	2,548	4,925	3,234	19,577
% Change	-3.7	271.1	55.7	-18.2	34.5	21.6	18.6	25.6	2.6	18.3
Lyon County										
2001	716	166	1,356	2,143	466	2,880	778	3,141	1760	14,868
2004	677	225	1,643	2,459	411	2,614	1,005	3,378	1,987	15,473
% Change	-5.4	35.5	21.2	14.7	11.8	-9.2	29.2	7.5	12.9	4.1
Mineral County										
2001	47	NA	58	NA	18	213	NA	203	618	2,333
2004	45	NA	59	21	NA	214	NA	217	603	2,401
% Change	-4.3	-	1.7	-	-	0.5	-	6.9	-2.4	2.9
Washoe County										
2001	668	1,001	18,934	14,579	15,492	37,616	21,703	105,672	24298	240,276
2004	630	1,089	23,538	14,818	15,252	39,488	24,890	111,087	26,626	257,737
% Change	-5.7	8.8	24.3	1.6	-1.5	5.0	14.7	5.1	9.6	7.3

Source: BEA 2006a
* Includes proprietors' income

The top five employers in Churchill County include the Churchill County School District, Churchill Community Hospital, the Department of Defense, Wal-Mart Stores, and Boeing Aerospace Operations (Nevada Workforce 2006a). The five largest employers in Lyon County were the Lyon County School District, Amazon.com, Lyon County, Quebecor World Nevada (a commercial printer), and MSC Industrial Supply ; Company (an industrial machinery supplier) (Nevada Workforce, 2006b). The largest employers in Mineral County were Day Zimmerman-Hawthorne, Inc., El Capitan (a casino), Mineral County, Mineral County School District, and Mount Grant general Hospital (Nevada Workforce 2006c). The employers of the largest portion of the labor force in Washoe County were the University of Nevada at Reno, International Game Technology (manufacturing), Washoe Medical Center, Silver Legacy Resort Casino, Peppermill Hotel Casino, City of Reno, and a large number of additional resort casino and hotel facilities (Nevada Workforce 2006d).

Income and Earnings by Industry

Per capita personal income in 2004 in the project area was highest in Washoe County, at $39,513, an increase of 5.7 percent over the 2001 income of $37,373. For Churchill County in 2004 the per capita personal income was $32,171, an increase of 22.6 since 2001. Mineral and Lyon Counties had the lowest per capita incomes, at $25,341 and $24,071 (BEA 2006b).

Earnings by persons employed in Churchill, Lyon, Mineral, and Washoe Counties increased by 26.3 percent, 22.2 percent, 18.6 percent, and 14.6 percent (Table 3.7-3). In terms of earnings, the largest industries in 2004 in Churchill County were government and services (with $196.6 million and $101.3 million in earnings). In Lyon County manufacturing and government had the highest earnings, with $118.9 million and $89.1 million in earnings. Government had the highest reported earnings in Mineral County with $28.2 million. The highest earnings in Washoe County was in the services and government sectors, with $4.0 billion and $1.6 billion in earnings (BEA 2006c).

Agriculture experienced the highest growth between 2001 and 2004 in Mineral and Washoe Counties (Table 3-11), and mining and finance/insurance/real estate experienced the greatest growth in Lyon County. The greatest increase in earnings in Churchill County was in construction. Earnings in mining declined in Churchill and Washoe Counties between 2001 and 2004 (by 8.8 percent and 37.7 percent). Manufacturing also decreased in these two counties by 13.3 percent and 3.3 percent (BEA 2006c).

Table 3-11
Earnings by Industry (in Thousands of Dollars)

	Agriculture	Mining and Extractive Industries	Construction	Manufacturing	Transportation/ Communications/ Utilities	Wholesale and Retail Trade	Finance/ Insurance/ Real Estate	Services	Government	Total Earnings
Churchill County										
2001	12,553	1,033	22,188	27,418	24,443	39,964	27,519	81,927	158,359	436,000
2004	12,614	942	35,142	23,783	34,023	51,396	41,896	101,307	196,585	550,837
% Change	0.5	-8.8	58.4	-13.3	39.2	28.6	52.2	23.7	24.1	26.3
Lyon County										
2001	14,169	6,963	42,504	86,416	16,583	76,959	62,270	62,270	68,877	408,540
2004	16,475	11,399	59,002	118,935	17,758	77,386	74,895	74,895	89,088	499,347
% Change	16.3	63.7	38.8	37.6	7.1	0.6	20.3	20.3	29.3	22.2
Mineral County										
2001	-751	NA	849	NA	843	3,690	2,927	2,927	24,703	73,373
2004	-1504	NA	949	783	NA	3,710	4,505	4,505	28,211	87,013
% Change	-100.3	-	11.8	-	-	0.5	53.9	53.9	14.2	18.6
Washoe County										
2001	4,606	51,439	894,879	886,543	754,407	1,346,670	926,091	3,464,103	1,315,266	9,653,291
2004	9,852	3,2029	1,225,481	857,425	792,393	1,468,020	1,043,644	4,004,107	1,629,159	11,066,783
% Change	113.9	-37.7	36.9	-3.3	5.0	12.7	15.6	15.6	23.9	14.6

Source: US Bureau of Economic Analysis 2001a

Housing

Table 3-12 shows housing occupancy type and vacancy for the project area counties in 1990 and 2000. Between 1990 and 2000 the total number of housing units in Churchill, Lyon, and Washoe Counties increased, and Mineral County experienced a decrease in total housing units (-4.3 percent). Owner occupancy increased in all four of the project area counties. In 2000 Lyon County had the highest owner-occupancy rate (75.8 percent), and Washoe County had the lowest (59.3 percent). In 2000 Washoe County had the lowest vacancy rate (8.2 percent) but the largest number of vacant residences (11,824), and Mineral County had the highest vacancy rate (23.3 percent) but the fewest vacant housing units (669) (US Census 1990a, 2000b).

Table 3-12
Housing

	Churchill County	Lyon County	Mineral County	Washoe County
Total Units				
1990	7,290	8,722	2,994	112,193
2000	9,732	14,279	2,866	143,908
Percent Change	33.5%	63.7%	-4.3%	28.3%
Owner-Occupied[1]				
1990	63.1%	72.4%	66.5%	54.1%
2000	65.8%	75.8%	72.5%	59.3%
Vacancy				
1990	8.6%	11.9%	15.5%	8.8%
2000 (number)	8.4%	8.9%	23.3%	8.2%
	(820)	(1,272)	(669)	(11,824)

Source: US Census Bureau 1990a, 2000b

[1]Percent of units that are occupied by owner

Schools

One school district serves Churchill County, with six elementary schools, a junior high school, a high school, a charter high school, and an alternative education school, with a total enrollment in the 1999-2000 school year of 4,860 students. The Lyon County School District is the only public school district for Lyon County, Nevada. Seven elementary schools, four middle schools, and four high schools served 6,539 students in the 1999-2000 school year. One school district serves Mineral County's 907 students. The district is composed of a primary school (pre-kindergarten through third grade), two elementary schools, a middle school, a high school, and an alternative education center. The Washoe County School District had an enrollment of 54,508 students in its 58 elementary schools, 12 middle schools, 12 high schools, one vocational school, one special education center, three English-as-a-second-language schools, and two alternative education facilities (NCES 2002).

Environmental Justice

This section addresses specific topics related to environmental justice, as required by the National Environmental Policy Act of 1969. Specifically, a discussion of issues related to environmental justice are presented in accordance with EO 12898, and issues related to

protection of children from environmental health risks are presented in accordance with EO 13045.

On February 11, 1994, President Clinton issued EO 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. This order requires that "each federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities, on minority populations and low-income populations" (EO 12898, 59 FR 7629 [Section 1-101]). The following studies have been conducted to comply with the order:

- Gathered economic, racial, and demographic information generated to identify areas of low-income and high minority populations in and around the project area, and
- Assessed the alternatives for disproportionate impacts resulting from on-site activities associated with the proposed action.

The leasing areas are in portions of Churchill, Lyon, Mineral, and Washoe Counties. Racial and ethnic data for these areas for 1990 and 2000 have been compiled and are illustrated in Table 3-13. In 2000 only Mineral County had a minority racial population of greater than ten percent (approximately 79.0 percent of the population fell into the white/other racial category). The Hispanic population formed one of the few ethnic groups within the four project area counties with a substantial population percentage (8.7, 11.0, 8.4, and 16.6 percent in Churchill, Lyon, Mineral, and Washoe Counties). Mineral County experienced a decline in all population groups between 1990 and 2000, with the exception of the Native American group. This group increased by 4.1 percent during this period and made up approximately 15.4 percent of the county's population in 2000 (US Census 1990a, 2000c).

The US Census Bureau uses a set of income thresholds that vary by family size and composition to determine which families are poor. If a family's total income is less than its threshold, then that family, and every individual in it, is considered poor. The poverty thresholds do not vary geographically, but they are updated annually for inflation using the Consumer Price Index. For example, in 2000 the average estimated poverty threshold for an individual was an annual income of $8,787, and for a four-person household it was $17,601 (Dalaker and Proctor 2000). The 1998 Census estimates indicate that approximately 10.6 percent of the population of Churchill County, 11.6 percent of Lyon County, 16.6 percent of Mineral County, and 9.9 percent of Washoe County was below the poverty line in 1998. This represents a 26.7, 52.8, 4.5, and a 34.0 percent increase in the number of individuals below the poverty line in Churchill, Lyon, Mineral, and Washoe Counties from 1990 levels (US Census Bureau 1990b and 2001).

Table 3-13
Population Percentage by Race/Ethnicity

Race/Ethnicity	Churchill County	Lyon County	Mineral County	Washoe County
Total White and Other				
1990	91.3	95.8	81.9	92.0
2000	90.7	96.2	79.0	91.4
Percent Change	32.8	73.2	-24.5	32.4
Hispanic				
1990	5.6	7.6	8.4	9.0
2000	8.7	11.0	8.4	16.6
Percent Change	106.0	150.4	-21.6	145.2
Total African American				
1990	1.1	0.3	5.4	2.2
2000	1.6	0.7	4.8	2.1
Percent Change	88.7	240.9	-31.1	24.9
Total Native American, Eskimo, Aleut				
1990	5.0	3.1	11.6	1.9
2000	4.8	2.4	15.4	1.8
Percent Change	28.0	35.5	4.1	25.2
Total Asian and Pacific Islander				
1990	2.6	0.8	1.1	3.9
2000	2.9	0.7	0.9	4.7
Percent Change	50.9	61.6	-34.3	63.7

Source: US Census 1990a, 2000c
Note: Percentages for a given area for a given year do not add to 100 because "Hispanic" is an ethnicity category, which includes all races.

EO 13045, Protection of Children from Environmental Health Risks and Safety Risks (62 FR 19885), states that each federal agency must make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. Environmental health risks and safety risks mean risks to health or to safety that are attributable to products or substances that the child is likely to come into contact with or to ingest.

Approximately 28.9 percent of Churchill County, 27.1 percent of Lyon County, 24.4 percent of Mineral County, and 24.9 percent of Washoe County is made up of children (under 18 years of age). Within Reno, approximately 23.2 percent of the population was under 18 years of age in 2000 (US Census 2000a).

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CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter is a description of the potential environmental consequences of the proposed action and the No Action Alternative. CEQ regulations implementing the procedural provisions of NEPA (40 CFR 1500-1508) defines three types of impacts from a proposed action to be considered in the environmental analysis: direct, indirect, and cumulative. Direct impacts are caused by the action and occur at the same time and place. Indirect impacts are caused by the action but take place later in time or farther removed in distance but that are still reasonably foreseeable. Cumulative impacts result from the incremental impact of the proposed action added to other past, present, and reasonably foreseeable actions.

As described in Chapter 1, the proposed action considered in this EA—issuing leases for geothermal resources—is considered a federal action and a commitment to resource development, so it requires NEPA analysis. While issuing a lease for geothermal resources confers on the lessee the right to future exploration and development of geothermal resources within the lease area, issuing a lease does not confer on the lessee the right to explore for or develop geothermal resources if such activities would extend beyond the level of casual use. As a result, there would be no direct impacts from the proposed issuance of geothermal leases.

Nevertheless, it is reasonably anticipated that issuing a lease would result in subsequent exploration, development, production, and closeout activities by the lessee. Such subsequent activities could result in indirect impacts. For the purposes of this EA, assumptions regarding these subsequent actions are described in a reasonable development scenario (Appendix A).

The potential environmental impact of the proposed leasing action depends on a number of factors in the reasonable development scenario. These factors include the type and extent of the geothermal deposits, the probable sequence and success or failure

of the various phases (i.e., exploration, development, production, and closeout after abandonment or production ceases), the proportion of government to private land ownership, and the biological, physical, and demographic characteristics of the local area involved.

Because there is limited knowledge concerning the occurrence, location, and suitability for developing geothermal resources in the area proposed for leasing, it is not possible to quantify the number of facilities that may eventually be built on the leased areas nor to identify their specific location. These uncertainties make it difficult to accurately predict environmental impacts. As a result of these uncertainties, environmental impact analysis must be somewhat generalized and conceptual at the leasing stage. Specific impacts and associated mitigation measures of subsequent activities would be addressed in the required post-leasing analysis and approval process when details of such activities are known.

The impact analysis is organized in order of the resource areas described in Chapter 3. As described above, the proposed leasing project would not result in direct impacts on the physical or human environment, but the potential for significant indirect impacts as a result of subsequent geothermal exploration and development activities must also be assessed. Because of the large potential lease area and the lack of specific locations for subsequent geothermal development activities, potential impacts cannot be accurately characterized. As a result, the potential for significant impacts for each resource in each lease area is characterized as being of high, medium, or low risk. The determination of environmental risk is resource-specific and is based on a number of factors (criteria), including the presence and extent of resources within a proposed lease section, the extent of resources in the surrounding area, and the quality of existing data:

- High—If there were significant impacts on individual resource criteria;
- Medium—If there were moderate impacts on individual resource criteria; and
- Low—If there were minor or no impacts on individual resource criteria.

The actual level of impact would depend on the extent of geothermal resource development.

In addition to complying with its Geothermal Resources Leasing and Operations rules, the BLM may further require geothermal leasing and development to reduce the effects on the human and natural environment. Standard operating procedures outlined in the CCFO CRMP provide the general parameters of environmental controls for leasing (see Appendix B). They also provide for the development and inclusion of subsequent restrictions, including conditions of approval (see Appendix B). These are measures that may be required of the lessee as part of the BLM's environmental review or permit approval for ground-disturbing activities related to geothermal exploration, development, operation, or closeout. Standard lease stipulations may also be required to

address any additional concerns. Standard lease stipulations that would be required for all leases approved as part of the proposed action were developed to address any additional concerns (see Appendix C). Because the proposed action is leasing and because impacts would occur only during subsequent exploration and development, these mitigating measures are assumed to be in place during subsequent development activities and are therefore included in determining the risk of potentially significant environmental impacts. The environmental risk for each section of land proposed for leasing is summarized in Table 4-1.

Table 4-1
Environmental Risk Levels* for Proposed Lease Areas

LEASE AREAS															
Township / Range	Section	Lease Applicant	Serial Number	Air	Water Resources	Land Use	Recreation/ Special Designations	Visual Resource Management	Vegetation	Fish and Wildlife	Special Status Species	Geology / Soils	Range Resources (Grazing/ WHB)	Cultural and Native American Resources	Paleontological Resources	Socioeconomics/ Environmental Justice
Steamboat Lease Area				L	L-M	**H**	M	M	L-M	M	M-**H**	L	L	**H**		L
17 N 19E	12	EVERGREEN ENERGY LLC	N74884													
17N 20E	8													M		
Hazen Lease Area				L	L-M	L	M	M	L-M	M	M-**H**	L	L	M-**H**	M	L
19N 26E	4	MACKIE STUART J	N76014													
		KINGZETT JAMES M														
20N 25E	34	KINGZETT JAMES M														
			N77739													
20N 25E	22	KINGZETT JAMES M	N77646													
6																
		KINGZETT JAMES M	N76139													
20N 26E	30	KINGZETT JAMES M	N75005													
Salt Wells Lease Area				L	L-M	L-M	M	M	L-M	M-**H**	M-**H**	L	L	**H**	M	L
32																
17N 29E	1, 2	ORMAT NEVADA INC	N79107													
17N 30E	5, 6, 7, 8	ORMAT NEVADA INC	N79106													
17N 31E	5, 6	WESTERN GEO PARTNERS	N80607													
18N 29E	35	ORMAT NEVADA INC	N79103													
18N 30E	22, 26, 27	WESTERN GEO PARTNERS	N77722													
	25, 34, 35, 36	WESTERN GEO PARTNERS	N77436													
18N 31E	5, 8, 17	WESTERN GEO PARTNERS	N80606													
	18, 19, 20	WESTERN GEO PARTNERS	N80609													
	30, 31	WESTERN GEO PARTNERS	N77435													
18N 30E	5,6	STILLWATER HOLDINGS	N77158													

LEASE AREAS																	
Township / Range	**Section**	**Lease Applicant**	**Serial Number**	**Air**	**Water Resources**	**Land Use**	**Recreation/ Special Designations**	**Visual Resource Management**	**Vegetation**	**Fish and Wildlife**	**Special Status Species**	**Geology / Soils**	**Range Resources (Grazing/ WHB)**	**Cultural and Native American Resources**	**Paleontological Resources**	**Socioeconomics/ Environmental Justice**
19N 30E	31, 32, 33															
	29	STILLWATER HOLDINGS	N77690													
Lee Hot Springs Lease Area				L	L	L-**H**	**H**	M	L-M	L	M-**H**	L	L	M-**H**	M	L
15N 29E	4															
	5															
	8															
	9	VULCAN POWER CO	N74255													
	16															
	17															
	20															
	21	VULCAN POWER CO	N74256													
16N 29E	19															
	20															
	21															
	22	VULCAN POWER CO	N74257													
	23															
	26															
	29															
	30	VULCAN POWER CO	N74258													
	27															
	34	EARTH POWER RES INC	N73930													
	28															
	33	RON BARR	N73679													
	28															
	31															
	32															
	33	VULCAN POWER CO	N74259													

LEASE AREAS																
Township / Range	**Section**	**Lease Applicant**	**Serial Number**	**Air**	**Water Resources**	**Land Use**	**Recreation/ Special Designations**	**Visual Resource Management**	**Vegetation**	**Fish and Wildlife**	**Special Status Species**	**Geology / Soils**	**Range Resources (Grazing/ WHB)**	**Cultural and Native American Resources**	**Paleontological Resources**	**Socioeconomics/ Environmental Justice**
	35	VULCAN POWER CO	N74260													
North Aurora Lease Area				L	L	L	M	M	L-M	M--**H**	**H**	L	L	**H**	M	L
	30, 31,															
7N 27E	32, 33	VULCAN POWER CO	N79890													
6N 27E	4, 5, 6, 8	VULCAN POWER CO	N79888													
	9	VULCAN POWER CO	N79889													
South Aurora Lease Area				L	L	L	M	M	L-M	M--**H**	**H**	L	L	**H**	M	L
5N 27E	12, 13, 14		N79885													
5N 28E	2, 3, 4, 5	VULCAN POWER CO	N74249													
	6, 7, 8,17		N79886													
	9, 10, 11, 15	VULCAN POWER CO	N74250													
	16	VULCAN POWER CO	N74251													
	18, 19, 20, 21, 22, 29, 30, 31															
	32, 33		N79887													
6N 27E	4, 5, 6, 8	VULCAN POWER CO	N79888													
	9	VULCAN POWER CO	N79889													
6N 28E	13, 14, 22, 23	VULCAN POWER CO	N74252													
	24, 26, 27, 28	VULCAN POWER CO	N74253													
	32, 33, 34, 35	VULCAN POWER CO	N74254													

LEASE AREAS																
Township / Range	Section	Lease Applicant	Serial Number	Air	Water Resources	Land Use	Recreation/ Special Designations	Visual Resource Management	Vegetation	Fish and Wildlife	Special Status Species	Geology / Soils	Range Resources (Grazing/ WHB)	Cultural and Native American Resources	Paleontological Resources	Socioeconomics/ Environmental Justice
Wabuska Hot Springs Lease Area				L	L-M	L	L	M	L-M	L-M (sec. 14 &23)/ M-**H** (sec. 15, 16, 22)	M-**H**	L	L	M	M	L
15N 25E	14, 15, 16, 22, 23	HOMESTRETCH GEO LLC.	N79988													
Gabbs Valley Lease Area				L	L	L	M	M	L-M	M-**H**	M-**H**	L	L	M-**H**	M	L
13N 34E	17, 20, 29, 32	ORMAT NEVADA INC	N76822													
12N 34E	17, 18, 19	ORMAT NEVADA INC	N76823													
	6, 7	ORMAT NEVADA INC	N76827													
13N 33E	24, 18, 19	ORMAT NEVADA INC	N76824													
	25, 36, 30, 31	ORMAT NEVADA INC	N76826													
12N 33E	1, 2, 11,12	ORMAT NEVADA INC	N76821													
	1, 2, 11,12	MILLER DUSTY LLC	N78774													
	13, 14, 23, 24	ORMAT NEVADA INC	N76825													
13N 33E	31, 32, 33	MILLER DUSTY LLC	N78771													
	34, 35	MILLER DUSTY LLC	N79705													
12N 33E	5, 6, 7, 8	MILLER DUSTY LLC	N78772													
	3, 4, 9, 10	MILLER DUSTY LLC	N78773													
	15, 16	MILLER DUSTY LLC	N79706													
	17 18															
12N 32E	13, 24	MILLER DUSTY LLC	N78775													

LEASE AREAS																
Township / Range	**Section**	**Lease Applicant**	**Serial Number**	**Air**	**Water Resources**	**Land Use**	**Recreation/ Special Designations**	**Visual Resource Management**	**Vegetation**	**Fish and Wildlife**	**Special Status Species**	**Geology / Soils**	**Range Resources (Grazing/ WHB)**	**Cultural and Native American Resources**	**Paleontological Resources**	**Socioeconomics/ Environmental Justice**
Hawthorne Lease Area				L	L-M	L	M	M	L-M	M-**H**	M-**H**	L	L	M	M	L
8N 29E	25	WESTERN GEO PARTNERS														
7N 30E	5, 6	WESTERN GEO PARTNERS														
8N 30E	29, 30, 31, 32	WESTERN GEO PARTNERS														
Wilson Canyon Lease Area				L	L-M	L	M	M	L-M	M-**H**	M-**H**	L	L	M-**H**	M	L
10N 25E	1	WESTERN GEO PARTNERS	N80598													
	2, 3	WESTERN GEO PARTNERS	N77602													
11N 25 E	15, 16, 22, 35	WESTERN GEO PARTNERS	N80601													
		WESTERN GEO PARTNERS	N77600													

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4.1 AIR QUALITY

This section is an analysis of the direct impacts from the proposed action and indirect impacts from reasonably foreseeable future actions (discussed in Appendix A, Reasonable Development Scenario).

Direct Impacts

The proposed action would have no direct impacts on air quality. Leasing land in the proposed lease areas does not involve ground-disturbing activities, construction, or other activities that would produce air pollutant emissions. Since most of the proposed lease areas are not within nonattainment areas, Clean Air Act conformity requirements do not apply.

The proposed Steamboat lease area within the Washoe County nonattainment area could produce emissions above de minimis levels. However, the required BLM review and any necessary environmental reviews prior to development and exploration are expected to lessen the possibility of such impacts; therefore, the requirements of the EPA general conformity rule are not applicable to lease actions within these areas.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting air resources is assessed with respect to three significance criteria. Potential impacts to air resources could occur if any of the following were to take place:

- Reasonably foreseeable future actions conflict with or obstruct implementation of the applicable air quality attainment plan;
- Reasonably foreseeable future actions violate any stationary source air quality standard or contribute to an existing or projected air quality violation; or
- Reasonably foreseeable future actions expose sensitive receptors (e.g., concentrations of children, elderly, or persons with respiratory conditions) to major pollutant concentrations.

The potential risk assessment of indirect impacts affecting air resources from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and summarized in Table 4-1.

Future actions based on the reasonable development scenario could result in indirect impacts. Temporary construction-related emissions would result from ground-disturbing activities, construction vehicle exhaust emissions, diesel generator and power tool use, and worker vehicle emissions. Operational emissions could include venting hydrogen sulfide from the wells, localized fogging around the wells, and slight heating of the local

atmosphere. Implementing standard lease stipulations would reduce fugitive dust emissions during construction; additional measures to reduce fugitive dust could be included as a requirement of development plans. However, the required BLM review and any necessary environmental reviews prior to development and exploration are expected to lessen the possibility of such impacts and the risk for impacts on air quality would be low.

Similarly, the proposed Steamboat lease area within the Washoe County nonattainment area could produce emissions above de minimis levels. A formal Clean Air Act conformity determination would be required if actions at the lease sites in nonattainment areas were to result in emissions greater than 100 tons per year of carbon monoxide or 70 tons per year of PM_{10}. It is unlikely that geothermal development and operations would result in emissions of this magnitude. Additionally, the required BLM review and any necessary environmental reviews prior to development and exploration are expected to lessen the possibility of such impacts; therefore, the requirements of the EPA general conformity rule are not applicable to lease actions within this area and the risk for impacts to air quality would be low.

No Action Alternative

Impacts on air quality under the No Action Alternative would be similar to those under the proposed action. The current case-by-case approach to approving leases and ROW authorizations limits the number of gas and oil projects permitted, due to limited BLM resources and staff time. This could reduce the likelihood of indirect impacts from that represented in the proposed action.

4.2 LAND USE ENVIRONMENTAL CONSEQUENCES

This section is an analysis of the direct impacts from the proposed action and indirect impacts from reasonably foreseeable future actions on land use in the proposed lease areas. (Reasonably foreseeable future actions are discussed in Appendix A, Reasonable Development Scenario.)

Direct Impacts of the Proposed Action

Leasing land in the lease areas does not involve ground-disturbing activities or any type of construction, so there would be no direct impact on land use.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting land use is assessed with respect to two significance criteria. Potential impacts on land use could occur if reasonably foreseeable future actions were to:

- Conflict with multiple use management of lands administered by the BLM CCFO or USFS (Humboldt-Toiyabe National Forest); or
- Result in proposed uses that are incompatible with existing or adjacent land uses.

The potential risk assessment of indirect impacts affecting land use from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4.

Although all lease areas may contain existing valid surface uses (such as easements, rights-of-way, and range improvements), it is assumed that these uses are largely nonexclusive, so compatible rights can be granted. Additionally, the BLM and any necessary environmental reviews that would take place prior to ground-disturbing activities would identify and provide mitigation measures for impacts on land use. Therefore, the overall risk of indirect land use impacts is assumed to be low. Exceptions to this are noted below for specific lease areas. Standard lease stipulations in Appendix C specify that all leasing activities are subject to these existing rights.

Steamboat Lease Area

Geothermal development in this area would not conflict with multiple use management objectives of the BLM or USFS, and land sections proposed for leasing are consistent with the direction contained in the Southern Washoe County Urban Interface Plan Amendment.

Although all proposed changes in land use would occur on land administered by either the BLM, Senate Bill 40 requires that actions on BLM land be evaluated for consistency with county policy plans for public lands. Leasing activities on public lands designated as open would be consistent with the policies of Washoe County. Due to the highly urbanized nature of the Steamboat area, depending on the exact location of future

geothermal development, potential conflicts with existing or planned urban and open space land uses in the surrounding area could occur. Impacts may be mitigable through BLM and county site approvals. Leasing and potential future geothermal development of split estate lands in the Steamboat area would be incompatible with private surface uses.

The risk for potentially significant impacts on land use would be high for all land sections in the Steamboat area.

Salt Wells Lease Area

Geothermal development in this area would not conflict with multiple use management objectives of the BLM and BOR, which have concurred that development of geothermal resources in this area would not conflict with its management objectives for withdrawn lands in the area. Several areas proposed for leasing include portions of the Carson Lake Pastures area. The federal government has retained the right to lease portions of land outside this area. Nevertheless, leasing the remaining land within these sections could result in development that is incompatible with adjacent sensitive land uses.

Although geothermal development in the Salt Wells area could be inconsistent with the designated uses for the surrounding lands, as contained in the Churchill County Master Plan, almost no private land subject to these use designations is found around the lease area.

The risk for potentially significant impacts on land use would be medium for sections that include the Carson Lake Pastures and low for all remaining sections.

Lee Hot Spring Lease Area

Geothermal development in this area would not conflict with multiple use management objectives of the BLM. Sections 20 and 21 T16N R29E are designated for disposal in the CCFO CRMP for use by the city of Fallon as a landfill. Geothermal development in these sections may be precluded by this land use.

Proposed lease sections 4, 9, 16 and 21 T15N R29E are on Navy withdrawn lands adjacent to the B-19 training range. Geothermal development in these sections is height restricted and may be somewhat inconsistent with surrounding military land uses.

Although geothermal development in the Lee Hot Spring area could be inconsistent with the designated uses for the surrounding lands, as contained in the Churchill County Master Plan, almost no private land subject to these use designations is found around the lease area.

The risk for potentially significant impacts on land use would be high for sections designated for disposal for the Fallon landfill (sections 20 and 21 T16N R29E), medium for sections that are on Navy withdrawn land (sections 4, 9, 16 and 21 T15N R29E), and low for all remaining sections.

4.3 SOILS, GEOLOGY, AND MINERALS

This section is an analysis of the direct impacts from the proposed action and the indirect impacts from reasonably foreseeable future actions on soils, geology, and mineral resources (reasonably foreseeable future actions are discussed in Appendix A, Reasonable Development Scenario).

Direct Impacts of Proposed Action

Leasing land in the leasing areas does not involve ground-disturbing activities or any type of construction, so there would be no direct impact on soils, geology, or minerals.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting soils, geology, or minerals is assessed with respect to five significance criteria. Potential impacts on these resources could occur if reasonably foreseeable future actions:

- Were located on or near the trace of a known active fault or an area characterized by surface rupture that might be related to a fault;
- Were to increase the potential for human injury or economic loss from earthquakes, liquefaction, slope failure, or other geologic hazards;
- Were to reduce or prevent exploration or recovery of important economic mineral resources;
- Were to substantially reduce important farmland or loss of soil that supports important habitat, or if they were to sufficiently erode terrain to render it unsuitable for existing uses; or
- Were to damage or degrade an important geologic feature or landmark.

The potential risk assessment of indirect impacts affecting soils, geology, or minerals from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and is summarized in Table 4-1.

All Proposed Lease Areas

Soils. Soils in most of the geothermal lease areas are either rocky or alkaline or have other limitations that make them unsuitable as farmland. However, in some small areas there are soils that are classified as prime farmlands if irrigated. Others are designated as prime farmlands if they are irrigated and reclaimed of excess salts and sodium. These areas, if properly managed or reclaimed, could be productive farmlands. In other areas, the soils are mainly used to support wildlife habitat. Geothermal development could reduce the potential for future use of soils as farmland, but in most areas lack of irrigation water already limits agricultural development. If necessary, geothermal facilities can be designed to minimize encroachment on farmland or potential farmland.

Therefore, placing geothermal facilities on these lands could affect agricultural use of the soils. Due to the relatively small size of geothermal facilities, the amount of productive soils lost is not expected to be significant. There is a low potential risk for impacts on soils from future geothermal activities.

Constructing roads and geothermal facilities requires disturbing soils and land cover. In many of the geothermal lease areas, the land is sparsely vegetated and surface soils are "armored" with a layer of pebbles and gravel called "desert pavement," which has resulted from years of wind erosion winnowing the soils. The desert pavement stabilizes the surface soil, and when disturbed the soil becomes more vulnerable to erosion. The chemistry and properties of surface soils may be much different than the subsurface soils at shallow depth. With little rainfall, desert soils tend to develop and evolve over long periods so that scars from soil disturbance may remain for many years. These characteristics of desert soils can lead to slow recovery vegetation in disturbed areas. In general, soil disturbance can be minimized through the use of best management practices. Future environmental studies may be required to identify mitigation options appropriate for specific sites where these impacts could occur. Such studies and mitigation measures are typically identified when grading and building permit applications are filed.

Seismicity. In general, two types of seismic impacts are possible; one results from ground shaking in a large earthquake, which could damage geothermal structures; the other can be caused by operating a geothermal plant, including fluid injection or withdrawal, which could trigger earthquakes.

Geothermal resources tend to occur in areas of geologically recent volcanic activity. Often these areas contain active faults, and often geothermal fluids circulate from deep to shallow depths because of fault-related fracturing. Also, some faults that may be distant from the geothermal area may produce earthquakes large enough to cause severe ground shaking in the project area. Seismic hazards from ground shaking or liquefaction are typically identified and designed on a site-specific and facility-specific basis, and building plans are reviewed for conformance with building codes before construction begins. Therefore, although seismic hazards may exist at a site, the engineering design should reduce the level of hazard to less than significant levels.

Injecting fluids into fractured rock in an active fault zone increases the pore pressure in the rocks and theoretically can trigger earthquakes on an existing prestressed fault. However, the excess pore pressure created by geothermal fluid injection is typically much less than the pressure needed to stimulate movement on a fault (Chevron Resources Company 1987). Past experience with geothermal energy production facilities suggests that operating the facilities is unlikely to induce strong earthquakes, although it may cause minor detectable increases in seismicity. Therefore, the significance of the potential increase in seismicity associated with operating of geothermal facilities is considered less than significant.

Mineral Resources. Geothermal areas are sometimes also areas of hydrothermal mineral deposition. Heated groundwater circulating through fractured rock dissolves metals from the rock and redeposits them in the fractures, which over long periods can create significant ore deposits. Areas where these hydrothermal mineral encrustations are visible in rocks near the surface are often good mineral prospecting sites. In some areas, geothermal fluids themselves may contain high concentrations of dissolved salts of economic mineral, which may be recoverable along with the geothermal heat energy. Often, the dissolved salts precipitate as the water is brought to the surface, due to cooling, reduction in pressure, and other changes in chemical characteristics of the water. The precipitation of these salts in pipes represents an engineering problem for geothermal plants. Thus, the economics of geothermal development could be influenced by the mineral content of the geothermal fluids.

Both geothermal development and mining could be conducted in the same general area. The extent of their compatibility would depend on the nature of the mining operation and of the geothermal development. For example, pit mining or quarrying operations could interfere with siting more permanent geothermal facilities (wells, pipelines, power plants). Thus, geothermal development of an area could restrict the ability to extract minerals.

Steamboat Lease Area

Soils. Most of the soils in the lease area are shallow and rocky and on moderate to steep slopes. Although the potential for erosion is high, the low precipitation and runoff in the area reduces the potential for significant soil erosion.

Seismicity. As discussed in Section 3.3, the Steamboat area is seismically active and could be subject to strong ground motion from a large earthquake on one of the many active faults in the area. Geothermal facilities would be designed to meet all building codes and seismic safety ordinances. Geotechnical studies should be performed before facilities are designed to ensure that they are not sited on an active trace of the fault; geothermal facilities, wells, or pipelines could be damaged. However, relative to other risks associated with a large earthquake, the potential risk of impacts on public health or the environment from geothermal power plant damage is low.

Mineral Resources. Section 8 contains an abandoned mine and a number of prospects. There is also an abandoned mine in the southwest quarter of Section 12. As discussed above, geothermal development is not likely to significantly reduce access to or to affect future development of mineral resources in the lease area. There is a low potential risk for impacts on mineral resources.

Hazen Lease Area

Soils. Ground disturbance during construction of roads, utility lines, and structures may increase the potential for soil erosion either by runoff, or by wind. Wind erosion is likely to be a more significant mechanism for soil loss than rainfall, because it occurs more frequently and is able to redistribute eroded soil more widely. Runoff capable of

transporting significant amounts of soil occurs infrequently. The amount of land area that would be affected by ground-disturbing activities is expected to be generally small, except where new roads and power transmission lines would be constructed. Nevertheless, in some areas, soil erosion resulting from ground disturbance may create permanent scars on the landscape, and loss of soil may prevent vegetation from becoming established on the disturbed area. New roads and utility lines would be constructed in compliance with permit requirements, including any state and local requirements to implement nonpoint source pollution prevention measures during construction. There is a low potential risk for impacts on soils from future geothermal activities.

Seismicity. Geothermal power production is not expected to have any impact on the frequency or magnitude of significant seismic events, although seismic events detectable with instruments may be induced by circulating geothermal fluids under certain conditions. Earthquakes on faults in or beyond the project area could cause ground shaking of a magnitude that would damage structures or facilities. Structures and facilities will be constructed to current building code standards, so that seismic hazards will be reduced to acceptable levels. There is a low potential risk for impacts on seismic activity.

Mineral Resources. Although the area contains marginal mineral resources, including metal deposits and sand and gravel for building materials, construction and operation of geothermal production plants is not expected to significantly affect access to minerals or mineral production. Geothermal exploration, including drilling deep wells, may have the beneficial impact of identifying additional, previously unrecognized, mineral deposits. There is a low potential risk for impacts on mineral resources.

Salt Wells Lease Area, Lee Hot Springs Lease Area, North and South Aurora Lease Areas, Wabuska Lease Area, Gabbs Lease Area, Hawthorn Lease Area, and Wilson Canyon Lease Area

The potential risk of indirect effects from geothermal leasing on soils and mineral resources is expected to be low, for the reasons described above for the Hazen Lease Area. Areas with slopes greater than 40 percent can be at risk from landslide and rock fall, including those caused by seismic activity. There are areas with slopes of 40 percent or greater in the South Aurora and Wilson Canyon lease areas. Any development on or beneath these slopes would have to be designed and operated with retaining fences or other mitigation.

4.4 WATER RESOURCES

This section is an analysis of direct impacts from the proposed action and indirect impacts from reasonably foreseeable future actions on water resources. Reasonably foreseeable future actions are discussed in Appendix A, Reasonable Development Scenario.

Direct Impacts of Proposed Action

Leasing land does not involve ground-disturbing activities or any type of construction, so there would be no direct impact on water resources.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting water resources is assessed with respect to seven significance criteria. Potential impacts on water resources could occur if reasonably foreseeable future actions were to result in any of the following:

- Violate promulgated federal, state, or local water quality standards or objectives;
- Impair existing or potential beneficial uses of waters of the US or of Nevada;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level;
- Result in water or sediment quality conditions that could be harmful to aquatic life or human health, even if an accepted standard were not formally violated;
- Increase the potential for a substantial off-site flood hazard (substantial flood hazard is greater than one percent, or once in a hundred years);
- Result in erosion or sedimentation that would alter or impair the course of a permanent stream or substantially alter the area or capacity of a surface water feature; or
- Result in uses or facilities that would substantially degrade surface or groundwater quality.

The potential risk assessment of indirect impacts affecting water resources from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and is summarized in Table 4-1.

All Proposed Lease Areas

Surface Water. During normal operations and when production wells are tested, geothermal plants produce wastewater from cooling tower blowdown. This is the spent water that is periodically discharged from the cooling system. Water in water-cooled

systems periodically needs to be replenished due to evaporative losses. The original coolant water and the replenishment water contain salts that become concentrated in the cooling system over time, requiring that the coolant be periodically replaced. The cooling water may also contain metals or other constituents introduced from corroding pipes or from chemicals used to inhibit corrosion or microbial growth in the system. Once a plant is operational, all excess fluids are injected back into the ground. Discharging cooling water blowdown to the surface would need approval.

The water used in cooling could be from local groundwater. The specific nature of any impacts related to the generation of wastewater would not be known until the specific development proposal is submitted. Any potential impacts would be addressed through NPDES permit requirements.

Additives must be added to the coolant to prevent corrosion, and the coolant may contain some dissolved metals from the piping. Low-toxicity additives are available that could be used in the cooling towers to lower the potential for impacts from this source.

Any discharge of cooling tower blowdown would require a National Pollution Discharge Prevention System (NPDES) permit from the State of Nevada Department of Environmental Protection (NDEP), which would require testing to ensure that the water met the discharge requirements. It is likely that the water would be discharged either to the ground or to an evaporation pond. The state could require that the water be discharged to a lined pond to prevent infiltration. Therefore, the potential for water quality impacts on surface water from discharges of a geothermal plant are expected to be less than significant or mitigable.

Additionally, future exploration, development, and production would also involve a site-specific environmental analysis. The components of this analysis would be locating, characterizing, and quantifying surface water resources once a specific site for geothermal resources development is identified. The level of impact on surface water resources from geothermal resource development would be influenced by, for example, specific geothermal operation plans, new developments in the area, and site-specific surface water studies.

Flooding. Some of the proposed lease areas are either within a delineated 100-year flood zone or may be in areas subject to periodic flooding where the flood hazard has not yet been determined. Special Stipulation 1 in Section C.5 of Appendix C states that no surface occupancy would be allowed within 650 feet of a floodplain. Constructing facilities in areas subject to flooding would not be permitted.

Groundwater. Discharge of cooling tower blowdown or water from testing of geothermal production wells could affect shallow groundwater quality if the discharged water percolated to a shallow aquifer. As discussed for surface water, the discharge of cooling tower blowdown water would be subject to an NPDES permit issued by the NDEP.

Therefore, the permit holder would be required to demonstrate that the discharge did not degrade groundwater quality.

The source of the makeup water would likely be groundwater from local production wells. Makeup water is used to replace or make up for the evaporative losses and blowdown in a water-cooled system. The quantity of cooling tower blowdown depends on the size of the power plant, the quality of the makeup water (lower quality water requires more frequent cycling), the nature of the additives to prevent mineral scale, and the number of times the water is cycled. The size of the power plants depends on a number of factors that cannot be predicted, including the demand for electricity and the productivity of the geothermal resources at the sites. The two power plants in the Steamboat I facility each have a capacity of 11.3 megawatts (mw), but small modular units of about one megawatt capacity, or larger plants could be built. A 3.6-mw power plant consisting of three individual 1.2-mw units proposed for the Soda Lake area was estimated to require discharge of about 100 af of blowdown water per year (Chevron Resources Company 1987). Thus, for estimation purposes, geothermal power production may require on the order of 25 af of discharge per mw of electricity produced per year. This is equivalent to about 15 gallons per minute of continuous discharge. Since blowdown operations would occur when needed, the actual discharge rate, and the rate of replacement of the makeup water, would be higher and was estimated by Chevron Resources, Inc., to be about 200 to 375 gallons per minute for the 3.6-mw system. The impacts on groundwater resources depend on the size of the plant(s) and the quality of the groundwater. Lack of sufficient quantities of groundwater could represent a constraint on geothermal production feasibility in some areas.

Additionally, future exploration, development, and production would involve a site-specific environmental analysis. Components of this analysis would be locating, characterizing, and quantifying groundwater resources once a specific site for geothermal resources development is identified. The level of impact on groundwater resources from geothermal resource development would be influenced by, for example, specific geothermal operation plans, new developments in the area, and site-specific groundwater studies.

Steamboat Lease Area

Surface Water. During construction, ground-disturbing activities, such as road and foundation pad construction and utility installation, could lead to an increase in soil erosion, with the result that more soil might be transported in surface runoff. Best management practices to reduce sediment erosion and to prevent sediment from being transported to surface water areas would be implemented in compliance with nonpoint (stormwater) pollution prevention requirements of the Clean Water Act. Impacts from discharged cooling tower blowdown water, if this method of cooling were used, or from water generated from testing geothermal production wells, would be prevented by complying with an NPDES discharge permit from the NDEP. The potential risk for impacts on surface water would be low.

Groundwater. Geothermal resource development could affect groundwater resources because of consumption of water by evaporation and the need to reinject water to replenish the geothermal reservoir. The magnitude of the effects would vary depending on groundwater conditions and availability within the basin and on the type of geothermal plant. Availability of water resources could be a limiting factor, affecting the expansion of geothermal resource development in a given area. The cost effectiveness of geothermal energy production tends to increase with the size and number of plants in a given geographic area.

Existing demand for potable water in southern Washoe County is nearing the available supply. The county is evaluating options for increasing the municipal water supply, including purchasing irrigation water rights, implementing conservation measures, such as using reclaimed water, and adopting conjunctive use (storing excess surface water in the groundwater aquifer). Any significant additional demand for groundwater as a source of geothermal cooling makeup water is likely to further stress available supplies.

Groundwater extraction and injection wells are installed and pumped to cycle geothermal fluids within the geothermal reservoir to remove heat energy. To be effective, it is desirable to create an efficient circulation system where the injected (cool) water is resident in the formation long enough to heat up to the maximum temperature without significantly altering subsurface pressures. This requires a highly permeable geothermal aquifer that is preferably isolated from any shallow cool water or potable water aquifer above it. High injection pressures can fracture rock, with resultant leakage of geothermal fluids. Typically these fluids are highly mineralized, so geothermal production systems could contaminate shallow freshwater aquifers and heat could be lost to the surface. Extracting geothermal fluids could result in drawdowns in connected shallower groundwater aquifers, with the resulting potential to affect streams or springs that are in turn 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. There is a medium risk for potentially significant impacts on groundwater supplies from the use of groundwater for geothermal activities.

A small potential for adverse impacts on groundwater quality exists if the cooling water evaporation ponds recharge shallow groundwater. The potential risk of impacts is expected to be low because the discharge ponds would be monitored in accordance with a permit from the NDEP.

Hazen Lease Area

Surface Water. During construction, ground-disturbing activities, such as road and foundation pad construction and utilities installation, could increase soil erosion, with the result that more soil might be transported in surface runoff to, for example,

perennial streams. In areas of higher than average erosion potential, best management practices to reduce sediment erosion and to prevent sediment from being transported to wetland areas would be implemented in compliance with nonpoint (stormwater) pollution prevention requirements of the Clean Water Act. Similarly, petroleum product or other chemical spills that may occur during construction would be cleaned up, in compliance with state and local permit requirements.

As described above, for the Steamboat lease area, geothermal power plants may require water for cooling and therefore may generate wastewater from cooling tower blowdown and from testing of new geothermal production wells. Discharging blowdown or geothermal well water would require an NPDES permit, and compliance with permit requirements is expected to reduce potential impacts on receiving water quality to less than significant levels. Overall, there is a low potential risk for impacts on surface water.

Groundwater. For the reasons described above for the all proposed lease areas and Steamboat lease area, no significant indirect groundwater impacts are expected to result from geothermal leasing in the Hazen lease area.

Salt Wells Lease Area

Surface Water. During construction, ground-disturbing activities, such as road and foundation pad construction and utility installation, could increase soil erosion, with the result that more soil might be transported in surface runoff. For the reasons described above for the Hazen lease area, no significant indirect surface water impacts are expected to result from geothermal leasing in the Salt Wells lease area. There is a low potential risk for impacts on surface water.

Groundwater. For the reasons described above for the all proposed lease areas and Steamboat lease area, no significant indirect groundwater impacts are expected to result from geothermal leasing in the Salt Wells lease area.

Lee Hot Springs Lease Area

Surface Water. During construction, ground-disturbing activities, such as road and foundation pad construction and utility installation, could increase soil erosion, with the result that more soil might be transported in surface runoff. For the reasons described above for the Hazen lease area, no significant indirect surface water impacts are expected to result from geothermal leasing in the Lee Hot Springs lease area. There is a low potential risk for impacts on surface water.

Groundwater. For the reasons described above for the all proposed lease areas and Steamboat lease area, no significant indirect groundwater impacts are expected to result from geothermal leasing in the Lee Hot Springs lease area.

North and South Aurora Lease Areas

Surface Water. Both the North and South Aurora lease areas contain surface water. For example, Rough Creek is in the North Aurora lease area. During construction, ground-

disturbing activities, such as road and foundation pad construction and utility installation, could increase soil erosion, with the result that more soil might be transported in surface runoff. Geothermal leasing is not expected to have any significant indirect impacts on surface water resources in the South Aurora lease area, for the reasons described above for the Hazen lease area. There is a low potential risk for impacts on surface water.

Groundwater. For the reasons described above for the all proposed lease areas and Steamboat lease area, no significant indirect groundwater impacts are expected to result from geothermal leasing in the North and South Aurora lease areas.

Wabuska Lease Area

Surface Water. During construction, ground-disturbing activities, such as road and foundation pad construction and utility installation, could increase soil erosion, with the result that more soil might be transported in surface runoff. Geothermal leasing is not expected to have any significant indirect impacts on surface water resources in the Wabuska lease area, for the reasons described above for the Hazen lease area.

Groundwater. For the reasons described above for the all proposed lease areas and Steamboat lease area, no significant indirect groundwater impacts are expected to result from geothermal leasing in the Wabuska lease area.

Hawthorne Lease Area

Surface Water. During construction, ground-disturbing activities, such as road and foundation pad construction and utility installation, could increase soil erosion, with the result that more soil might be transported in surface runoff. For the reasons described above for the Hazen lease area, no significant indirect surface water impacts are expected to result from geothermal leasing in the Hawthorne lease area. There is a low potential risk for impacts on surface water.

Groundwater. For the reasons described above for the all proposed lease areas and Steamboat lease area, no significant indirect groundwater impacts are expected to result from geothermal leasing in the Hawthorne lease area.

Gabbs Valley Lease Area

Surface Water. During construction, ground-disturbing activities, such as road and foundation pad construction and utility installation, could increase soil erosion, with the result that more soil might be transported in surface runoff. For the reasons described above for the Hazen lease area, no significant indirect surface water impacts are expected to result from geothermal leasing in the Gabbs Valley lease area. There is a low potential risk for impacts on surface water.

Groundwater. For the reasons described above for the all proposed lease areas and Steamboat lease area, no significant indirect groundwater impacts are expected to result from geothermal leasing in the Gabbs Valley lease area.

Wilson Canyon Lease Area

Surface Water. During construction, ground-disturbing activities, such as road and foundation pad construction and utility installation, could increase soil erosion, with the result that more soil might be transported in surface runoff. For the reasons described above for the Hazen lease area, no significant indirect surface water impacts are expected to result from geothermal leasing in the Wilson Canyon lease area. There is a low potential risk for impacts on surface water. Because Section 16 is along the West Fork of the Walker River, the potential impacts from exploration and subsequent activity would be higher compared to the rest of the lease area.

Groundwater. For the reasons described above for the all proposed lease areas and Steamboat lease area, no significant indirect groundwater impacts are expected to result from geothermal leasing in the Wilson Canyon lease area.

4.5 VEGETATION AND INVASIVE SPECIES

This section is an analysis of direct impacts from the proposed action and indirect impacts from reasonably foreseeable future actions on vegetation and noxious weeds.

Geothermal activities could affect vegetative resources in a variety of ways. The exploration, development, and production phases all involve certain activities, any of which may have effects on vegetation, either adverse or beneficial, or short-term or long-term. Some of these possible impacts are described below.

Exploratory drilling and associated surface disturbances could cause soil to become contaminated. The pollutants or disturbed soil could be transported through surface water runoff to water sources, such as creeks or ponds. Flora and fauna that rely on the water for habitat could be harmed by the pollutants or turbidity.

Development and production phases can have short-term or long-term impacts related to construction activities, including changes in habitat from buildings and from maintenance activities.

Small birds that depend on a particular vegetative zone for food also would be vulnerable to serious loss of habitat within an area. Many small bird species are narrowly adapted to certain vegetation community types, so removing vegetative cover could be detrimental in terms of their foraging and reproduction needs. In particular, waterfowl need cover for escape, nesting, and brood raising. Eliminating habitat in any of the present waterfowl use areas could have significant impacts.

Finally, as development proceeds through test drilling and production testing stages, physical land modification and human occupation would occur. Such activities as road, pond, drill site construction, well drilling, and generation and transmission facility building could decrease habitat. The permanence of these effects would depend on the nature of the specific construction or operational activity in a particular area.

Other potential impacts may result from improperly planned or executed handling of geothermal fluids. Uncontrolled releases, spills, seepage or well blowouts could result in the addition of toxic, mineralized, or saline geothermal waters to streams and ponds, and adverse impacts would result. Impacts include alteration of vegetative cover, and any large-scale reduction in vegetative cover could affect distribution and abundance of wildlife by reducing forage and cover.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could have indirect impacts. The potential risk of these indirect impacts affecting vegetation is assessed with respect to three significance criteria. Potential impacts on vegetation could occur if reasonably foreseeable future actions were to:

- Adversely affect a species, natural community, or habitat that is specifically recognized as biologically significant in local, state, or federal policies, statutes, or regulations;
- Adversely affect a natural community or habitat that is recognized for scientific, recreational, ecological, or commercial importance; or
- Alter or destroy habitat that would prevent biological communities that inhabited the area prior to the project from reestablishing;

The potential risk assessment of indirect impacts affecting vegetation from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and is summarized in Table 4-1.

4.5.1 Vegetation, Riparian Areas, and Noxious Weeds

Short-term vegetation loss would occur during construction. Longer term vegetation loss would occur in areas where power plants are located and where access roads are maintained. Because successful revegetation with native species is not always feasible, there is the potential for native rangelands and scrub habitats to be converted to nonnative grasslands dominated by invasives, such as cheatgrass following disturbance. In addition, groundwater drawdown associated with geothermal development could affect riparian and wetland vegetation by reducing water available to these communities.

Riparian habitat is of high value to numerous fish, wildlife, and migratory bird species. Riparian vegetation in arid desert environments is critically important to numerous species of wildlife, fish, and birds. Wetland habitats (including vernal pools, seasonal swales and drainages, and ponds and reservoirs) are also extremely valuable areas for biological resources. These habitat areas may be affected by exploration, development, and production of geothermal leases. Species that depend on stream flows associated with these habitats, and the habitats themselves, may be affected locally. The reduction of return flows may reduce flows and water levels in local streams and irrigation ditches. The reduced flows may dewater wetland, marsh, and riparian areas, which may stress the vegetation and result in fewer species foraging or residing in these habitats. If these conditions are sustained for multiple years, then the local impacts may become more pronounced. Removing riparian vegetation can result in slightly higher water temperatures or increased turbidity. Many species depend on these habitat types and use them as sources of food, water, and cover.

Noxious weeds have invaded the CCFO and can be found throughout the proposed lease areas. Their seeds have been transported by wind, humans, machinery, and animals (pets, livestock, and wildlife). Removing any vegetation can also provide suitable conditions for noxious weeds to grow. Cooperative weed management activities exist among the counties, private landowners, and government agencies. Noxious weed management has been addressed in the ROD for The Vegetation Treatment on BLM Lands in Thirteen Western States EIS, completed in 1991. However, noxious weed

invasion is increasing and will continue, potentially increasing the need for treatment efforts.

A variety of control techniques (biological, manual, cultural, and herbicidal) would be used to address invasive plant species resulting from geothermal exploratory and development activities. Nonchemical control techniques would be preferable in order to increase effectiveness and to minimize reliance on chemicals. During application of herbicide to noxious weeds, there is always a slight potential for chemicals to get into surface water. Careful management and monitoring of applications would minimize this potential. The impacts on water resources are expected to be approximately the same in each lease area. Reducing noxious weed populations promotes growth of native plants, which can reduce soil erosion and sediment loads in adjacent streams.

Overall, the potential risk for increase to noxious and invasive plant species would be low to medium where control techniques are specified as a stipulation for issuing leases.

4.6 FISH AND WILDLIFE

This section is an analysis of indirect impacts from reasonably foreseeable future actions on biological resources, including wildlife, fisheries, and migratory birds.

Geothermal activities could affect fish and wildlife in a variety of ways. The exploration, development, and production phases all involve certain activities, any of which may have effects on fish and wildlife, either adverse or beneficial, or short-term or long-term. Some of these possible impacts are described below.

Exploratory drilling and associated surface disturbances could cause soil to become contaminated. The pollutants or disturbed soil could be transported through surface water runoff to water sources, such as creeks or ponds. Flora and fauna that rely on the water for habitat could be harmed by the pollutants or turbidity caused by the soil.

Development and production phases can have short-term or long-term impacts from construction activities, including noise, changes in habitat, and maintenance activities. Aboveground obstacles, such as transmission and phone lines, and well drilling structures could kill birds from collision or electrocution.

Also, birds of prey may perch on transmission lines in the vicinity of sensitive prey species, such as the sage grouse. Waterfowl and raptors would be most affected, especially if these lines were located in flyways or over nesting or feedings sites. Small birds that depend on a particular vegetative zone as a source of food also would be vulnerable to serious loss of habitat within an area. Many small bird species are narrowly adapted to certain vegetation community types, so removing vegetative cover could be detrimental to certain species in terms of their foraging and reproduction needs. In particular, waterfowl need cover for escape, nesting, and brood raising. The elimination of habitat in any of the present waterfowl use areas could have significant impacts.

Finally, as development progresses, land modification and human occupation would occur. Such activities as road, pond, and drill site construction, well drilling, generation and transmission facility construction could decrease habitat value for wildlife. The permanence of these effects would depend on the nature of the specific construction or operational activity in a particular area. Many biological resources can adapt to human-related disturbance and noise, which would decrease the adverse impacts that may result from the above activities.

Wildlife could also be affected by increases in poaching or hunting that is made easier by such factors as changes in habitats and increases in road access. Other potential impacts on wildlife may result from improperly planned or executed handling of geothermal fluids. Uncontrolled releases, spills, seepage, or well blowouts could add toxic, mineralized, or saline geothermal waters to streams and ponds, and adverse impacts would result. Impacts include altering vegetative cover. Any large-scale reduction in vegetative cover could affect distribution and abundance of wildlife by reducing forage

and cover. Competition for available food resources could result, which may change migration patterns or cause decline in population health and numbers.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting biological resources is assessed with respect to six significance criteria. Potential impacts on biological resources could occur if reasonably foreseeable future actions were to:

- Affect a species, natural community, or habitat that is specifically recognized as biologically significant in local, state, or federal policies, statutes, or regulations;
- Affect a species, natural community, or habitat that is recognized for scientific, recreational, ecological, or commercial importance;
- Impede fish or wildlife migration routes for a period that would significantly disrupt that migration;
- Alter or destroy habitat that would prevent biological communities that inhabited the area prior to the project from reestablishing;
- Extensively alter or cause the loss of biological communities in high-quality habitat for longer than one year; or
- Affect unique communities or communities of limited distribution within the project area.

The potential risk assessment of indirect impacts affecting fish and wildlife from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and summarized in Table 4-1.

4.6.1 Wildlife, Fisheries, and Migratory Birds

Geothermal energy resource development would continue to result in the removal of vegetation associated with exploration, development, and production, predominantly well and power plant construction, road building, pipelines, and transmission line construction, as described in Section 4.5. In addition, geothermal energy development could result in direct mortality of wildlife during construction and as a result of birds colliding with structures and power lines. Current management practices and the NEPA analysis required for development would take into consideration these impacts, and stipulations necessary for mitigation would be assigned. All lease applications received in open areas would be subject to the full range of stipulations, depending on resources affected.

The loss of native habitats through long-term vegetation removal or unsuccessful revegetation with native species could reduce the amount of habitat available to native wildlife species.

Steamboat Lease Area

This area contains winter habitat for mule deer in the southeast. The winter range for deer has been greatly reduced by previous human encroachment. Loss and fragmentation of wintering habitat and migration corridors for mule deer have greatly affected the population of this species in this region (Wasley 2004). Additional ground disturbance and development as a result of geothermal activities in deer wintering habitat area could negatively affect mule deer populations in this area. Reduction in habitat value (as a result of exploration, development, and production activities) or of habitat area coverage, which is critical to their survival during the winter, could have an adverse impact on mule deer. Lease stipulations identified would reduce the level of potential impact through avoidance or seasonal occupancy restrictions.

Many small common mammal species are found in this area, including various rabbit and hare, mouse, gopher, kangaroo rat, and squirrel species, as well as skunk and fox that prey on these smaller mammal species. Bird species may pass through or fly over the property. Some of these species are adapted to human encroachment and most likely would not be significantly affected by this project activity. Also, populations of plants and animals and the diversity of migratory bird species within habitat communities fluctuate naturally.

This area contains riparian habitat in some sections proposed for leasing. Riparian habitat is of high value to numerous wildlife and migratory bird species. The following areas contain riparian habitat: the northwest corner of Section 18, along Steamboat Creek, along State Highway 395, has some riparian habitat. Several tributary washes to Steamboat Creek drain north through Section 18. A small tributary also drains westward from the northwestern corner of Section 20 into Washoe Lake, and just north of the Scripps Wildlife Management Area. Avoidance of impacts on riparian habitat could present low to moderate impacts on siting geothermal facilities in these areas.

Potential development proposed in lease sections containing or adjacent to stream channels, or on minor tributaries to streams, including Steamboat Creek (T17N 20E Sections 8 and 18) could negatively affect fisheries downstream in Washoe Lake. Adverse effects on fish habitat would be possible in the exploration, development, and production activities related to this project. Construction activities along waterfront areas could affect wetland habitat and habitat for fish and migratory bird species. Future development in this area could result in increased potential for nonpoint pollution of surface water and increased turbidity as a result of sediment release. Any toxic or treated materials or discharges into rivers could have adverse effects on fish species. These impacts on sensitive habitats would be minimized by required preconstruction permitting and agency consultation. Removing vegetation could have adverse impacts on wildlife and bird species, as described above. Adverse impacts on riparian areas would be mitigated by lease stipulations requiring avoidance of any riparian area by 650 feet.

Additional potential impacts on riparian corridors are discussed further below. Overall, the potential risk for impacts on wildlife, fisheries, and migratory birds would be medium.

Hazen Lease Area

The Hazen lease area occurs on the southern boundary of the Fernley State WMA. While substantial wetland and riparian habitat occurs in the southern portion of the Fernley WMA (T20N R25E Sections 16, 17, and 18), the risk of impacts on wetland and riparian habitat from leasing in this area is estimated to be medium. Potential impacts may result from various exploration and development activities described above but which mainly involve presence of geothermal fluids via uncontrolled releases, spills, seepage or well blowouts. These could result in increases in toxic, mineralized, or saline waters to groundwater, streams, and ponds. Impacts include alteration of fishery habitat, waterfowl nesting and feeding areas, or riparian corridors important for wildlife species in the WMA. Any large-scale reduction in vegetative cover could affect distribution and abundance of wildlife by reducing forage and cover. Lease stipulations for minimizing impacts on wetland habitat defined in Appendix C would reduce the potential risk of impact.

The habitats within the Hazen lease area provides habitat for a variety of migratory birds. The BLM 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 to certain seasons. Alternatively, cooling and process water ponds may attract migratory birds. Waterfowl, raptors, and small birds that depend on a particular vegetative community as a source of food or cover could be vulnerable to loss of habitat within an area as a result or project activities. Removing vegetative cover could be detrimental to certain species in terms of their foraging and reproduction needs. In particular, migratory birds need cover for escape, nesting, and brood raising. The elimination of habitat in any of the present migratory bird nesting and foraging areas could have significant impacts. Lease stipulations to avoid ground 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 Nevada viceroy is a butterfly species that inhabits moist open or shrubby areas, such as lake and swamp edges, willow thickets, valley bottoms, wet meadows, and roadsides. Surface-disturbing activities that reduce riparian habitat would have a negative effect on the long-term viability of any local population. Pre-activity surveys to determine potential habitat and locations would mitigate against any impacts. The risk of geothermal activities on this species would be low where appropriate buffers are placed around important habitat elements to reduce habitat disturbance and removal in riparian zones and wetlands.

Other resident wildlife species, such as the small to mid-sized common mammal species typically found in such areas, would not be adversely affected by this project activity.

Overall, the potential risk of impacts on wildlife, fisheries, and migratory birds would be medium.

Salt Wells Lease Area

At least five leases within the Salt Wells area immediately overlap Carson Lake and its associated wetlands (T18N R29E Section 35; T17N R29E Sections 1 and 2; T17N R30E, Sections 5, 6, 7 and 8). Other leases in the northern portion of this lease area also overlap wetland areas (T18N R30E Sections 5 and 6; T19N R30E Sections 28, 29, 31, 32, and 33). These areas have high importance for numerous migratory birds and their migration routes and for wildlife management because they likely support wetland vegetation and other riparian resources important for foraging, nesting, and security cover year-round. Although no surveys for wetland or riparian resources were conducted as part of this analysis, based on available reports, mapping, and input from BLM resource specialists, the risk of impacts on wetland and riparian habitat from leasing in these adjacent areas has been estimated to be high. Lease stipulations for avoidance of wetland habitat defined in Appendix C would reduce, but not remove the potential for substantial impacts.

The wetland habitats within this area provide habitat for a variety of migratory birds. The BLM 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 to certain seasons. Alternatively, cooling and process water ponds may attract migratory birds. Waterfowl, shorebirds, and other bird life that depend on food, water, and cover in riparian zones along stream courses, wet meadows, marshes, and spring areas are considered at risk if vegetation in these areas is damaged or altered by project activities.

Lease stipulations include the measure that the project proponent should avoid ground disturbance activities during the migratory bird nesting season to avoid potential violations of the Migratory Bird Treaty Act. This measure, combined with the avoidance of wetlands, would reduce the potential impact on migratory birds to less than significant.

The leases in the area north of State Highway 50 and south of the Stillwater NWR (T17N R31E Sections 5 and 6; T18N, R31E Sections 5, 8, 17, 18, 19, 20, 30, and 31; and T18N R30E Sections 22, 25, 26, 27, 34, 35, and 36) occur in and around the Lahontan Mountains. These areas are generally low lying, and the potential impacts on other resident wildlife species would depend on the type and intensity of activity, which could disrupt the movement of wildlife species between Carson Lake and the Stillwater NWR. Overall, the potential risk of impacts on wildlife and migratory birds would be medium to high.

Lee Hot Springs Lease Area

This proposed lease area contains upland habitat consistent with the habitat in the surrounding area. Exploration and development would affect only a small area relative to the available upland habitats. Potential impacts on other resident wildlife species

would not be significant, similar to that described above for the Hazen area. Overall, the potential risk of impacts on wildlife and migratory birds would be low.

North Aurora Lease Area

The North Aurora lease area is on the edge of the Humboldt-Toiyabe National Forest in the Bridgeport Ranger District. The entire lease area (5,085 acres) is within mule deer winter range and summer range for the pronghorn antelope (Figure 3-3). As a result, both mule deer and antelope may be negatively affected by the construction of fencing and other developments. Activities that result from exploration, drilling, and development of geothermal leases may produce noise or other construction-related impacts that could disturb these species. In order to reduce these impacts the lease should stipulate that any fences allow for the passage of deer and antelope.

Potential impacts on other resident wildlife species could be as significant or more, as described above for the Steamboat area. Overall, the potential risk of impacts on wildlife and migratory birds would be medium to high, depending on the location, intensity, and timing of geothermal activities.

South Aurora Lease Area

The South Aurora lease area is on the edge of the Humboldt-Toiyabe National Forest in the Bridgeport Ranger District. The entire lease area (24,199 acres) is within mule deer winter range and pronghorn antelope summer range (Figure 3-4). As a result, both mule deer and antelope may be negatively affected, as described above for the North Aurora lease area.

Overall, the potential risk of impacts on wildlife and migratory birds would be medium to high, depending on the location, intensity, and timing of geothermal activities.

Wabuska Lease Area

Riparian/lowland habitat occurs in the Wabuska lease area in sections for which lease applications have been filed (T15N R25E Sections 14, 15, 16, and 23). Leasing in these sections would require adhering to lease stipulations to maintain adequate setbacks. Mule deer winter range occurs on 2,470 acres (78 percent); pronghorn antelope year-round range (3,173 acres) occurs over the entire lease area. Wetland habitat is found a couple miles to the southwest in the Mason Valley WMA. The wetland areas are sloughs that receive overflow from the Walker River. No surveys for wetland or riparian resources were conducted as part of this analysis, but, based on available reports, mapping, and input from BLM resource specialists, the risk of impacts on wetland and riparian habitat from leasing is estimated to be high. Standard lease stipulations defined in Appendix C would reduce the potential for substantial impacts. Potential impacts on other resident wildlife species would not be significant, similar to that described above for the Hazen and Salt Wells lease areas. Overall, the potential risk of impacts on wildlife and migratory birds would be low to medium in Sections 14 and 23, but medium to high if exploration and developments occur in Sections 15, 16, and 22.

Gabbs Valley Lease Area

This proposed lease area contains mostly barren and rocky areas, with some salt desert shrub, which is consistent with the habitat in the surrounding area. Pronghorn antelope year-round range occurs over the entire lease area (26,347 acres). Exploration and development would affect a relatively large area (43 sections) compared to the available upland habitats. Overall, the potential long-term risk of impacts on wildlife and migratory birds would as described for the North and South Aurora lease areas and would be medium to high, depending on the location, intensity, and timing of geothermal exploration and development activities.

Hawthorne Lease Area

This proposed lease area contains upland habitat at the base of a higher elevation foothill region adjacent to the Hawthorne Naval Ammunition Depot. Exploration and development would affect only a small area (4,219 acres) relative to the available upland habitats. Potential impacts on other resident wildlife species would be significant, depending on the location, timing, and intensity of exploratory and development activities. Overall, the potential risk of impacts on wildlife and migratory birds would be medium to high depending on the species affected.

Wilson Canyon Lease Area

This proposed lease area contains upland habitat similar to the Hawthorne lease area. Exploration and development would affect a moderately sized area (5,087 acres), relative to the available upland habitats. Potential impacts on other resident wildlife species would be significant, depending on the location, timing, and intensity of exploratory and development activities. Overall, the potential risk of impacts on wildlife and migratory birds would be medium to high, depending on the location, intensity, and timing of exploratory and development activities and the particular species affected.

4.7 SPECIAL STATUS SPECIES

This section is an analysis of direct impacts from the proposed action and indirect impacts from reasonably foreseeable future actions to special status species.

Geothermal activities could affect special status species in a variety of ways. The exploration, development, and production phases all involve certain activities, any of which may have effects on special status species, either adverse or beneficial, or short term or long term. Some of these possible impacts will be described below.

Exploratory drilling and associated surface disturbances could cause soil to become contaminated. The pollutants or disturbed soil could be transported through surface water runoff to water sources, such as creeks or ponds. Special status flora and fauna that rely on the water for habitat could be harmed by the pollutants or turbidity caused by the soil.

Development and production phases can have impacts related to construction activities (and these may be short term or long term), including noise, changes in habitat from buildings, and disturbance from maintenance activities. Aboveground obstacles, such as transmission and phone lines and well drilling structures, could cause bird mortalities from collision or electrocution. Also, transmission lines may provide perching locations for birds of prey in the vicinity of sensitive prey species, such as the sage grouse.

Waterfowl and raptors would be most affected especially if these lines were located in flyways or over nesting or feedings sites. Small birds that depend on a particular vegetative zone as a source of food also would be vulnerable to serious loss of habitat within an area. Many small bird species are narrowly adapted to certain vegetation community types, and removing vegetation could affect their foraging and reproduction needs. In particular, waterfowl need cover for escape, nesting, and brood raising. The elimination of habitat in any of the present waterfowl use areas could have significant impacts.

Finally, as development occurs through test drilling and production testing stages, physical land modification, and human occupation would occur. Road and pond construction, drilling, and generation and transmission facilities construction could decrease special status species habitat. The permanence of these effects depends on the nature of the specific construction or operational activity in a particular area. Many biological resources have the ability to adapt to human-related disturbance and noise, which would decrease the adverse impacts that may result from the above activities.

Special status wildlife could also be affected by increases in poaching or hunting that is made easier by such factors as changes in habitats and increases in road access. Other potential impacts on special status wildlife may result from improperly planned or poorly executed handling of geothermal fluids. Uncontrolled releases, spills, seepage, or well blowouts could result in toxic, mineralized, or saline geothermal waters being added to streams, ponds, and other water bodies. Adverse impacts would result, including

altered vegetative cover. Any large-scale reduction in vegetation could affect the distribution and abundance of wildlife by reducing forage and cover. Competition for available food resources could result, which could change migration patterns or cause a decline in population health and numbers.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting special status species is assessed with respect to seven significance criteria. Potential impacts on special status species could occur if reasonably foreseeable future actions were to:

- Affect a population of a threatened, endangered, regulated, or other sensitive species, for example, by reducing numbers, by altering behavior, reproduction, or survival, or by causing the loss or disturbance of habitat (any "take" of a listed or sensitive species is considered significant);
- Affect a species, natural community, or habitat that is specifically recognized as biologically significant in local, state, or federal policies, statutes, or regulations;
- Affect a species, natural community, or habitat that is recognized for scientific, recreational, ecological, or commercial importance;
- Impede fish or wildlife migration routes for a period that would significantly disrupt that migration;
- Alter or destroy habitat that would prevent biological communities that previously inhabited the area from reestablishing;
- Extensively alter or cause the loss of biological communities in high-quality habitat for longer than one year; or
- Affect unique communities or communities of limited distribution within the project area.

The potential risk assessment of indirect impacts affecting special status species from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and summarized in Table 4-1.

4.7.1 Special Status Species

Case-by-case review and approval of lease applications would result in assigning lease stipulations to protect sensitive species.

Impacts on sensitive species could occur in areas with sensitive species populations, but where they have not been documented. In these cases, ground-disturbing activities could remove sensitive plants and could result in the direct mortality of sensitive animals. The chances of these impacts occurring are relatively small because of the extensive records

kept by the Nevada Natural Heritage Program (NNHP) and the typical survey requirements of lease approval.

Potential impacts from geothermal energy development could result from birds and bats colliding with structures such as transmission lines, especially for migratory species. Sensitive bird and bat species are listed in Table 3-5 in Section 3.7. Of particular concern are greater sage grouse because it depends on sagebrush for survival and can be found in a variety of sagebrush habitats. An essential element of sage-grouse habitat is the availability of habitat to support male strutting grounds, which are known as leks. Leks are located on relatively open sites surrounded by sagebrush, or in areas where sagebrush density is low, such as exposed ridges, knolls, or grassy swales (NatureServe 2005). These areas are open so that males are visible to females during the breeding season but are often surrounded by taller sagebrush areas that can be used to escape predators if needed. Nesting habitat is characterized primarily by Wyoming big sagebrush communities that have 15 to 38 percent canopy cover and a grass and forb understory; residual cover of grasses is likely an important factor in suitability (Sage-Grouse Conservation Team 2004). The nests are made in depressions on the ground under sagebrush (NDOW 2005). This once common species has experienced sharp population level declines through its range over the last 50 years, a trend that has only grown more dramatic in the last 20 years (NatureServe 2005). Population Management Units (PMU) were identified by the Local Area Conservation Planning groups as part of the Governor's Nevada Sage-Grouse Conservation Strategy (Wasley 2004).

Steamboat Lease Area

The Steamboat buckwheat, the southwestern willow flycatcher, and wintering bald eagle are the only federal listed species that may occur in the Steamboat lease area. Surface-disturbing activities related to geothermal exploration and development could directly remove plants and disturb soil substrates that could support future populations. Exploration and development of geothermal resources will require consultation with the USFWS in accordance with the Endangered Species Act. Standard lease stipulations require the avoidance of any endangered plant species. However, the risk of surface disturbances affecting plants or soil is low because lease stipulations require surveys to determine the presence of local populations before any ground-disturbing activities. Standard lease stipulations require site-specific surveys before any activities would be permitted to occur and avoidance of any habitat where endangered species occur. However, the risk of impacts on these three species is low because lease stipulations require surveys to determine the presence of local populations before any ground-disturbing activities.

Thirteen federal species of special concern may occur in the Steamboat Lease Area, including eight bat species. Changes to hydrology in the lease area may affect a bat's source of food and water. Also, land cleared for geothermal resource development may diminish roosting and breeding habitat.

The two remaining species of special concern that may occur in the area are the pygmy rabbit and the western burrowing owl. Should these two species be present in the area they may be negatively affected by ground-disturbing activities. Project design or size could be adjusted or deferred as part of the BLM or the county's site approval process to minimize impacts. Lease stipulations in Appendix C would protect any special status species found in this area. Lease stipulations suggest avoiding riparian areas by 650 feet to minimize impacts on riparian habitats and wildlife that depend on them. If this measure is also applied to riparian habitats, the impact would be less than significant, provided no flycatcher or bald eagle winter roosting areas are removed during exploration or development.

Overall, the potential risk of impacts on special status species is medium to high, depending on the location, intensity, duration, and timing of exploratory and development activities and the particular species affected.

Hazen Lease Area

Wintering bald eagle is the only federally listed species identified as potentially occurring in this area. In addition, eight bat species of special concern were identified as potentially occurring there. These species likely rely on the wetland habitats for foraging opportunities. Impacts on bats are similar to those described above under the Steamboat area. Lease stipulations suggest avoiding riparian areas by 650 feet to minimize impacts on riparian habitats and wildlife that depend on them. If this measure is also applied to wetland habitats, the impact would be less than significant, provided no roosting areas are removed during exploration or development.

Ground-disturbing activities in the area may negatively affect any pygmy rabbit and western burrowing owl, which have been identified as federal species of concern. Risk level of impacts on these species could be high because they depend on particular vegetation zones.

Overall, the potential risk of impacts on special status species is medium to high, depending on the location, intensity, duration, and timing of exploratory and development activities and the particular species affected.

Salt Wells Lease Area

Wintering bald eagle is the only federally listed species identified as potentially occurring in this area. The southern portion of Fernley State Wildlife Management Area is north of the proposed lease area. The Fernley WMA provides habitat for a variety of migratory birds, including waterfowl which could provide a prey source for migrating bald eagles. Lease stipulations protecting wetland habitats and migratory birds should reduce the impacts on migratory bird species to a below significant level. The same stipulations should reduce impacts on the seven bat species of concern listed in Table 3-5 in Section 3.7. These impacts are similar to those described above for the Steamboat area.

Ground-disturbing activities in the area may negatively affect any pygmy rabbit and western burrowing owl, which have been identified as federal species of concern. Risk level of impacts on these species could be high because they depend on particular vegetation zones.

Overall, the potential risk of impacts on special status species is medium to high, depending on the location, intensity, duration, and timing of exploratory and development activities, and the particular species affected.

Lee Hot Springs Lease Area

Wintering bald eagle is the only federally listed species identified as potentially occurring in this area. However, four endemic invertebrate species of special concern could occur there. Hardy's aegilian scarab beetle, Sand Mountain aphodius scarab beetle, and Sand Mountain serician beetle. are associated with sand dunes. The Sand Mountain blue butterfly depends on its host plant, Kearney buckwheat, to survive and is known to occur only in the Sand Mountain Recreation Area. If the population of Kearney buckwheat declines at Sand Mountain, the Sand Mountain blue butterfly population would likely follow.

The same stipulations should reduce impacts on the seven bat species of concern listed in Table 3-5 in Section 3.7. These impacts are similar to those described above for the Steamboat, Hagen, and Salt Wells lease areas.

Ground-disturbing activities may negatively affect listed bat species, the pygmy rabbit, and western burrowing owl, should these species occur in the area. These species have been identified as federal species of concern. Impacts on bats are similar to those described above under the Steamboat area. Risk level of impacts on the pygmy rabbit and western burrowing owl could be high because they depend on particular vegetation zones.

Overall, the potential risk of impacts on special status species is medium to high depending on the location, intensity, duration, and timing of exploratory and development activities, and the particular species affected.

North and South Aurora Lease Area

The federally threatened Lahontan cutthroat trout is found in the western portion of the South Aurora Lease Area, which is within the watershed for Bodie Creek. This creek flows through the area, and runoff caused by geothermal activity could affect the creek, particularly in areas with steep slopes (greater than 40 percent). Bodie Creek does not currently contain cutthroat trout but may be a recovery area in the future.

Wintering bald eagle and southwestern willow flycatcher are also federally listed species identified as potentially occurring in these two lease areas. Impacts and lease stipulations described for the Steamboat lease area are also applicable to this area.

Four plant species of special concern may occur in the lease areas, including the Bodie Hills rockcress, Bodie Hills draba, Mono County phacelia, and the Lavin egg milkvetch. The Bodie Hills rockcress inhabits the dry, open, rocky, high or north-facing slopes or exposed summits of granitic or rhyolitic material. It is found on moisture-accumulating microsites in sagebrush associations within the pinyon-juniper and mountain sagebrush zones. The Bodie Hills draba occurs in the area of scrub and in the pinyon and juniper woodland on clay or rocky soils. The Mono County phacelia inhabits the more alkaline barren or sparsely vegetated grayish, brownish, or reddish shrink-swell clays of mostly andesitic origin. It is found on various slopes and aspects, mostly on stabilized or low-intensity artificial or natural disturbances. Mono County phacelia is most abundant on road berms that cross such soils, less frequently on naturally eroding badlands or apparently undisturbed soil, in the pinyon-juniper and mountain sagebrush zones. The Lavin egg milkvetch inhabits open, dry, relatively barren gravelly clay slopes, knolls, badlands, or outcrops, derived from volcanic ash or carbonate, usually on northeast to southeast aspects, in openings in the pinyon-juniper or sagebrush zones. Standard lease stipulations require the avoidance of any plant species of special concern, including those listed by the BLM and the USFS. However, the risk of impacts on these species is low because lease stipulations require surveys to determine the presence of local populations before any ground-disturbing activities, and the locations of sensitive plant species would require significant buffers to avoid disturbance. Relocating sensitive plant species is undesirable and could represent additional risks to subpopulations.

A federal species of concern that is an important game species and is of local interest, sage grouse may occur in the project area. Essential habitats for sage grouse are breeding areas, including strutting grounds and nest sites (typically within two miles of a strutting ground) and upland meadows, which provide forage for young and adults during the summer and fall.

Both the North and South Aurora lease areas have been identified as occurring within the Mount Grant PMU, which include sage grouse brood and nesting areas. Sage grouse brood rearing habitat has been identified in the southern half of the North Aurora lease area. The southern third of the South Aurora lease area has been identified as a sage grouse recovery area. Sage grouse brood rearing habitat also occurs in a six-square-mile area west of the lease area and one mile south of Aurora Peak, immediately south of the South Aurora lease area. Any ground- or vegetation-disturbing activities in sage grouse habitat, such as transmission lines associated with geothermal development, could negatively affect sage grouse populations.

If sage grouse are confirmed in the area, potential impacts on this species could be significant, depending on proximity of habitat to exploration, development, and production activities. In order to reduce the potential for impacts on this species, the lease stipulations in Appendix C should be included to ensure that no activities would occur during the breeding season for the sage grouse and that any of its critical habitat areas would be avoided during all stages of the project activities.

Wong's springsnail is restricted to isolated populations associated with wetlands. Lease stipulations would ensure that wetlands would not be disturbed and that wetland areas would be appropriately protected to prevent additional unnatural sediment loads and nonpoint and source point pollution. Risk level to this springsnail would be low because the species depends on wetlands that would not be disturbed.

Ground-disturbing activities may also negatively affect the eight bat, the pygmy rabbit, and western burrowing owl, should these federal species of concern occur in the area. Impacts on bats are similar to those described above under the Steamboat area. Risk level of impacts on the pygmy rabbit and western burrowing owl could be high because they depend on particular vegetation zones.

Overall, the potential risk of indirect impacts on special status species is high due to the proximity of potential activities to directly remove vegetation, or in some cases, result in direct mortality to individuals, which would constitute a "take" under Section 10 of the ESA. Activities that result in a take situation are a significant violation of the ESA because of the loss of individuals or their habitat necessary for survival. Any activity that would degrade surface waters important to Lahontan cutthroat trout would also be considered a take, and thus also a significant violation under the ESA.

Wabuska Lease Area

Wintering bald eagle is the only federally listed species identified as potentially occurring in these two lease areas. Impacts and lease stipulations described for the Steamboat lease area are also applicable to this area. Ground-disturbing activities may negatively affect bat species, the pygmy rabbit, and western burrowing owl, should these species of special concern occur in the area. Impacts on bats are similar to those described above under the Steamboat area. The risk level of impacts on the pygmy rabbit and western burrowing owl could be high because they depend on particular vegetation zones.

Approximately 61 acres of the Wabuska Lease Area is within the Pine Nut PMU. Impacts on sage grouse are the same as those described for the North and South Aurora lease areas and would also depend on the location, intensity, duration, and timing of geothermal exploration and development activities. If sage grouse are confirmed in the area, potential impacts on this species could be significant, depending on proximity of habitat to exploration, development, and production activities. The risk to sage grouse and their habitats in this lease area would be medium to high.

Overall, the potential risk of impacts on special status species is medium to high, depending on the location, intensity, duration, and timing of exploratory and development activities and the particular species affected.

Gabbs Valley Lease Area

Wintering bald eagle is the only federally listed species identified as potentially occurring in these two lease areas. Impacts and lease stipulations described for the Steamboat lease area are also applicable to this area. Ground-disturbing activities may negatively affect

seven bat species, the pygmy rabbit, and western burrowing owl, should these federal species of concern occur in the area. Impacts on bats are similar to those described above for the Steamboat Lease Area. The risk of impacts on the pygmy rabbit and western burrowing owl could be high because they depend on particular vegetation zones.

Hawthorne Lease Area

Wintering bald eagle is the only federally listed species identified as potentially occurring in these two lease areas. Impacts and lease stipulations described for the Steamboat lease area are also applicable to this area. About 75 percent of the proposed lease area has been identified as occurring within the Mount Grant PMU. In areas where sage grouse brood and nesting areas occur, the potential risk to sage grouse is significant and considered high. Impacts on sage grouse are the same as those described for the North and South Aurora and Wabuska Lease Areas.

Ground-disturbing activities may also negatively affect seven bat species, the pygmy rabbit, and western burrowing owl, should these federal species of special concern occur in the area. Impacts on bats are similar to those described above for the Steamboat Lease Area. The risk of impacts on the pygmy rabbit and western burrowing owl could be high because they depend on particular vegetation zones.

Overall, the potential risk of impacts on special status species is medium to high depending on the location, intensity, duration, and timing of exploratory and development activities and the particular species affected.

Wilson Canyon Lease Area

Wintering bald eagle is the only federally listed species identified as potentially occurring in these two lease areas. Impacts and lease stipulations described for the Steamboat lease area are also applicable to this area. The entire proposed lease area has been identified as occurring within the Desert Creek/ Fales PMU. If sage grouse brood and nesting areas occur in this lease area, the potential risk to sage grouse would be significant and would be considered high. Impacts on sage grouse are the same as those described for the North and South Aurora Lease Areas.

Ground-disturbing activities may also negatively affect seven bat species, the pygmy rabbit, and western burrowing owl should these federal species of concern occur in the area. Impacts on bats would be similar to those described above. The risk of impacts on the pygmy rabbit and western burrowing owl could be high because they depend on particular vegetation zones.

Overall, the potential risk of impacts on special status species is medium to high, depending on the location, intensity, duration, and timing of exploratory and development activities and the particular species affected.

4.8 CULTURAL, NATIVE AMERICAN, AND PALEONTOLOGICAL RESOURCES

Proposed Action

Direct Impacts

Implementing the proposed action would likely result in more consistent management of cultural resources because of the implementation of the SOPs and lease stipulations listed in Appendices B and C, respectively. Under the proposed action, granting leases would not directly affect cultural or Native American resources since leases would not permit the lessee to proceed with any ground-disturbing activities related to exploration or development. As such, the possibility of direct impacts on cultural and Native American resources under the proposed action is considered low.

Indirect Impacts

This section analyzes indirect impacts from reasonably foreseeable future actions to cultural and Native American resources.

Prehistoric/Historic Cultural Resources Sensitivity Methodology. Certain landforms and associated natural resources, such as water, are known to be magnets for past human activity. By default, because geothermal resources involve water, areas surrounding these resources have proven to be culturally sensitive. Prehistoric topographical features also known to contain numerous cultural resources, such as ancient shorelines, were analyzed as part of the sensitivity rating. In some cases, resource information was provided through consultation with other federal agencies that manage the land where the resource area is located.

Section 106 of the NHPA states that an undertaking would have an effect on a historic property (i.e., NRHP-eligible resource) if that undertaking were to alter those characteristics of the property that qualify it for inclusion in the NRHP. An undertaking is considered to have an adverse effect on a historic property when it diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Future actions based on the reasonable development scenario could result in indirect impacts on an historic property. The potential risk of these indirect impacts is assessed with respect to four significance criteria. Potential impacts on these resources could occur if reasonably foreseeable future actions:

- Isolate the property or alter the character of the property's setting when that character contributes to the property's qualifications for the NRHP;
- Introduce visual, audible, or atmospheric elements that are out of character with the property or changes that may alter its setting;
- Cause a property to be neglected, resulting in its deterioration or destruction; or

- Result in the transfer, lease, or sale of a property without adequate provisions to protect the property's historic integrity.

The assessment of indirect impacts affecting historic properties from exploration, development, production, or closeout is based on a scale that rates the risk in each area from high to low. The following definitions of high, medium, and low for cultural resources are assigned according to the potential future risk of indirect impacts in the region of influence:

- Low sensitivity—Describes an area where sites have been previously recorded but not surveyed, where some portions of the sites have been surveyed, where surveys of nearby sites were negative, or where landform and topography do not suggest the likelihood of unrecorded significant resources.
- Medium sensitivity—Describes areas where there may be some recorded resources, where some nearby sites been some surveyed but no recorded resources have been found, or where landforms and topography suggest the presence of unrecorded resources.
- High sensitivity—Describes areas that may have numerous recorded resources, where significant or numerous resources have been recorded, that are a part of a delineated NRHP historic district, or whose landforms or topographic qualities are known to be highly sensitive.

In general, the potential risk of impacts on cultural resources resulting from geothermal resource production is medium. However, the potential for impacts on historic cultural resources from geothermal resource production is considered to be high. This is due to the presence of the Newlands Project through much of the planning area. Impacts on features of the historic irrigation project that are listed in the NRHP would be significant. Since it is unknown if other features of the project have been evaluated for inclusion in the NRHP, it must be assumed that they are eligible. As such, indirect impacts on any portion of the historic Newlands Project would be significant and the sensitivity for potential impacts is considered high in the Salt Wells, Steamboat, and Hazen lease areas where the Newlands Project is nearby or within the lease area.

Although the study area has not been surveyed in its entirety, there has been sufficient survey coverage in some lease areas to identify and record locations of prehistoric and historic resources as well as areas of high sensitivity for such resources. Drilling would not be permitted within 200 feet of these sites, per BLM cultural resource regulations. Known prehistoric and historic resources have been identified in the North and South Aurora, Wilson Canyon, and Hazen lease areas. Several of these sites have been determined to be NRHP-eligible. Impacts on NRHP-eligible resources would be significant. As such, the potential for impacts on cultural resources in the North and South Aurora, Wilson Canyon, and Hazen lease areas is considered high.

Native American Resources Sensitivity Methodology. As required by law, the BLM consulted with Native American tribes associated with each geothermal resource area. Significant effects on Native American resources may consist of any action that alters any characteristic of a resource that contributes to its importance to Native Americans. The significance of an effect on a Native American resource is determined based on the importance of the resource to Native American groups and the type of effect the overall project would have. This may include changes to both the resource and to the setting of the resource. Many sacred areas, because they have spiritual association, do not easily fall into categories, such as the ones used here to describe sensitivity. Lakes, rivers, and especially springs are known to be important spiritual places to Native Americans; as such, proximity to any geothermal resource would suggest a probability that the area is sensitive to Native Americans. To facilitate the sensitivity model, responses from Native American tribes were used in the ways described below.

- Low sensitivity areas are those that Native American tribal representatives did not specifically express as being of concern or importance, and that are not near surface geothermal resources, and that do not contain landforms or dramatic topographical features.
- Medium sensitivity areas are those that Native American tribal representatives may not have specifically identified but that, due to the area's cultural sensitivity, are likely to become areas of concern, or that, based on landform and proximity to aboveground resources or topographical characteristics, are likely to contain sacred sites.
- High sensitivity areas are those that Native American tribal representatives have identified as highly sacred, that contain known traditional use areas, that are near known sensitive areas, or that are within historic districts.

Table 4-1 shows the cultural resources sensitivity ratings and the Native American resources sensitivity ratings for the noncompetitive lease areas. Lease stipulations include provisions for full compliance with all federal legislation and federal guidelines regarding both cultural and Native American resources. Areas that contain significant cultural resources may be mitigated through data recovery or other appropriate methods. A possible exception to this may be historic properties where intrusion of geothermal plants would destroy the integrity of a nearby property's setting. Areas that have a highly sensitive Native American component likely represent a nonrenewable resource, and any impacts would be considered significant and difficult to mitigate because of irreversible impacts associated with geothermal resource development. For example, disturbing the surface of areas with sacred value to Native Americans would permanently damage the resource.

Overall, the potential risk of impacts on Native American resources resulting from geothermal resource production is between medium and high. The Steamboat, Salt Wells, Lee Hot Springs, North and South Aurora, and Gabbs lease areas are all

considered to be high sensitivity areas for Native American concerns. All other lease areas are considered to be of medium sensitivity.

Paleontological Resources. Prior to exploration or development, a paleontological survey would be performed to ascertain the presence and type of fossils in the areas to be disturbed. Mitigation would depend on the type and scientific value of any fossils found. Trained researchers under BLM permit would collect fossils and store them at a qualified museum or other public institution.

No Action Alternative

The overall impacts on cultural and paleontological resources under the No Action Alternative are the same as under the proposed action, with less possibility for indirect impacts.

Continuation of current management would mean a continuation of the present trend in energy development activities, which could disturb previously unidentified cultural resources sites since the BLM's database of cultural sites in the planning area is incomplete. However, the case-by-case approach to approving leases and ROW authorizations limits the number of gas and oil projects permitted, due to limited BLM resources and staff time. This could reduce the likelihood of indirect impacts from that represented in the proposed action.

4.9 LIVESTOCK GRAZING

Impacts on grazing resources are calculated by assuming that maximum reasonable development of a lease area would disturb roughly 70 acres per section from constructing wells, well pads, access roads, power plants, and transmissions lines (see Appendix A, Reasonable Development Scenario). Grazing would be limited by construction of fencing and loss of access to vegetation.

Direct Impacts of the Proposed Action

The proposed leasing would not have any direct impact on grazing activities in the lease areas.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting grazing resources is assessed with respect to one significance criteria: Potential impacts on grazing resources could occur if reasonably foreseeable future actions resulted in a loss of more than 10 percent of the AUMs supported by a given allotment.

The assessment of indirect impacts affecting grazing resources from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and is summarized in Table 4-1.

The exploration, development, production, and closeout that may occur as a result of geothermal leasing may adversely affect the quality of grazing resources in the lease areas. Development of the lease areas could result in a reduction of 5,551 acres (11 percent) and approximately 191 AUMs (12 percent) distributed through the six grazing allotments that overlap the lease areas. Under BLM regulations, grazing allotment permits are held subject to other uses of the public lands. If it approves other (nonemergency) uses that would limit grazing within allotments, the BLM gives the permit holders two years notice of a reduction in the allotment. If a reduction is sufficiently minor—for example, if it would reduce the number of AUMs in an allotment only by a small amount—then the BLM may unilaterally issue a grazing decision.

These potential indirect impacts from developing lease areas are discussed more specifically by each lease area. Table 4-2 provides a breakdown of grazing allotments and the approximate acres and AUMs overlapped by each lease area. The table is a summary of the approximate acres affected and AUMs lost due to the reasonably foreseeable development scenario.

Table 4-2
Grazing Allotment Data for Allotments in the ROI of the Proposed Leasing Areas

Lease Area	Allotment Name	Total Area of Grazing Allotment (Acres)	Approximate Acres within Lease Areas Available for Grazing	Approximate Allotment Acres within Lease Areas Lost	Approximate AUMs within Lease Areas	Approximate AUMs within Lease Areas Lost
Hazen	Truckee-Virginia	21,369	4,275	468	225	25
Salt Wells	Salt Wells	58,611	7,023	768	106	26
Lee Hot Springs	Bass Flats	46,789	1,007	110	35	4
	Horse Mountain	63,043	13,498	1,476	643	70
South Aurora	Nine Mile	25,665	1,329	145	121	13
Wabuska	Adriance Valley	31,790	3,170	347	167	18
Gabbs Valley	Philips Well	70,431	1,945	213	41	4
	Pilot-Table Mountain	512,449	18,505	2,024	294	31
Total		**830,147**	**50,752**	**5,551**	**1,632**	**191**

Source: BLM 2002 (Summaries of Grazing Leases, Carson City Management Area)

Hazen Lease Area

Approximately 4,275 acres (20 percent) of the Truckee-Virginia Grazing Allotment overlap with the Hazen lease area (Table 4-2). If this area were fully developed, it would result in the disturbance and loss of access to approximately 468 grazing acres, or about two percent of the allotment. Complete development of the Hazen lease area could in the long term result in the loss of up to 25 AUMs, or less than three percent of the Truckee-Virginia AUMs. The potential risk of impacts on grazing resources in the Hazen lease area is low.

Salt Wells Lease Area

Approximately 768 acres (1.3 percent) of the Salt Wells Grazing Allotment overlap with the Salt Wells lease area. If this area were fully developed, it would result in the disturbance and loss of access to approximately 768 grazing acres, or less than one percent of the allotment. Developing these overlapping sections could in the long term result in the loss of up to 26 AUMs, or less than one percent, of the Salt Wells AUMs. The potential risk of impacts on grazing resources in the Salt Wells lease area is low.

Lee Hot Springs Lease Area

Approximately 1,007 acres (2.1 percent) of the Bass Flat Grazing Allotment overlap the lease area. If this area were fully developed, it would result in the disturbance and loss of access to approximately 110 grazing acres, or less than one percent of the allotment. Developing these overlapping sections could in the long term result in the loss of up to four AUMs, or less than one percent of the Bass Flat AUMs.

Approximately 13,498 acres (21.4 percent) of Horse Mountain Grazing Allotment overlap with this lease area. If this area were fully developed, it would result in the

disturbance and loss of access to approximately 1,476 grazing acres, or two percent the allotment. Complete development of these overlapping sections could in the long term result in the loss of up to 70 AUMs, or two percent of the Horse Mountain AUMs.

The potential risk of impacts on grazing resources in both the Bass Flats and Horse Mountain grazing allotments is low.

South Aurora Lease Area

Approximately 1,329 acres (5.2 percent) of Nine Mile Grazing Allotment overlap with this lease area. If this area were fully developed, it would result in the disturbance and loss of access to approximately 145 grazing, or less than one percent of the allotment. Complete development of these overlapping sections could in the long term result in the loss of up to 13 AUMs, or less than one percent, of the Nine Mile AUMs. The potential risk of impacts on grazing resources in the Nine Mile Grazing Allotment is low.

Wabuska Lease Area

Approximately 3,170 acres (10 percent) of the Adriance Valley Grazing Allotment overlap this lease area. If this area were fully developed, it would result in the disturbance and loss of access to approximately 347 grazing acres, or one percent of the allotment. Complete development of these overlapping sections could in the long term result in the loss of up to 18 AUMs, or approximately one percent of the Adriance Valley AUMs. The potential risk of impacts on grazing resources is low.

Gabbs Valley Lease Area

Approximately 1,945 acres (three percent) of the Phillips Well Grazing Allotment overlap the lease area. If this area were fully developed, it would result in the disturbance and loss of access to approximately 215 grazing acres, or less than one percent of the allotment. Developing these overlapping sections could in the long term result in the loss of up to four AUMs, or less than one percent of the Phillips Well AUMs.

Approximately 18,505 acres (four percent) of Pilot-Table Mountain Grazing Allotment overlap with this lease area. If this area were fully developed, it would result in the disturbance and loss of access to approximately 213 grazing acres, or less than one percent of the allotment. Complete development of these overlapping sections could in the long term result in the loss of up to 31 AUMs, or less than one percent of the Pilot-Table Mountain AUMs.

The potential risk of indirect impacts on grazing resources from a full development scenario in both the Phillips Well and Pilot-Table Mountain grazing allotments is low.

4.10 WILD HORSES AND BURROS

This section is an analysis of the direct impacts from the proposed action and indirect impacts from reasonably foreseeable future actions on wild horses and burros. A discussion of reasonably foreseeable future actions appears in Appendix A, Reasonable Development Scenario.

Direct Impacts of Proposed Action

The proposed action would have no direct impact on the horses within the Lahontan HMA, which is six miles north of the Wabuska Lease Area. The proposed action would have no direct impacts on the Powell Mountain WHT, which occurs in the lower two-thirds of the South Aurora Lease Area.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario would not result in indirect impacts on the Lahontan HMA or the Marietta Wild Burro Range. However, indirect impacts could occur on horses within the Powell Mountain WHT. The potential risk of these indirect impacts affecting HMAs and WHT is assessed with respect to two significance criteria. Potential impacts on Wild Horses and Burros could occur if any of the following were to take place:

- Reasonably foreseeable future actions were to have an adverse effect on the habitat of wild horses and burros, or
- Reasonably foreseeable future actions were to interfere with the movement of wild horses and burros.

The assessment of indirect impacts affecting HMAs from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and is summarized in Table 4-1.

Based on the reasonable development scenario, the proposed action is expected to have a low risk of potentially significant impacts on the habitat of horses within the Lahontan HMA. Due to the distance (approximately six miles) of the HMA from the Wabuska Lease Area, exploration, development, production, and closeout would not affect the quality of the habitat in the HMA.

Although the Lahontan HMA is approximately six miles north of the Wabuska lease area, exploration, development, production, and closeout may involve activities that could overlap with and affect the movement of both Lahontan HMA horses and other horses that use the HMA or interact with its horses. Impacts could include altering the travel routes or grazing grounds of the horses due to activities and noises associated with exploration, development, production, and closeout. The risk of potentially significant impacts on the movement of horses is expected to be low.

Based on the reasonable development scenario, the proposed action is expected to have a high risk of potentially significant impacts on the foraging habitat and movements of

horses within the Powell Mountain WHT. Exploration, development, production, and closeout activities would significantly affect the quality of the habitat in the WHT occurring in 13 sections in T5N, R28E, including Sections 2, 3, 4, 10, 19, 20, 21, 22, 29, 30, 31, 32, and 33. Equipment, human presence, and noise would have the most significant effect on the 29 horses in this WHT. The risk of potentially significant impacts on the movement of horses would be high.

4.11 VISUAL RESOURCES

This section is an analysis of the direct impacts from the proposed action and indirect impacts from reasonably foreseeable future actions on visual resources (which are discussed in Appendix A, Reasonable Development Scenario).

Direct Impacts of the Proposed Action

Leasing land in the lease areas does not involve ground-disturbing activities or any type of construction; therefore, there would be no direct impact on any visual resources or visual resource management regulations.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting visual resources is assessed for five significance criteria. Potential impacts on these resources could occur if reasonably foreseeable future actions:

- Have adverse effects on a scenic vista;
- Damage a scenic resource within a scenic roadway;
- Degrade the existing visual character or quality of the site and its surroundings;
- Create a new source of light or glare; or
- Are incompatible with VRM classifications.

The potential risk assessment of indirect impacts affecting visual resources from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and is summarized in Table 4-1.

Steamboat Lease Area

Future exploration, development, and production could involve new structures, roads, and operations, as described in Appendix A. These new structures, roads, and operations would be near areas where people live and work or where frequent recreation takes place. The risk for potentially significant impacts on visual resources would be medium because changes to the visual character of the environment would be consistent with the area's current VRM classification. General stipulations for geothermal resource developers are outlined in Appendix C in order to address the potential impacts on visual resources.

Hazen Lease Area, Salt Wells Lease Area, Lee Hot Springs Lease Area, Wabuska Hot Springs Lease Area, Gabbs Valley Lease Area, Hawthorne Lease Area, and Wilson Canyon Lease Area

Future exploration, development, and production could involve new structures, roads, and operations described in Appendix A. These would be near areas where expansive

vistas are available, where recreation takes place, or where minimal nearby development exists. The risk of potentially significant impacts on scenic vistas, the visual character of a site, and nighttime lighting would be medium because changes to the visual character of the environment would be consistent with the area's VRM classification. Future exploration, development, and production would also involve a site-specific environmental analysis. General stipulations for geothermal resource developers are outlined in Appendix C in order to address the potential impacts on visual resources.

North and South Aurora Lease Areas

Future exploration, development, and production could involve new structures, roads, and operations described in Appendix A. These new structures, roads, and operations would be near areas where recreation takes place or where minimal nearby development exists. Potentially significant impacts on scenic vistas, the visual character of a site, and nighttime lighting would be medium because changes to the visual character of the environment would be consistent with the area's VRM classification. Future exploration, development, and production would also involve a site-specific environmental analysis. General stipulations for geothermal resource developers are outlined in Appendix C in order to address the potential impacts on visual resources. Also, if the USFS upgrades the scenic resources during the revision and combination of the Humboldt National Forest and the Toiyabe National Forest plans, geothermal development could have a greater impact on the aesthetics of the North and South Aurora lease areas.

Direct and Indirect Impacts of the No Action Alternative

There would be no impacts on visual resources because no surface development would occur. There would be no changes to existing visual resources.

4.12 RECREATION AND SPECIAL DESIGNATIONS

This section is a description of the impacts on recreational opportunities within the lease areas. No Special Designations have been identified within any of the lease areas, so they are not discussed further.

Direct Impacts of the Proposed Action

Leasing land in the lease areas does not involve ground disturbances or changes in population levels; therefore, there would be no direct impact on the use of existing recreational facilities, enjoyment of current recreational opportunities, or construction of recreational facilities.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting recreation is assessed with respect to two significance criteria. Potential impacts on recreation could occur if reasonably foreseeable future actions were to:

- Increase the use of neighborhood and regional parks or other recreational facilities such that facility would substantially deteriorate or that deterioration would be accelerated or
- Diminish the enjoyment of existing recreational opportunities or require the construction of recreational facilities that might have a physical effect on the environment.

The potential risk assessment of indirect impacts affecting recreation from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and is summarized in Table 4-1.

Exploration, development, production, and closeout initiated under a lease agreement should not contribute to any of the geothermal areas a significant number of new residents who could increase the use of existing recreational facilities; therefore, there is a low potential risk of impacts from increasing the use of existing recreational facilities. The following addresses potential impacts on recreation if the project were to diminish the enjoyment of existing recreational opportunities or require the construction of recreational facilities, which might have a physical effect on the environment.

General Impacts

Implementing the Proposed Action could result in the eventual development of energy resources in the lease areas and in areas of dispersed recreational resources. Development in all areas would reduce the amount of natural landscape as well as the amount of areas available for recreationists seeking solitude; however, the lease areas are only a small portion of the surrounding landscapes. The creation of new roads would increase opportunities for people to access public lands and create trails and routes that

currently do not exist; however, this benefit is considered to be minor compared with the overall degradation of quality of dispersed recreational opportunities.

Given the small size of the lease areas compared with existing landscapes, and the unknown likelihood of finding geothermal resources appropriate for development, the potential risk of impacts on recreational opportunities is low within lease areas that do not contain any specific recreational features that would attract recreational users other than dispersed recreational users. These areas with low potential risk of impacts are Salt Wells, Hazen, Steamboat, and Hawthorne.

Impacts Specific to Individual Lease Areas

In addition to the general impacts mentioned above this section is a description of impacts specific to individual lease areas that have unique recreational features.

Lee Hot Springs is likely to be affected since it is an area that already demonstrates geothermal activity and no wells have been identified in the vicinity (NBMG 2006a). Visitors to Lee Hot Springs are likely to have a decreased quality of experience due to likely changes in the landscape, possible disturbance of the spring itself, and, if geothermal energy is developed at the site, a potential reduction in water flows and temperature. The potential risk of impacts would be high for Lee Hot Springs.

Wabuska Hot Springs is likely to be affected since several springs and wells already exist in the area. Also, there are other human-made features that detract from the natural landscape, such as a pipeline, the Wabuska Drain, and a fish hatchery (NBMG 2006b), so the generalized impacts for all lease areas may not be as relevant at this location as site-specific impacts. The proposed action would allow for further development of previously identified geothermal resources at the site, potentially leading to the development of a power plant and further wells. Any existing recreational experiences at the remaining natural springs in the lease area would be diminished due to the change in the visual landscape, potential changes to public access to the springs, and the potential for decreased flows and temperatures in the springs that often occur with the extraction of geothermal fluids from the same subterranean geothermal resource or reservoir. The potential risk of impacts on recreational opportunities at the Wabuska Hot Springs lease area would be low.

Gabbs Valley. The features of Hot Well and Rawhide Hot Spring identified within the Gabbs Valley lease area are likely to be affected since they already demonstrate geothermal activity; however, recreational uses associated with the well and the hot spring have not been identified. The potential risk of impacts on recreational opportunities within the Gabbs Valley lease area would be low.

Wilson Canyon. The northwest corner of lease N80601 lease area overlies a small portion of the West Walker River and Wilson Canyon. The rest of the Wilson Canyon lease area extends south from the canyon approximately three miles. Developing this northwest portion of the lease area would pose a high risk of impacts on recreational uses in the

canyon, such as camping, fishing, hiking, picnicking, and particularly OHV use. Development in this area may conflict with the future designation of OHV routes by the USFS Travel Management Plan, which is under development. The prohibition of surface occupancy disturbance within 650 feet of any surface water bodies would remove potential conflict with OHV routes that are within 650 feet of Walker River, as well as with many of the other identified recreational uses within the canyon. Any such development would undergo separate environmental review that would address the specific siting of any such geothermal well or facility and its impact on local recreational uses. No other recreational features or uses are expected to be affected. The potential risk of impacts on recreational opportunities at the Wilson Canyon lease area would be medium.

North Aurora. Issuing leases within the northwestern section of lease N79890 could diminish the enjoyment of recreational opportunities at the East Fork of the Walker River. If the East Walker River were included in the Wild and Scenic River System, then recreational impacts would not be permitted within a quarter mile (1,320 feet) of the river. The lease stipulation of no surface occupancy disturbance within 650 feet of any river or riparian area would not afford the river the level of protection that would be given under the wild and scenic river status, but since this designation has not yet been given, the current level of protection is considered to be sufficient. Additionally, individual environmental review of specific proposed geothermal exploration and development projects would address specific impacts at the time and would evaluate conflicts between proposed projects and protections given to the river at that time.

Additionally, all sections within N79890 contain Rough Creek, a tributary of the East Fork of the Walker River, so development within any of these sections could likewise diminish the enjoyment of recreational opportunities along Rough Creek. No surface occupancy disturbance would be allowed within 650 feet of any surface water bodies, riparian areas, wetlands, playas, or 100-year floodplains to protect the integrity of these resources.

The potential risk of impacts on recreational opportunities at the North Aurora lease area would be low.

South Aurora. Issuing leases within the South Aurora lease area could diminish the enjoyment of recreational opportunities at several tributaries of the East Fork of the Walker River. No surface occupancy disturbance would be allowed within 650 feet of any surface water bodies, riparian areas, wetlands, playas, or 100-year floodplains to protect the integrity of these resources. No additional impacts are expected for the South Aurora lease area. The potential risk of impacts on recreational opportunities within the South Aurora lease area is low.

No Action Alternative

The No Action Alternative would have no impacts on dispersed recreation or on any specific features that attract recreationists.

4.13 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

This section is an analysis of the direct impacts from the proposed action and indirect impacts from reasonably foreseeable future actions on socioeconomics and environmental justice.

Direct Impacts of the Proposed Action

Leasing land in the noncompetitive lease areas does not involve ground-disturbing activities or any type of construction. Therefore, there would be no direct adverse socioeconomic or environmental justice impacts resulting from the proposed leasing of geothermal resources. No residents, minority or low-income populations, or businesses would be displaced, and no property would be acquired.

Indirect Impacts of Future Actions Based on Reasonable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. The potential risk of these indirect impacts affecting socioeconomics and environmental justice is assessed with respect to eight significance criteria. Potential impacts on socioeconomics and environmental justice could occur if reasonably foreseeable future actions were to:

- Affect expenditures or income within the study area associated with the project;
- Induce growth or population concentrations;
- Displace a proportion of residences in a community;
- Create a demand for additional housing that could not be sustained within the study area;
- Cause a decrease in local or study area employment;
- Displace or disrupt businesses;
- Generate student enrollment that exceeds the school district's capability to accommodate them; or
- Have a disproportionately high and adverse impact on minority or low-income populations.

The potential risk assessment of indirect impacts affecting socioeconomics and environmental justice from exploration, development, production, or closeout uses the high-to-low scale identified in the beginning of Chapter 4. The assessment is described below and is summarized in Table 4-1.

Geothermal Resource Exploration

No long-term increases in population or growth would be induced through operation of these leases, and demand for schools would not increase. Leasing could have a beneficial impact on the state and counties in which leasing occurs, in the form of tax revenues and increased land values. The State of Nevada receives 50 percent of the

revenues collected by the federal government. Although the federal government does not pay property tax, persons who hold leases to government lands are subject to taxation of the possessory interest value of that lease, and tax revenue to the county from geothermal development is likely to be the same regardless of ownership. Land values for private tracts of land bordering geothermal development areas could increase, based on the development potential, and possible profitability, exhibited on adjacent geothermal lands. Potential increased land values for adjacent private land could provide indirect revenue to Churchill, Lyon, Mineral, and Washoe Counties.

Geothermal exploration involving the installation of temperature gradient wells could temporarily increase employment in the local area surrounding the geothermal resource. Seismic testing crews usually employ about 20 workers for about three or four months in an area. Expenditures for equipment fuel, lodging, food, and other needs would provide a stimulus to the local economy over the duration of the drilling. The potential risk for impacts on socioeconomics or environmental justice resulting from surveying of geothermal resources is expected to be low.

Geothermal Resource Development

No residents, minority or low-income populations, or businesses would be displaced, and no property would be acquired as a result of geothermal development. Depending on the size and location, geothermal development could have a substantial beneficial effect on the surrounding economy. Geothermal resource development could involve considerable construction employment for installing access roads, pipelines, transmission lines, drill sites, and power plants, depending on the resource potential. Setting up and drilling a well can employ approximately 20 workers for about three or four months in an area. Most of the workers would not be local, although some locals may obtain employment in road and pipeline construction. Each well could cost as much as $2.5 million when reservoirs, which are relatively deep, are being drilled. New geothermal power plants would come online over two to ten years. Approximately 40 drill crew members and 200 additional people would be involved in the construction of a typical plant. Transmission facilities would be constructed concurrently with power plants. Approximately 190 construction personnel are typically employed in the construction of 100 miles of transmission line. All the personnel involved in well and transmission line construction would be temporary. Communities near geothermal development would be required to supply services, but geothermal development would provide revenues to offset the cost of supplying these services. Another possible benefit would be to broaden the economic base of the communities within the region of influence of geothermal resource area.

Expenditures for equipment, materials, fuel, lodging, food, and other needs would stimulate the local economy over the duration of development, which could extend to 10 to 30 years. As identified in Section 3, Mineral County alone of the study area counties experienced only a minor increase in construction employment between 2000 and 2004. The other counties experienced substantial increases in construction (between 24 and 56 percent). Employment in the mining and extractive industries in

Churchill and Lyon Counties increased by 271 and 21.2 percent; Washoe County experienced an increase of 8.8 percent. Large-scale geothermal development could improve these figures, but increased population growth and limited available housing, particularly in Churchill and Mineral Counties, could be adverse effects of aggressive geothermal development.

Air emissions, water quality, noise, cultural, geologic, hazard and aesthetic impacts, potentially resulting from geothermal development, could adversely affect Native American populations on lands adjacent to leasing areas. The most sensitive areas for environmental justice effects are the Stillwater leasing area, which is adjacent to the Fallon Indian Reservation, and the Lee Hot Springs and Wabuska lease areas, both of which are near the Walker River Reservation. These potential adverse environmental justice effects would be mitigated through best management practices and by implementing environmental mitigation measures appropriate for each type of physical disturbance during development.

Geothermal resource development could affect nearby recreational resources, which also could affect the economies of the areas in which the recreational resources are located if fewer visitors use the resources and spend fewer dollars in the local economy. Increased geothermal activities above current levels could affect revenues associated with the recreational activity (such as bird watching, mountain biking, and hiking) if these activities were reduced or eliminated. As identified in Section 4.8, Recreation, these impacts could include noise and objectionable odors of sulfur from drilling, limiting or preventing access to recreation areas, scaring wildlife away, or causing the loss of recreation areas. Less than significant impacts were identified for most nearby recreational areas, except the California Historic Trail, the Pony Express National Historic Trail, and Grimes Point (which the Salt Wells noncompetitive lease area overlaps), the Humboldt-Toiyabe National Forest in the Bridgeport Ranger District adjacent to the South Aurora noncompetitive lease area, and the Mason Valley Wildlife Management Area and east of the California Historic Trail (Sonora Route) near the Wabuska noncompetitive lease area.

As identified in Section 4.9, Grazing, ranchers and shepherds rely on portions of the geothermal leasing areas for grazing their stocks. The level of local economic impact of geothermal leasing activities on grazing would depend on the extent to which reducing the grazing areas would reduce the size or health of a permitee's herds or require that a permitee lease or purchase additional lands. As identified in Section 4.9, developing the lease areas could reduce at least 191 AUMs distributed throughout the six grazing allotments that overlap the lease areas. These impacts have been identified as less than significant percentages of the affected grazing allotments and, therefore, would be unlikely to affect the economic livelihood of ranchers and herders.

Overall, the potential risk of impacts on socioeconomics or environmental justice resulting from geothermal resource development is low.

Geothermal Resource Production

Impacts from geothermal production are similar to those described for development, but at a smaller scale because production involves mainly operation, maintenance, and new well development. Much of the higher levels of construction activity would have occurred during development with the installation of new infrastructure. Once the well field and power plant are operating, about five permanent employees would be needed for field production, and ten additional employees would be needed for each power plant (BLM 2001c).

As with resource development, the physical environmental effects of waste management and disposal and new well development could adversely affect Native American populations on lands adjacent to leasing areas. The most sensitive areas for environmental justice effects would be the Stillwater leasing area, which is adjacent to the Fallon Indian Reservation, and the Lee Hot Springs and Wabuska lease areas, both of which are near the Walker River Reservation. These potential adverse environmental justice effects would be mitigated through best management practices and implementation of environmental mitigation measures appropriate for each type of physical disturbance during production. Overall, the potential risk of impacts on socioeconomics or environmental justice resulting from geothermal resource production is low.

Closeout

No residents, minority or low-income populations, or businesses would be displaced, and no property would be acquired as a result of the closeout phase of geothermal development. This phase could have a beneficial effect on the surrounding economy. Closeout could involve construction employment for reclaiming disturbed areas, which could be drawn from both local and outside labor forces. Expenditures for equipment, materials, fuel, lodging, food, and other needs would stimulate the local economy over the duration of the closeout phase. This phase is unlikely to generate population growth and concentrations or increase the demand for housing in the local area. Best management practices would be used when grading to minimize runoff, fugitive dust, and noise disturbance to adjacent or nearby Native American lands (particularly the Fallon Indian Reservation, adjacent to the Stillwater leasing areas, and the Walker River Reservation, near the Lee Hot Springs and Wabuska lease areas) so that potential adverse environmental justice effects would be avoided. Overall, the potential risk of impacts on socioeconomics or environmental justice resulting from closeout is low.

4.14 CUMULATIVE IMPACTS

CEQ regulations state that the cumulative impact analysis should include the anticipated impacts on the environment resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time" (40 CFR 1508.7).

Impacts of the proposed action and alternatives presented in this EA are assessed for cumulative impacts with other actions conducted in the region. This analysis considers the effects of the proposed action, as evaluated in detail in Chapter 4, when combined with the effects of other past, present, and future actions in the affected region. Cumulative actions evaluated in this document include other local geothermal development actions, other proposed land actions and use of those lands, and other reasonably foreseeable future actions. The cumulative effects analysis area is the entire CCFO.

Current or reasonably foreseeable actions that have been identified are described below.

Salt Wells Geothermal Binary Power Plant and other geothermal energy development. AMP Resources, LLC is constructing a geothermal binary power plant in the area of Salt Wells. In addition, seven other geothermal power plants are operating within the CCFO management area, four of them on private land in the Steamboat Springs Area. Although no detailed proposals have been developed, geothermal development is being considered on private, tribal, and US Navy land throughout the CCFO management area.

North Valleys Rights-Of-Way Projects. Fish Springs Ranch Limited Liability Corporation (LLC) and Intermountain Water Supply LTD submitted separate right-of-way applications to construct and operate water transmission pipelines across public land administered by the BLM Carson City Field Office. Each company is proposing to construct and operate water supply and transmission projects to meet present and future water demands of the North Valleys Planning Area in Washoe County. The proposed projects would install and operate wellheads, electrical distribution lines, water pipelines, pump stations, surge tanks, and a terminal water storage tank. In addition, Fish Springs Ranch's proposed project would construct an electrical substation on private land adjacent to the Alturas 345 kilovolt (kV) transmission line in Honey Lake Valley. A draft environmental impact statement has been prepared for the project.

Tracy to Silver Lake 120 kV Transmission Line Project. Sierra Pacific Power Company has proposed constructing a 120 kV overhead power transmission line and two new electrical substations to improve the reliability of the power supply to customers in the Spanish Springs Valley and the Stead area. The proposed transmission line would originate at the Tracy Power Plant and would extend approximately 34 miles through the Spanish Springs Valley to the Silver Lake substation in the Stead area. The first

phase of the project is estimated to be constructed in 2005 and completed in 2007. The second phase of the project is estimated to be started and completed in 2009.

NAS Fallon INRMP. NAS Fallon is updating its Integrated National Resources Management Plan (INRMP). The purpose of the INRMP is to ensure consistency with the use of NAS Fallon to support the preparedness of the Armed Forces, while providing for the conservation and rehabilitation of natural resources on NAS Fallon-administered lands, the sustainable multipurpose use of the resources, including hunting, fishing, trapping, and nonconsumptive uses, and public access to NAS Fallon-administered lands within safety and military security requirements. The overall goal of the INRMP is to develop a program that preserves and enhances ecosystem integrity and sustains both biological diversity and continued availability of those resources for military readiness and sustainability and other human uses.

Fallon Range Complex Management Plan. NAS Fallon is producing a Range Complex Management Plan to improve range sustainability by preserving, conserving, and developing range resources for future use. The plan was completed in 2006 and will support the Fleet strategic 10-year vision.

Fort Churchill to Buckeye 120 kV Transmission Line. In September 2005, Sierra Pacific Power Company completed the construction of a 120 kV overhead power transmission line to improve the reliability of the power supply to the customers in the Minden and South Lake Tahoe regions. The transmission line originated at the Fort Churchill Power Plant and extended 37.7 miles through Mason Valley and the Pine Nut Mountains to the Buckeye Substation in the Carson Valley.

Planned Development in the Hazen Area. Urbanization is proposed for the Hazen area. A large industrial site (640+ acres) and residential (2,200 homes) development have recently been presented to the County Planning Department. A major highway construction project, now in progress, will widen Alt Hwy 50 to four lanes in the Hazen lease area (Deshler 2006).

Air Quality

Since the project would not result in any direct air quality impacts, it would not contribute to any cumulative air quality impacts.

Land Use

The cumulative indirect effects of the project on land use are expected to be generally less than significant, provided that construction and operation of geothermal facilities is consistent with surrounding land uses.

Soils, Geology, and Mineral Resources

The cumulative indirect effects of the project on soils, seismicity, and exploration and production of mineral resources are expected to be generally less than significant,

provided that construction and operation of geothermal facilities is in compliance with building codes and state and local permit requirements.

Water Resources

Extraction and geothermal activities could require the consumption of water. Any additional consumption of water would have a cumulative impact when joined with other water use projects, such as water transfers. The actual consumption of water by energy facilities can be mitigated (for example, water can be reuse) so as to minimize this potential cumulative impact. There is a potential for energy facilities to concentrate in areas abundant with the resource. In such areas, there is a greater potential to contribute to cumulative depletion of water resources. Groundwater depletion is not one of the issues addressed in the proposed lease stipulations, except indirectly through the requirement for compliance with applicable laws and regulations. The state engineer is responsible for assigning water rights and managing groundwater resources. Any added use of or discharge to groundwater in the Steamboat area, where demand for potable water is nearing the available supply, could contribute to cumulative impacts on groundwater.

Vegetation and Invasive Plant Species

The risk to vegetation and invasive plants is proportionate to the amount of ground-disturbing activities in the region. Because the project would have direct impacts on vegetation if exploratory and development activities were approved, it would contribute additional cumulative vegetation resources impacts.

Fish and Wildlife

The risk to fish and wildlife species and their habitat is proportionate to the amount of ground-disturbing activities in the region. Because the project would result in direct impacts on vegetation if exploratory and development activities were approved, it would have additional indirect cumulative impacts on fish and wildlife resources. Direct mortalities on less mobile species would also contribute additional direct cumulative impacts on affected fish and wildlife resources.

Special Status Species

The risk to special status species and their habitat is proportionate to the amount of ground-disturbing activities in the region. Because the project would result in direct impacts on vegetation if exploratory and development activities were approved, it would contribute additional indirect cumulative impacts on special status species. Direct mortalities on less mobile species, particularly plant species, would also contribute additional direct cumulative impacts on affected special status species.

Cultural and Paleontological Resources

The risk to regional cultural resources is proportionate to the amount of ground-disturbing activities in the region. However, since the project would not result in any direct cultural resources impacts, it would not contribute to any cumulative cultural resources impacts.

The risk to regional Native American resources is proportionate to the amount of ground-disturbing activities in the region. However, since the project would not result in any direct Native American resource impacts, it would not contribute to any cumulative Native American resources impacts.

Prior to exploration or development, a paleontological survey would be performed to ascertain the presence and type of fossils in the areas to be disturbed. Should fossils be found, impacts would be mitigated to negligible levels, in accordance with BLM policy and procedures.

Livestock Grazing

The proposed action would contribute additional adverse impacts on livestock grazing where surface-disturbing activities directly remove vegetation important as livestock forage. The loss of 191 AUMs would be small compared to the overall availability of lands for grazing; however, the proposed actions could contribute additional adverse cumulative impacts on livestock grazing, and the effect could be greater for smaller livestock operators who are permitted to graze fewer livestock or have limited access to grazing allotments.

Wild Horses and Burros

The proposed action would not contribute adverse impacts that would cause additional cumulative impacts on wild horses and burros or any HMAs.

Visual Resources

Cumulative impacts on visual resources in the Steamboat lease area would be high. Although the Steamboat lease area already has some commercial and residential development nearby, the additional structures and activities from the proposed project and the cumulative actions within these areas would noticeably diminish the aesthetics of the interface between urban and open space lands.

Due to the expansive nature of the visual environment and minimal development in geothermal lease areas in the Great Basin, cumulative impacts from development could be high. Cumulative impacts could be significant, because geothermal development and the cumulative projects described above could add a significant number of new industrial structures and activities in areas that are fairly undeveloped. Also, geothermal development in Stillwater wildlife areas, Carson Lake Pastures, and Aurora Crater would represent significant visual impacts on areas preserved for natural processes.

Recreation/ Special Designations

The proposed action would contribute to adverse impacts on dispersed recreational opportunities that would also result from the Salt Wells geothermal project, the two transmission line projects, the planned development in the Hazen area, and the North Valleys Rights-of-Way projects. While individually these projects affect only a small land area, they all contribute to the overall trend in Nevada of development of natural lands, resulting in loss of the natural landscape and views, decreased opportunities for free

movement by dispersed recreational users, and increased noise and human presence in these formerly natural areas.

The project would not affect any specially designated areas so would not contribute to any cumulative impacts on special designations.

Public Safety/Hazardous Materials

Each phase of the proposed action's indirect activities (discussed in Appendix C) could involve hazardous materials. This would also be true for other geothermal development projects. As the amount of activity in an area increases, the likelihood of an accident, such as a collision involving a vehicle transporting hazardous material, increases. However, cumulative impacts are not expected to be significant because of the various regulations and requirements associated with using, transporting, storing, and disposing of hazardous materials.

Socioeconomics and Environmental Justice

The overall economic effect of geothermal leasing and the subsequent reasonable development scenario would be a positive stimulus to the economy of the local area surrounding the geothermal resource. Potential environmental justice effects on adjacent or nearby Native American populations would be avoided through best management practices and implementation of environmental mitigation measures appropriate for each type of physical disturbance. In combination with other future planned development, potential adverse effects due to the proposed geothermal leasing program would be less than significant.

SECTION 5
CONSULTATION AND COORDINATION

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Individuals from the Bureau of Land Management, Carson City Field Office, who were involved in the preparation and review of this Environmental assessment are listed below:

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MFA, Writing
BA, Technical and Professional Writing
Years of Experience: 18
(Technical Editor)

5.2 PERSONS, GROUPS OR AGENCIES CONSULTED

Federal Agencies

US Forest Service
- Humboldt-Toiyabe National Forest
- Supervisors Office (Sparks, Nevada)
- Carson City Ranger District
- Bridgeport Ranger District

Bureau of Reclamation
- Lahontan Basin Area Office

Tribes

Fallon Paiute-Shoshone Tribe
Pyramid Lake Paiute Tribe
Reno Sparks Indian Colony

Walker River Paiute Tribe
Washoe Tribe of Nevada and California
Yerington Paiute Tribe
Yomba Shoshone Tribe
Bridgeport Indian Colony
Lovelock Paiute Tribe

CHAPTER 6
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SECTION 7
LIST OF ACRONYMS

Acronym	Full Phrase
ACEC	Areas of critical environmental concern
AUM	Animal unit month
BEA	Bureau of Economic Analysis
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BOR	Bureau of Reclamation
BP	Before Present
CAA	Clean Air Act
CCFO	Carson City Field Office
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon monoxide
CRMP	Consolidated resource management plan
CWA	Clean Water Act
DOD	Department of Defense
DOE	Department of Energy
EA	Environmental assessment
EIS	Environmental impact statement
EO	Executive order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act of 1976
FONSI	Finding of no significant impact

Acronym	Full Phrase
FSC	Federal species of concern
HMA	Herd management area
KGRA	Known geothermal resource area
MBTA	Migratory Bird Treaty Act
MMPA	Mining and Mineral Policy Act
mW	Megawatts
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	Naval Air Station
NDEP	Nevada Division of Environmental Protection
NDOW	Nevada Division of Wildlife
NDWP	Nevada Division of Water Planning
NEP	National Energy Policy
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NNHP	Nevada Natural Heritage Program
NNNPS	Northern Nevada Native Plant Society
NO_2	Nitrogen dioxide
NRCS	Natural Resources Conversation Service
NRHP	National Register of Historic Places
NSBDC	Nevada Small Business Development Center
NV	Nevada
NWR	National Wildlife Refuge
O_3	Ozone
ODS	Ozone depleting substance
OHV	Off-highway vehicles
PL	Public Law
$PM_{2.5}$	Fine particulate matter
PM_{10}	Inhalable particulate matter
ppm	Parts per million
RMP	Resource management plan
ROI	Region of influence
ROW	Right-of-way
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SEC	State Environmental Commission
SHPO	State Historic Preservation Officer
SO_2	Sulfur dioxide
SO_4	Sulfate particles
SR	State route
T&E	Threatened and endangered

Acronym	Full Phrase
TCID	Truckee-Carson Irrigation District
TCP	Traditional cultural property
TMDL	Total maximum daily load
UBC	Uniform Building Code
$\mu g/m^3$	Micrograms per cubic meter
US	United States
USC	United States Code
USDA	US Department of Agriculture
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
VRM	Visual resource management
WHT	Wild Horse Territory
WMA	Wildlife management area
WSA	Wilderness study area

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APPENDIX A
REASONABLE DEVELOPMENT SCENARIO

Although the proposed action involves the issuance of leases for geothermal resources by the Carson City Field Office of the BLM, it is reasonable to assume that the investment in obtaining a lease could eventually result in the use of geothermal resources. In order to assess the potential for environmental impacts that may result in an area as a result of lease approval, a reasonable development scenario has been developed. The reasonable development scenario for geothermal resource use involves four sequential phases: (1) exploration, (2) development, (3) production, and (4) closeout. The success or failure of each phase affects the implementation of subsequent phases, and, therefore, subsequent environmental impacts.

The general assumptions outlined in the following four phases serve to establish reasonable development possibilities for analyzing future environmental impacts that may result from the Carson City Field Office issuing leases for geothermal resources. It should be noted that the reasonable development scenario permits a general evaluation of the types of impacts that may occur but cannot accurately predict the magnitude and extent of these impacts. This is due in part to the inability to predict future development scenarios, including types of development, timing, and location. It is also due in part to the fact that the development scenario is based on expected activities undertaken for single lease. Since a lease can range in size from a portion of one section of land (less than 640 acres) up to four sections of land (2,560 acres), potential impacts may be concentrated or diffuse depending on the size a lease development and the number of developments in an area.

Phase One: Geothermal Resource Exploration

A known geothermal resource area (KGRA) is an area where BLM determines that persons knowledgeable in geothermal development would spend money to develop geothermal resources (43 CFR Part 3200). Before geothermal resources are developed, however, a geothermal resource developer explores geothermal resources on leased land to determine the location of suitable geothermal reservoirs within the KRGA. For the

same reason, exploration is equally important within a non-KGRA. Exploration involves first surveying and then drilling temperature gradient wells. It would take between one and five years to complete exploration.

Surveys

Surveying includes conducting or analyzing satellite imagery and aerial photography, volcanological studies, geologic and structural mapping, geochemical surveys, and geophysical surveys of leaseable areas that could support geothermal resource development. The surveys consist of collecting electrical, magnetic, chemical, seismic, and rock data. For example, water samples from hot springs could be used to determine the subsurface characteristics of a particular area. Once the data is compiled, geologists and drillers examine the data and make inferences about where the higher temperature gradients may occur. High temperature gradients can indicate the location of potential underground geothermal reservoirs capable of supporting commercial uses.

The environmental impacts from the physical surveys are similar to impacts that result from recreation activities, such as hiking, driving, or camping, that typically occur on federal lands. Therefore, a geothermal resource developer would not be required to obtain authorization from BLM prior to conducting these surveys.

Temperature Gradient Wells

The second step of the exploration phase is to drill temperature gradient wells on leased land. This allows the lessee to confirm a more precise location of high temperature gradients. Temperature gradient wells can be drilled using a truck-mounted rig and range from 200 feet to over 4,000 feet deep. Geologists examine either rock fragments or long cores of rock that are brought up from deep within the well. Also, temperatures are measured at depth. Both well temperatures and the results of rock sample analyses are used to determine if additional exploration is necessary to identify the presence and characteristics of an underground geothermal reservoir.

With the exception of impacts to air quality, the environmental impacts from exploration could be localized to access road construction and the construction and operation of the temperature gradient well. Whenever possible, a driller would access the temperature gradient well site using existing roads. When existing roads are not available, new access roads may need to be constructed for the truck-mounted rig to reach the site.

Preparing the site for drilling could include leveling the surface and clearing away vegetation. The lessee could drill several temperature gradient wells on a lease to determine both the areal extent of the temperature anomaly and where the highest temperature gradient occurs. Each drill site could disturb approximately 0.07 acre, and the drill rig could be approximately 60 feet tall. During exploration, a driller may not produce any fluids out of, or inject any fluids into, the well. In addition to the drill rig, a diesel generator may also be used at the site to power equipment.

All surface disturbances would be reclaimed to the satisfaction of BLM. If a temperature gradient well was unsuccessful, it would be abandoned, and the drill site would be reclaimed. Abandonment includes plugging, capping, and covering the wells. Reclamation includes removing all surface equipment and structures, regrading the site to predisturbance contours, and replanting native vegetation.

Phase Two: Geothermal Resource Development

Based on the results of exploration, geothermal resource development would involve assembling the infrastructure needed to use the underground geothermal reservoir. The type of development that occurs would be based on the size and temperature of the geothermal reservoir. Geothermal resources can be classified as low temperature (less than 90°C, or 194°F), moderate temperature (90°C to 150°C, or 194 to 302°F), and high temperature (greater than 150°C, or 302°F). The highest temperature resources are generally used only for generating electric power, and uses for both low and moderate temperature resources can be either direct use or ground-source heat pumps. Direct use involves using the heat in the water directly for such things as heating buildings, industrial processes, greenhouses, aquaculture (growing fish), and resorts. Direct use projects generally use resource temperatures between 38°C (100°F) and 149°C (300°F). A ground-source heat pump, which moves heat from one place to another, transfers heat from the soil to a house during the winter and heat from a house to the soil in summer. It uses geothermal resource temperatures between 4°C (40°F) and 38°C (100°F).

High temperature reservoirs are suitable for the commercial production of electricity. Three types of power plants that harness geothermal resources are dry steam plants, flash steam plants, and binary-cycle plants. Dry steam power plants use the steam from the geothermal reservoir as it comes from the wells and route it directly through turbine/generator units to produce electricity. Flash steam power plants use water at temperatures greater than 182°C (360°F). Water is pumped under high pressure to the generation equipment at the surface, the pressure is suddenly reduced, allowing some of the hot water to convert' or "flash," into steam, and the steam is used to power the turbine/generator units to produce electricity. Binary-cycle power plants use water from the geothermal reservoir to heat another "working fluid." The working fluid is vaporized and used to turn the turbine/generator units. The geothermal water and the working fluid never come in contact with each other. Binary-cycle power plants can operate with lower water temperature 107°C to 182° C (225°F to 360°F) and produce few air emissions.

The development phase involves the most intense activity and would occur over two to ten years. Drilling would take place 24 hours a day. If a reservoir is discovered, characteristics of the well and the reservoir are determined by flow testing the well. If the well and reservoir were sufficient for development, a wellhead, with valves and control equipment, would be built on top of the well casing. Development activity would involve the following construction and operation:

- Access roads—New access roads to accommodate the larger equipment associated with the development phase could be constructed. The roads could be approximately 0.5 mile to 3 miles long. New access roads could also be necessary for accessing the user of the geothermal resource (see fourth bullet below).
- Drill site development—Production-size wells can be over two miles (10,560 feet) deep. In order to drill these deep holes, a two-acre well pad would be constructed and a large drill would be erected. Up to two wells may be drilled per lease.
- Geothermal pipelines—The pipelines are usually 24 to 36 inches in diameter and are covered with insulation. When feasible, they would parallel the access roads and existing roads to the destination of the geothermal resource's steam or water. The pipelines would be no longer than approximately four miles.
- Geothermal resource user—Most of the geothermal resources are expected to be used for power plants or put to direct use. A power plant could occupy 10 acres. The desired use of the geothermal resource's steam or water would be based on the location of the underground reservoir and its temperature.
- Electric transmission lines—Transmission lines may range in length from 5 miles to 50 miles. Wooden poles would most likely support them, and one acre could be disturbed per mile of transmission line.
- Reclamation—If a production well were successful, a wellhead with valves and control equipment would be built on top of the well casing. The well site would be reclaimed to the satisfaction of BLM. Reclamation includes removing all surface equipment and structures, regrading the site to predisturbance contours, and replanting native vegetation. If a production well were unsuccessful, the well would be abandoned. Abandonment includes plugging, capping, and covering the wells.

The greatest environmental impacts are more likely to occur during the development phase because of the intense production well drilling activity. Also, infrastructure, such as a power plant or greenhouse, for utilizing the geothermal resource would need to be constructed. The following environmental impacts could be associated with the above construction and operation activity of the development phase:

- Air quality—Impacts on air quality could include emissions from diesel generators and engines during construction, venting of hydrogen sulfide from the well, slight heating of the local atmosphere around the well, localized fogging around the well, or fugitive dust emissions during construction.
- Water quality—Impacts on water quality could include polluted surface water runoff during construction, obtaining rights to use water for drilling

in very arid areas, lowering the groundwater table at the well site, or saline intrusion at the well site.

- Biological resources—Impacts on flora and fauna for all aspects of the development phase could include the loss of vegetation and habitat, the alteration of migratory routes, loss of nesting and denning sites, animals (especially birds and bats) wandering on-site and coming into contact with poisonous substances, and the invasion of noxious weeds in disturbed areas.
- Noise—Impacts associated with noise for all aspects of the development phase could include disturbances to nearby humans and animals from equipment noise or groundborne vibration and noise.
- Cultural resources—Impacts on cultural resources for all aspects of the development phase could include damaging undiscovered or buried resources or activities that disturb prayer or meditation sites.
- Geology—Impacts on geology and soil could include subsidence from drilling and withdrawal/injection activity. Soil erosion and landslides could also occur during all aspects of the development phase.
- Hazards—Impacts from hazards at the drill site could include the disposal of drilled material and drilling mud and induced seismicity from injection. Impacts to hazards during all aspects of the development phase could include accidental spills, fires, routine use of hazardous materials (such as solvents and fuels) to operate and maintain equipment and facilities or disposal of piping or old equipment.
- Aesthetics—Impacts on aesthetics during all aspects of the development phase could include nighttime glare from safety/security lighting or the visibility of industrial structures and activity in undeveloped remote locations.

Phase Three: Production

The production phase could last from 10 to 30 years and involves the operation and maintenance of the geothermal field(s) and includes new drill sites. The drilling of new production wells, if necessary, in order to manage a geothermal field would involve drilling and impacts that are similar to those discussed above in the development phase.

Operation and maintenance of existing facilities and production of geothermal energy would also take place during the production phase. Environmental impacts associated with operation and maintenance and energy production would involve managing waste generated by daily activities; equipment, fugitive dust, and well emissions; noise from equipment, vehicles, and wells; and managing geothermal water.

Phase Four: Closeout

This phase involves abandoning the well after production ceases and reclaiming all disturbed areas in conformance with BLM standards. Abandonment includes plugging,

capping, and covering the wells. Reclamation includes removing all surface equipment and structures, regrading the site to predisturbance contours, and replanting native vegetation.

APPENDIX B
STANDARD OPERATING PROCEDURES AND CONDITIONS OF APPROVAL

B.1 STANDARD OPERATING PROCEDURES (SOPS)

In addition to the restrictions on leasing authority contained in the Geothermal Steam Act, the CCFO CRMP, and other established law or regulation, as described in Chapter 1, the following SOPs for leasable minerals are set forth in the CCFO CRMP (BLM 2000). These SOPs define the approach to managing leasable mineral exploration and development in the CCFO management area.

1. Oil, gas, and geothermal exploration and production upon BLM land are conducted through leases with the Bureau and are subject to terms and stipulations to comply with all applicable federal and state laws pertaining to various considerations for sanitation, water quality, wildlife, safety, and reclamation. Stipulations may be site specific and are derived from the environmental analysis process.

2. Geophysical exploration permits for oil, gas or geothermal resources may be obtained prior to leasing of the lands. Mitigation of any resource conflicts identified in the review process will be stipulated in the permit.

3. Wilderness Study Areas are closed to mineral leasing.

B.2 CONDITIONS OF APPROVAL

All ground disturbing activity related to geothermal exploration, development, operation, and closeout in the CCFO management area are subject to BLM environmental review and permit approval. As part of these reviews, BLM may require the following types of measures to reduce impacts to resources. Measures listed below are representative of the types of measures that may be included as part of environmental review or permit approval. Additional measures may be included to

address site-specific concerns, including SOPs for other resources described in the CCFO CRMP.

B.2.1 CONDITIONS OF APPROVAL

Geophysical Exploration

1. The operator shall furnish a project map(s) at a minimum scale of 1:100,000 with the Notice of Intent (NOI) depicting the approximate line route to be used. A map shall also be filed with the Notice of Completion (NOC) depicting the actual location of the complete line.

2. Any changes in location of exploration lines or test arrays will be brought to the attention of the Authorized Officer (AO) prior to the change being made on the ground.

3. No blading or other dirt work will be allowed without prior approval of the AO.

4. All geophysical exploration activities will be in compliance with Washoe County or State of Nevada air quality standards.

5. Activities of the geophysical operations shall not prevent, obstruct, or unduly interfere with any activities of other authorized users of the public lands.

6. Removal or alteration of existing improvements (fences, cattle guards, etc.) is not permitted without prior approval of the AO. Existing improvements will be maintained in a serviceable and safe condition.

7. Fences shall not be cut without prior approval of the AO. Before cutting through any fences, the operator shall firmly brace the fence on both sides of the cut; a temporary gate will be installed for use during the course of operations unless the fence is immediately repaired. Upon completion of operations, fences shall be restored to at least their original condition.

8. During periods of adverse conditions affecting soil moisture caused by climatic factors such as thawing, heavy rains, snow, flooding, or drought, all activities off existing maintained roads that create excessive surface rutting may be suspended. When adverse conditions exist, the operator will contact the AO for an evaluation and decision based on soil types, soil moisture, slope, vegetation, and cover.

9. Off-road vehicle travel will be limited to that which is necessary for the completion of the geophysical operations. Multiple off-road travel routes will not be permitted without AO approval.

10. The use of specialized low surface impact equipment (wide or balloon tired vehicles, ATVs) and/or helicopters may be required for any activities in off-road areas where it is deemed necessary by the AO to protect the fragile soils and/or other resource values.

11. Powder magazines shall be located at least ¼-mile from traveled roads. Loaded shot holes and charges shall be attended at all times.

12. No blasting will be permitted within ¼-mile of historic trails, natural areas, identified archaeological sites, recreation areas, known caves, water wells, or springs.

13. All trash, flagging, lath, etc. will be removed and hauled to an authorized disposal site. No oil or lubricants shall be drained into the ground surface.

14. Areas proposed for project routes or surface disturbance will be inventoried for the presence of noxious weeds prior to commencement of activities.

15. A noxious weed control program will be developed, maintained, and implemented by the lessee/operator in order to prevent and avoid the proliferation of noxious weeds, as defined in the Nevada Designated Noxious Weed List. The control program shall include a monitoring strategy and contingency plans to address noxious weed control for a period of at least 5 years following completion of use or closeout. The underside of all heavy equipment must be cleaned by water before entering public lands to do work. Driving through or parking on noxious weed infestations will be avoided.

16. It is the responsibility of the lessee/operator to control and treat for noxious weeds and all infestations of noxious or poisonous weeds, resulting from surface disturbance caused by the operator, will be controlled before spreading occurs into the surrounding area.

17. All disturbed areas will be reclaimed as directed by the AO. Bond liability will not be released until this reclamation is completed to the satisfaction of the AO.

18. Reclamation required by the AO will be done concurrently with the exploration operations insofar as possible or within 30 days of the AO's receipt of the NOC.

19. Disturbed areas will be re-seeded with a diverse native perennial seed mix, as specified in the Nevada Final Guidelines for Successful Revegetation, and approved by the AO. Where applicable, disturbed areas will be rehabilitated as lek habitat. Temporary fences will be used to protect re-vegetated areas.

Reseeding will be undertaken by the operator between the dates of October 1 and March 15.

20. All topsoil from all disturbances will be stockpiled for use in reclamation.

21. Vegetation that is removed will be stockpiled, shredded, and used as mulch during site rehabilitation. Any delay of reclamation for any reason, such as weather, must be approved by the BLM.

22. Drill hole cuttings will be returned to the hole if possible, or at a minimum, raked and spread out so as not to impede regrowth of vegetation or to create erosion problems.

23. The operator shall notify the AO the date rehabilitation operations commence and are completed.

24. A portable mud pit is recommended when drilling with fluids and will be required by the AO as needed to protect natural resources.

25. Geophysical exploration activities will comply with the regulations of the Nevada Division of Minerals under Nevada Administrative Code, Chapter 534A, Geothermal Resources.

26. A copy of these recommended operating procedures shall be kept by the party chief of each geophysical crew.

27. The operator may be required to have fire-fighting equipment available on-site while operations are in progress, depending on hazards inherent in the type of operation and fire hazard levels. The quantity and type of equipment will be specified by the AO. All uncontrolled fires will be reported immediately to the AO (775-885-6000).

28. Consultation with the U.S. Fish and Wildlife Service is required per section 7 of the Endangered Species Act if any proposed listed or listed threatened or endangered species or its critical habitat is likely to be affected by project activities. If, through consultation, there is deemed to be an adverse impact to a threatened or endangered species or its habitat, the proposal must be modified or denied.

29. Prior to surface disturbance, the Nevada Division of Wildlife will be consulted to determine how to avoid impacts to any special status species or critical habitat in the area proposed for geothermal resource development. If, through consultation, there is deemed to be an adverse impact to a threatened or endangered species or its habitat, the proposal must be modified or denied.

30. Actions which will adversely impact a plant or animal species or its habitat proposed for federal listing as threatened or endangered will be modified in order to prevent possible future listing of these species as threatened or endangered.

31. When BLM determines geophysical activities may impact BLM sensitive species, the operator will be required to conduct a sensitive species survey prior to BLM granting permit approval.

32. When BLM determines geophysical activities may impact migratory birds, the operator will be required to inventory the area prior to BLM granting permit approval.

33. No surface use within 0.6 miles of known migratory bird nesting areas will be permitted in the nesting season, between March and June, or as determined for specific areas by the AO and with input from appropriate wildlife agencies.

34. Any identified bald eagle roost sites, peregrine falcon hack sites, and occupied raptor aeries (nests) will be avoided during geophysical operations. A ½-mile buffer zone will be imposed on all activities in these areas.

35. Measures to avoid impacts to Sage Grouse

    a. Prior to entry on any lease areas that include known or potential Sage Grouse habitat, lessee/operator shall contact the AO to discuss proposed activities.

    b. No surface occupancy will be permitted within 0.6 miles of any known Sage Grouse strutting grounds (leks).

    c. No surface use will be permitted within 2 miles of known Sage Grouse breeding areas during the breeding season, March through May, or as determined for specific areas by the AO and with input from appropriate wildlife agencies.

    d. No surface use will be permitted within 0.6 miles of known Sage Grouse nesting and brood rearing areas between April and August, or as determined for specific areas by the AO and with input from appropriate wildlife agencies.

    e. No surface use shall be permitted within 0.6 miles of known Sage Grouse winter range between October and March.

    f. Potential Sage Grouse habitat shall be avoided where possible, or if not possible, off-site mitigation to create habitat at least as suitable as

the lost habitat, and at a replacement ratio of 2 to 1, shall be considered.

36. No surface use shall be permitted in crucial migratory routes or winter habitat for mule deer and antelope, between October 15 and April 15, or as determined for specific areas by the AO and with input from appropriate wildlife agencies.

37. Cultural resource inventories will be conducted on all proposed project routes or areas of potential surface disturbing impacts prior to authorization of the geophysical operations. Inventories will be completed by BLM or BLM-approved cultural resource permit holders and section 106 consultation will be completed.

38. All identified cultural resources will be avoided by project-related activities as per the Nevada BLM Programmatic Agreement for Cultural Resources. If avoidance is not feasible, geophysical activities must cease until mitigating measures are developed and implemented and Section 106 consultation is completed. Archaeological monitors may be required in special cases.

39. All traffic associated with geothermal exploration, development, production, and closeout must follow routes that avoid cultural resources. Flagging crews will identify and flag anticipated detours on the route, so that potential detours can be inventoried. The following may be excluded from cultural inventory requirements:

    - Operations located on constructed roads or well defined existing roads and trails;
    - Pedestrian routes and placement sites for hand-carried equipment;
    - One time pass routes of wheeled vehicles under 10,000GVW;
    - Helicopter-supported activities that do not require helicopter staging area preparation and use of off-roads and trails; and
    - Exploration activities defined as casual use in 43 CFR 3250.

    The decision to conduct a cultural clearance on projects involving methods listed above is at the discretion of the AO. All projects that include methods not listed above will require a clearance prior to their initiation.

40. Cultural resource clearance for projects will, at a minimum, involve one of the following types of inventories:

- Class I: A review of existing historic documentation, and field station records. This type of inventory is generally used when the proposed project is located in an area of complete disturbance, or where the area has been previously inventoried using methods consistent with existing standards.

- Class II: A review of existing historic documentation, and field station records and some fieldwork. This type of inventory is generally used when only a portion of the project area has been disturbed, or portions of the project area have been previously inventoried using methods consistent with existing standards. It may also include a determination of significance for cultural properties located within the project area, and a determination of effect.

- Class III: A complete inventory that includes a review of existing historic documentation and field station records, and a complete inventory of the project area. It will also include an evaluation of significance for cultural properties located within the project area and a determination of effect. This type of inventory is used in areas where there have been no previous inventories, in areas where there has been a change in ground visibility, or the area was inventoried using methods not acceptable by existing standards.

41. The operator is responsible for informing all persons associated with the project that knowingly disturbing cultural properties (historic or archaeological) or collecting artifacts is illegal.

42. During winter geophysical operations, requirements for cultural resource inventories may be waived by the AO if the unsurveyed lines are located on bare and frozen ground or are completely covered (100%) by snow and the snow is sufficiently deep (approximately 4-6") to prevent ground disturbing ruts. Should conditions change while operations are in progress, the Operator must contact the AO to determine if an archaeological monitor or a Class III survey is required prior to continuance of geophysical activities.

43. For any geophysical operations occurring within ¼ mile of listed National Register Districts or National Register-eligible properties and districts, a Section 106 consultation for a Determination of Effect must be completed and mitigation measures developed and implemented prior to authorization.

Application for Permit to Drill (APD) and Sundry Notices

The regulations governing drilling operations on public lands are stated in 43 CFR 3260. With submittal of an APD or Sundry Notice by the operator or lessee, the following conditions of approval will be required for the operation, as applicable.

Pre-Construction

1. Existing roads should be used to the extent possible. Additional roads, if needed, shall be kept to an absolute minimum and the location of routes must be approved by the AO prior to construction.

2. All access roads will be constructed and maintained to BLM road standards (BLM Manual Section 9113).

3. Off-road travel will be restricted to terrain with less than 30 percent slopes, 20 percent if highly erodable, unless approved by the AO.

4. Proposed surface disturbance and vehicular travel will be limited to the approved well location and access route.

5. Any changes in well location, facility location, access, or site expansion must be approved by the AO in advance.

6. Prior to approval of an APD or other lease operations, a Section 106 consultation must be completed by the AO as provided for under the Nevada BLM Programmatic Agreement for Cultural Resources.

7. Any activity planned within a ¼-mile on either side the Pony Express National Historic Trail must undergo a visual assessment. Appropriate mitigation of visual impacts will be implemented as necessary to keep the management corridor in as natural a condition as possible.

Well Pad and Facility Construction

1. A site diagram depicting the location of production facilities, recontoured slopes and stabilization measures shall be approved by the AO prior to installation of production facilities.

2. The design of all facilities, including well pads, roads, pumps, and pipelines, shall be approved by the AO prior to construction to avoid unnecessary conflicts with visual resources management objectives.

3. Drainage from disturbed areas will be confined or directed so that erosion of undisturbed areas is not increased. In addition, no runoff water (including that from roads) will allowed to flow into intermittent or perennial waterways without first passing through a sediment-trapping mechanism. Erosion control structures may include: water bars, berms, drainage ditches, sediment ponds, or devices.

4. Access road construction for exploratory wells should be planned such that a permanent road can later be constructed in the event of field development.

5. Construction of access roads on steep hillsides and near watercourses will be avoided where alternate routes provide adequate access.

6. Access roads requiring construction with cut and fill will be designed to minimize surface disturbance and take into account the character of the landform, natural contours, cut material, depth of cut, where the fill material will be deposited, resource concerns, and visual contrast.

7. Fill material will not be cast over hilltops or into drainages. Cut slopes should normally be no steeper than 3:1 and fill slopes no steeper than 2:1.

8. Low water crossings should be used whenever possible. Installation of culverts, if necessary, will be designed to maintain the original stream gradient and will be of adequate size to accommodate a 24-hour 100-year event. Fill material will be properly compacted in layers not exceeding 6 inches in thickness to insure stability and to prevent washing out or dislocation of the culvert. The road surface should not be less than 12 inches above the culvert to prevent crushing from weight loads.

9. As required, fill slopes surrounding culverts will be riprapped with a well-graded mixture of rock sizes containing no material greater than two feet or smaller than three inches. The ratio of maximum to minimum dimension of any rock shall not exceed 6:1.

10. Water turnouts needed to provide additional drainage will be constructed not to exceed two percent slope to minimize soil erosion.

11. Well site layout should take into account the character of the topography and landform. Deep vertical cuts and steep long fill slopes should be avoided. All cut and fill slopes should be constructed to the least percent slope practical.

12. Trash will be retained in portable trash cages and hauled to an authorized disposal site for disposal. Burning will not be allowed on the well site.

13. No drilling or storage facilities will be allowed within 650 feet of any pond, reservoir, canal, spring, or stream. Other protective areas near water may be required to protect riparian habitat and special status species.

14. As wells are drilled, the AO will require that the drilling company monitor the temperature and outflow of water from local hot springs. If the BLM determines the drilling or production operations have had a significant impact on spring level, outflow, or chemistry, the AO will require the operator take corrective action, which may include amending or shutting down operations

15. Spring and water developments on public lands may be used only with the prior written approval of the AO or the water rights holder.

16. To maintain aesthetics values, all semi-permanent and permanent facilities will be painted to blend with the natural surroundings. Standard environmental colors will be used for color selection. Fences shall be made of non-reflective materials.

17. Fences shall not be cut without prior approval of the AO. Before cutting any fences, the operator shall firmly brace the fence on both sides of the cut; a temporary gate will be installed for use during the course of operations unless the fence is immediately repaired. Upon completion of operations, fences shall be restored to at least their original condition.

18. As directed by the AO, cattle guards will be installed whenever access roads are through pasture gates or fences. These cattle guards shall be maintained. This includes cleaning out under cattle guard bases when needed.

19. The depth of surface soil material to be removed and stockpiled will be specified by the AO. If topsoil is stockpiled for more than one year, the stockpile shall be seeded or otherwise protected from wind and water erosion. The stockpile shall be marked or segregated to avoid loss or mixing with other subsurface materials. Any trees removed will be separated from soils and stockpiled separately.

20. Mud, separation pits, and other containments used during the exploration or operation of the lease for the storage of any hazardous materials shall be adequately fenced, posted, and/or covered.

21. Lessee/operator shall comply with all regulatory requirements for storage and handling of hazardous materials and wastes.

22. All drilling and production operations will be in compliance with Washoe County or State of Nevada air quality standards.

23. If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work that might further disturb such materials, and contact the AO. Within five working days the AO will inform the operator as to whether:

    - the materials appear eligible for the National Register of Historic Places

    - the mitigation measures the operator will likely have to undertake before the site can be used (assuming in situ preservation is not necessary)

    - a timeframe for the AO to complete an expedited review under 36 CFR 800.11 or other applicable Programmatic Agreement, to confirm, through the State Historic Preservation Officer, that the findings of the AO are correct and that mitigation is appropriate

24. If the operator wishes, at any time, relocate activities to avoid the expense of mitigation and/or the delays associated with the process described in item 23 above for inadvertent discovery of cultural resources, the AO will assume responsibility for whatever recordation and stabilization of the exposed materials may be required. Otherwise, the operator will be responsible for mitigation costs. The AO will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the AO that the required mitigation has been completed, the operator will then be allowed to resume construction.

25. No surface use will be permitted within 0.6 miles of occupied raptor aeries (nests) during the nesting and fledging period.

26. Field development construction activities within 2 miles of a sage grouse lek will require motorized equipment to have noise abatement devices to preclude excessive noise during the sage grouse strutting period.

27. The cutting of rare, unique or unusual trees will not be permitted.

28. Consultation with the U.S. Fish and Wildlife Service is required per section 7 of the Endangered Species Act prior to approval of an APD or other lease operations if any proposed listed or listed threatened or endangered species or its critical habitat is likely to be affected by project activities. If there is deemed to be any adverse impact, the proposal will be modified or the request denied.

29. Fences shall be flagged with bright colored flagging at least every rod for visibility to wild horses. All fences should be constructed using green steel posts with white or silver tops to increase visibility. Fences should also avoid obvious horse migration routes (deep trails, stud piles) if at all possible.

30. No access roads, drill pads, mud pits or storage facilities will be allowed within 500 feet of cave entrances, drainage areas and subsurface passages. No waste material or chemicals will be placed, or disposed of, in sinkholes or gates during specified time frames by cave entrances. If during construction activities any sinkholes or cave openings are discovered, construction activities will cease and the AO will be notified.

31. The discharge of dredged or fill material into surface waters such as navigable and interstate waters and their tributaries, wetlands adjacent to those waters and all impoundments of those waters may require an individual permit or notification under Section 404 of the Clean Water Act (CWA) issued by the District Engineer (DE) of the Corps of Engineers (COE). Criteria applied under Section 404 are established in regulation and will be used to determine the type of permit or notification required.

Field Operation

1. Operations shall be done in a manner that prevents damage, interference, or disruption of water flows, and improvements associated with all springs, wells, or impoundments. It is the operator's responsibility to enact the precautions necessary to prevent damage, interference, or disruptions. Monitoring wells may be required at all sites where exploration or development will occur to assess long-term impacts to quantity and quality.

2. Companies controlling roads that provide access into crucial wildlife areas may be required to close the road with a lockable gate to prevent general use of the road during critical periods of the year when resource problems are experienced (during hunting seasons, winter, etc.). This restrictive measure will be applied where needed to protect wildlife resources or to minimize environmental degradation.

3. The use of closed road segments will be restricted to legitimate, authorized agents of the lessee and/or their subcontractor(s), the land managing agency, and other agencies with a legitimate need (NDOW, other law enforcement agencies, etc.).

4. Unauthorized use or failure to lock gates during specified time frames by the lessee or its subcontractors will be considered a violation of the terms of the APD or associated grants.

5. The operator shall regularly maintain all roads used for access to the lease operation. A maintenance plan may be required. A regular maintenance program may include, but not be limited to, upgrading of existing roads, blading, ditching, culvert and drainage installation, and graveling or capping of roadbed.

6. Management actions within riparian areas will be designed to maintain or, where possible, improve riparian habitat condition.

7. All power poles and potential raptor perches within a 2-mile radius of a potentially active sage grouse lek will include anti-perching devices, placed underground, or otherwise designed to eliminate use by raptors.

8. Noxious weeds that may be introduced due to soil disturbance and reclamation will be treated by methods to be approved by the AO. These methods may include biological, mechanical, or chemical. Should chemical methods be approved, the lessee must submit a Pesticide Use Proposal to the AO 60 days prior to the planned application date.

Reclamation and Abandonment

1. A water well may be accepted by the Carson City Field Office upon completion of operations. Please submit the following information to the Office:

- Water Analysis
- Type of inside diameter of casing used in well
- Total depth of well
- Depth of concrete seal
- Depth of static water level
- Water bearing formation or description of aquifer

2. The operator or contractor will contact the AO 48 hours prior to reclamation work.

3. Restoration work may not begin on the well site until the reserve pits are completely dry.

4. Disturbed areas will be recontoured to blend as nearly as possible with the natural topography prior to revegetation. This includes removing all berms and refilling all cuts. Compacted portions of the pad will be ripped to a depth of 12 inches unless in solid rock.

5. Site preparation for reclamation may include contour furrowing, terracing, reduction of steep cut and fill slopes, and the installation of water bars, etc.

6. All portions of the access roads not needed for other uses as determined by the AO will be reclaimed.

7. The stockpiled topsoil will be spread evenly over the disturbed area.

8. The operator will be required to construct water bars and re-open drainages on abandoned access roads and pipeline routes to minimize erosion as required. Water bars will be spaced appropriately dependent upon topography and slope. Pipeline routes shall be water-barred perpendicular to the fall line of the slope.

9. The area is considered to be satisfactorily reclaimed when all disturbed areas have been recontoured to blend with the natural topography, erosion stabilized and an acceptable vegetative cover has been established. The Nevada Guidelines for Successful Revegetation for the Nevada Division of Environmental Protection, the Bureau of Land Management and the US Forest Service will be used to determine if revegetation is successful.

10. Rehabilitation shall be planned on the sites of both producing and abandoned wells. The entire site or portion thereof, not required for the continued operation of the well, should be restored as nearly as practical to its original condition. Final grading

of back-filled and cut slopes will be done to prevent erosion and encourage establishment of vegetation.

11. Petroleum products such as gasoline, diesel fuel, helicopter fuel, crankcase oil, lubricants, and cleaning solvents used to fuel, lubricate, and clean vehicles and equipment will be containerized in approved containers.

12. Hazardous material shall be properly stored in separate containers to prevent mixing, drainage, or accidents. Hazardous materials shall not be drained onto the ground or into streams or drainage areas.

13. Totally enclosed containment shall be provided for all solid construction waste including trash, garbage, petroleum products, and related litter will be removed to an authorized sanitary landfill approved for the disposal of these classes of waste.

14. All construction, operation, and maintenance activities shall comply with all applicable Federal, State, and local laws and regulations regarding the use of hazardous substances and the protection of air and water quality.

15. In construction areas where recontouring is not required, vegetation will be left in place wherever possible and the original contour will be maintained to avoid excessive root damage and allow for resprouting.

16. Watering facilities (e.g. – tanks, developed springs, water lines, wells, etc.) will be repaired or replaced if they are damaged or destroyed by construction activities to its predisturbed condition as required by the AO.

17. When sites are abandoned, they will be inventoried for the presence of noxious weeds and treated if noxious weeds are present.

18. Seed and mulch used to reclaim disturbed areas must be weed free. Mulching of the seedbed following seeding may be required under certain conditions (i.e. – expected severe erosion), as determined by the AO.

19. Seed will be broadcast between October 1 and March 15 using a site-specific seed mixture and depth of planting as determined by the AO. Seed may be applied with a rangeland drill at half the rate of broadcast seeding. All seeding application rates will be in pounds of pure live seed per acre. Seed should be adapted varieties.

APPENDIX C
GEOTHERMAL LEASE STIPULATIONS

The following lease stipulations have been developed as mitigating measures for geothermal leasing and other reasonably foreseeable development activities with regard to geothermal exploration and development within the Carson City Field Office.

C.1 BUREAU OF RECLAMATION STIPULATION

The Lessor reserves the ownership of brines and condensates and the right to receive or take possession of all or any part thereof following the extraction or utilization by Lessee of the heat energy and byproducts other than demineralized water associated therewith subject to such rules and regulations as shall be prescribed by the Secretary of the Interior. If the Lessor elects to take the brines and condensates, the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering system after separation of the steam and brine products or from the disposal system as specified by the Lessor for the extraction of said brines and condensates by such means as the Lessor may provide and without cost to the Lessee. There is not obligation on the part of the Lessor to exercise its reserved rights. The Lessor shall not be liable in any manner if those rights are not exercised, and, in that event, the Lessee shall dispose of the brines and condensates in accordance with applicable laws, rules and regulations.

The Lessor reserves the right to conduct on the leased lands, testing and evaluation of geothermal resources which the Lessor determines are required for its desalinization research programs for utilization of geothermal fluids. These programs may include shallow temperature gradient hole underground exploration, if they are conducted in a manner compatible with lease operations and the production by Lessee of geothermal steam and associated geothermal resources. Lessor reserves the right to erect, maintain, and operate any and all facilities, pipelines, transmission lines, access roads, and appurtenances necessary for desalinization on the leased premises. Any desalting plants, piping, wells, or other equipment installed by the Lessor on the leased premises shall remain the property of the Lessor; and the Lessee shall conduct his operations in a

manner compatible with the operation and maintenance of any desalting plants, piping, wells, or other equipment installed by the Lessor. Any brines and condensates removed by the Lessor shall be replaced without cost to the Lessee with fluids as compatible with reservoir fluids as the brines or condensates that the Lessor removed and where the Lessor and Lessee determine that they are needed by the Lessee for his operation or for reinjection into the geothermal anomalies.

The Lessor and the Lessee, if authorized by law, may enter into cooperative agreements for joint development and production of geothermal resources from the leased premises consistent with applicable laws and regulations.

Any geophysical, geological, geochemical, and reservoir hydraulic data collected by either the Bureau of Reclamation or the Lessee will be made available upon request to the other party, and the data furnished to Reclamation by the Lessee shall be considered confidential so long as the following conditions prevail:

a. Until the Lessee notifies Reclamation that there is no requirement to retain the submitted data in confidential status or until Lessee relinquishes all interest in the leased area from where the information was obtained.

b. Reclamation shall not incorporate data received from the Lessee in its publications or reports during the period that confidential data are being retained without written authorization from the Lessee.

c. Information obtained by Reclamation, and upon request submitted to the Lessee, shall not be used in publications or reports issued by Lessee without written consent of Reclamation until the data have been published or otherwise given distribution by Reclamation.

The United States reserves the right to flood, seep and overflow the lands, permanently or intermittently, in connection with the operation or maintenance of the Newlands Project.

The Lessee will not interfere with the operation and maintenance of the Newlands Project. Prior to use of operation or maintenance roads within the Newlands Project, the Lessee will notify the AO in order to be appraised of areas that should be avoided to prevent interference with the operation and maintenance of the project. Reclamation will review all road or bridge crossing, piping or closure of any Newlands Project feature, and review NEPA and Cultural clearances on an individual basis.

There is also reserved to the United States, the right of its officers, agents, employees, licensees and permittees, at all proper times and places freely to have ingress to, passage over, and egress from all of said lands for the purpose of exercising, and protecting the rights reserved herein.

The Lessee further agrees that the United States, its officers, agents and employees and its successors and assigns shall not be held liable for any damage to the Lessee's improvements or works by reason of the exercise of the rights here reserved; nor shall anything contained in this paragraph be construed as in any manner limiting other reservations in favor of the Unites States contained in this lease.

The lands subject to this stipulation include all or part of the following lease sections:

Salt Wells Lease Area

- T. 17 N., R. 30 E., sections 05, 06, 07 and 08;
- T. 17N., R. 29 E., sections 01 and 02;
- T. 18 N., R. 29 E. section 35;
- T. 18 N., R. 30 E., sections 05 and 06;
- T. 19 N., R. 30 E., sections 29, 31, 32, and 33.

Hazen Lease Area

- T. 19 N., R. 26 E., section 04;
- T. 20 N., R. 25 E., section 22;
- T. 20 N., R. 26 E., sections 30 and 32.

C.2 US FOREST SERVICE STIPULATION

For leases within Forest Service lands, the lessee/operator must comply with all the rules and regulations of the Secretary of Agriculture set forth in Title 36, Chapter II of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of Interior in the lease/permit. The secretary of Agriculture's rules and regulations must be complied with for:

1. all use and occupancy of the NFS lands prior to approval of an exploration plan by the Secretary of Interior;
2. uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of Interior; and
3. use and occupancy of the NFS lands not authorized by an exploration plan approved by the Secretary of Interior.

As a condition to the consent to the issuance of this lease, the Forest Service reserves the right to either consent to the approval of the surface use plan or the joint approval with the BLM of any surface operations conducted under the term of the lease.

On lands administered by the Forest Service, no occupancy or other surface disturbance will be allowed on slopes in excess of 40 percent.

On lands administered by the USFS, no drilling will be allowed within 200 feet of historic sites.

Surveys for USFS sensitive species will be conducted prior to initiating any ground disturbing activities.

The Forest Service will be consulted with regarding the location of Sage Grouse strutting grounds (leks), and breeding, nesting, and brooding habitats. The distances and times that these areas will be avoided will be determined by the Forest Service.

The lands subject to this stipulation include all or part of the following lease sections:

South Aurora Lease Area

- T. 5 N., R. 28 E., sections 02, 03, 04, 05, 09, 10, 11, 15, and 16;
- T. 6 N., R. 28 E., sections 13, 14, 22, 23, 24, 26, 27, and 28; and
- T. 7 N., R. 27 E. sections 30, 31, 32, and 33.

C.3 MATERIAL SITE STIPULATION

The Lessee accepts this lease subject to the right of the State of Nevada to remove material from the land embraced in Material Sites and agrees that operations performed by the lessee will not interfere with operations of the State of Nevada, Department of Transportation.

The lands subject to this stipulation are described as all potential lease sections.

C.4 CONTINGENCY RIGHTS STIPULATION

BLM has reviewed existing information and planning resources documents and, except as noted in other attached stipulations, knows of no reason why normal development, subject to the controls of applicable laws and regulations and the lease terms and conditions, can not proceed on the leased lands. However, specific development activities could not be identified prior to lease issuance since the nature and extent of geothermal resources were not known and specific operations have not been proposed. The lessee is hereby made aware that consistent with 43 CFR 3200.4, all post lease operations will be subject to appropriate environmental review and may be limited or

denied only if unmitigable and significant impacts on other land uses or resources would result.

The lands subject to this stipulation are described as all potential lease sections.

C.5 SPECIAL STIPULATIONS FOR ALL LEASES IN CARSON CITY FIELD OFFICE MANAGEMENT AREA

The following mitigating measures are to be included as special stipulations on all geothermal leases issued in the Carson City Field Office Management area. The lessee shall comply with the following special conditions and stipulations unless they are modified by mutual agreement of the Lessee and the Authorized Officer (AO):

1. No surface occupancy or disturbance will be allowed within 650 feet (horizontal measurement) of any surface water bodies, riparian areas, wetlands, playas, or 100-year floodplains to protect the integrity of these resources (as delineated by the presence of riparian vegetation and not actual water). Other buffer zones and areas of restricted surface occupancy may be required to protect other resource values, including but not limited to, critical or rare or endangered species habitat.

2. Endangered Species Act Section 7 Consultation: The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modifications of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act, 16 USC § 1531 *et seq.*, as amended, including completion of any required procedure for conference or consultation.

3. BLM IM 2005-003: This lease may be found to contain historic properties or resources protected under the National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, EO 13007, or other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require exploration or development proposals to be modified to protect such properties, or it may disapprove any activity that is likely to result in adverse effects that could not be successfully avoided, minimized, or mitigated.

4. To secure specific compliance with the stipulations under Section 6, paragraph (2) of the geothermal resources lease form, the lessee shall, prior to operations, furnish to the AO a certified statement that either no archaeological values exist or that they may exist on the leased lands to be disturbed or occupied, to the best of the lessee's knowledge and belief, and that they might be impaired by geothermal resource operations. Such a certified statement must be completed in compliance with the BLM Nevada State Protocol by an archaeologist permitted by BLM for the Carson City Field Office.

   If the lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the lessee will engage a qualified archaeologist, acceptable to the AO, to survey and salvage, in compliance with the BLM Nevada State Protocol, in advance of any operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey and salvage will be borne by the lessee, and such salvaged property shall remain the property of the Lessor or the surface owner.

5. Surface occupancy and use is subject to all valid existing surface rights.

   The lands subject to this stipulation are described as all potential lease sections.

6. Special Stipulation for Water Resources: As exploration and development activities begin, the lessee will institute and pay for a hydrologic monitoring program, which will be site specific and its intensity will be commensurate with the level of exploration. For example, if the proponent were to conduct seismic studies, the monitoring would be limited to identifying water resources to be monitored as activities continue; if a drilling program were to be undertaken, the number of aquifers encountered, their properties, their quality, and their saturated thickness would be documented. The information collected would be submitted to the BLM and would be used to support future NEPA documentation as development progresses. Adverse impacts on surface expressions of the geothermal reservoir (hot springs), and threatened and endangered species habitat are not acceptable. The lessee will monitor the quality, quantity, and temperature of any hot springs or other water resource within the project area when conducting activities that could affect those resources. If adverse impacts do occur, the BLM will require the lessee to take corrective action to mitigate the impact. Corrective action may include shutting down the operation. These are lease stipulations, not operational, and the information gathered under the monitoring stipulation will be used to identify future impacts at the operational stage.

7. Special Stipulation for Native American Consultation: All proposed exploration and development is subject to the requirement for Native American consultation before the BLM will authorize the activity. Depending on the nature of the proposed lease development and the resource of concern, the time to complete

Native American consultation and to conduct any mitigation measures may extend the time for authorization. It may also change the ways in which developments are implemented. New lease applications would require Native American consultation.

C.6 SPECIAL STIPULATIONS FOR SPECIFIC LEASES IN CARSON CITY FIELD OFFICE MANAGEMENT AREA

The following mitigating measures are to be included as special stipulations on geothermal leases issued for specific areas in the Carson City Field Office Management area. The lessee shall comply with the following special conditions and stipulations unless they are modified by mutual agreement of the Lessee and the Authorized Officer (AO):

No surface occupancy or use will be permitted on lands under lease pursuant to the Recreation and Public Purposes Act of 1926, as amended.

The lands subject to this stipulation are described as:

Steamboat Lease Area

- T. 17 N., R. 19 E., section 12;
- T. 17 N., R. 20 E., section 08.

Wabuska Lease Area

- T. 15 N., R. 25 E., section 22.

Hawthorne Lease Area

- T. 8 N., R. 30 E. sections 31, and 32.

No surface occupancy will be permitted on public lands surrounding the City of Fallon landfill, which are designated for disposal in the Resource Management Plan, unless specifically approved by the AO of the Carson City Field Office.

The lands subject to this stipulation include all or portions of:

Lee Hot Springs Lease Area

- T. 16 N., R. 29 E., sections 20 and 21.

No surface occupancy will be permitted on public lands in which BLM retains mineral rights but surface rights are held by private entities, so called "split-estate" lands.

The lands subject to this stipulation include all or portions of:

- T. 17 N., R. 20 E., section 8, E2, SENW, NESW, S2SW.

Surface occupancy or use will be coordinated with the Nevada Division of Wildlife for all lease activities within the Fernley State Wildlife Management Area in order to minimize impacts on wildlife management and recreational uses.

The lands subject to this stipulation include all or part of the Hazen Lease Area.

Surface occupancy or use will be coordinated with the US Fish and Wildlife Service and Nevada Division of Wildlife for all leasing activities within 1 mile of the Stillwater National Wildlife Refuge or and Stillwater Wildlife Management Area to minimize impacts on wildlife management and recreational uses.

The lands subject to this stipulation include all or part of the Salt Wells Lease Area.

Surface use on Navy-withdrawn lands will be limited to a maximum height of 50 feet for all activities. All lease activities will be coordinated with US Navy, NAS Fallon.

The lands subject to this stipulation include all or part of:

Salt Wells Lease Area

- T. 18 N., R. 30 E., sections 19 and 30.

Lee Hot Springs Lease Area

- T. 15 N., R. 29 E., sections 4, 9, 16, and 21.

No surface occupancy will be permitted on public lands that have high resource value.

The lands subject to this stipulation include all or part of:

Lee Hot Springs Lease Area

- T. 16 N., R. 29 E., Sections 19, 20, 27, 28, 33, 34.

Salt Wells Lease Area

- T. 18 N., R. 30 E., Sections 19 and 30.

APPENDIX D
AMBIENT AIR QUALITY STANDARDS

Table D-1
Ambient Air Quality Standards Applicable in Nevada

		Standards in Parts Per Million by Volume (ppm)		Standards in Micrograms Per Cubic Meter (µg/m^3)		Violation Criteria	
Pollutant	**Averaging Time**	**Nevada**	**National**	**Nevada**	**National**	**Nevada**	**National**
Ozone	1 hour (outside Lake Tahoe Basin)	0.12	0.12	235	235	If exceeded	If exceeded on more than 3 days in a 3-year period
	1 hour (in Lake Tahoe Basin)	0.10	0.12	195	235	If exceeded	If exceeded on more than 3 days in a 3-year period
	8 hours	Not applicable	0.08	Not applicable	157		If exceeded by the mean of annual 4th highest daily values for a 3-year period
Carbon monoxide	1 hour	35	35	40,000	40,000	If exceeded	If exceeded on more than 1 day per year
	8 hours (areas at or above 5,000 feet elevation)	6	9	6,670	10,000	If exceeded	If exceeded on more than 1 day per year
	8 hours (areas below 5,000 feet elevation)	9	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
Nitrogen dioxide	Annual average	0.05	0.053	100	100	If exceeded	If exceeded
Sulfur dioxide	Annual average	0.03	0.03	80	80	If exceeded	If exceeded
	24 hours	0.14	0.14	365	365	If exceeded	If exceeded on more than 1 day per year
	3 hours	0.5	0.5	1,300	1,300	If exceeded on more than 1 day per year	If exceeded on more than 1 day per year

Table D-1
Ambient Air Quality Standards Applicable in Nevada *(continued)*

		Standards in Parts Per Million by Volume (ppm)		Standards in Micrograms Per Cubic Meter (μg/m^3)		Violation Criteria	
Pollutant	**Averaging Time**	**Nevada**	**National**	**Nevada**	**National**	**Nevada**	**National**
Inhalable particulate matter (PM_{10})	Annual arithmetic mean	Not applicable	Not applicable	50	50	If exceeded	For 1997 nonattainment areas, if exceeded. For attainment areas, if exceeded as a 3-year single station average
	24 hours	Not applicable	Not applicable	150	150	If exceeded	For 1997 nonattainment areas, if exceeded on more than 1 day per year. For attainment areas, if exceeded by the mean of annual 99th percentile values over 3 years
Fine particulate matter ($PM_{2.5}$)	Annual arithmetic mean	Not applicable	Not applicable	Not applicable	15.0		If exceeded as a 3-year spatial average of data from designated stations
	24 Hours	Not applicable	Not applicable	Not applicable	65		If exceeded by the mean of annual 98th percentile values over 3 years
Lead particles (TSP sampler)	Calendar quarter	Not applicable	Not applicable	1.5	1.5	If exceeded	If exceeded
Hydrogen sulfide	1 hour	0.08	Not applicable	112	Not applicable	If exceeded	

Notes:

All standards, except the national PM_{10} and $PM_{2.5}$ standards, are based on measurements corrected to 25 degrees C and 1 atmosphere pressure.

The national PM_{10} and $PM_{2.5}$ standards are based on direct flow volume data without correction to standard temperature and pressure.

The national 1-hour ozone standard will be rescinded for an area when EPA determines that the standard has been achieved for the area. The applicable national ozone standard for the area will then be the 8-hour standard.

The "10" in PM_{10} and the "2.5" in $PM_{2.5}$ are not particle size limits; these numbers identify the particle size class (aerodynamic diameter in microns) collected with 50% mass efficiency by certified sampling equipment. The maximum particle size collected by PM_{10} samplers is about 50 microns. The maximum particle size collected by $PM_{2.5}$ samplers is about 6 microns.

The Nevada standard for hydrogen sulfide represents an increment above naturally occurring background concentrations.

Sources: 40 CFR Parts 50, 53, and 58; Nevada Administrative Code, Section 445B.22097

APPENDIX E
FISH AND WILDLIFE AND SENSITIVE SPECIES LISTS

Table E-1
Fish and Wildlife Species that May Occur in the Planning Area

	Forests & Woodlands	Range-lands	Riparian & Wetlands		Forests & Woodlands	Range-lands	Riparian & Wetlands
Birds			R-m	Ring-necked Duck			C-w,m
Common Loon							
Horned Grebe			U-m	Canvasback			A-r*
Eared Grebe			C-s,m*	Greater Scaup			C-m
Western Grebe			R-s,m	Lesser Scaup			C-r*
Pied-billed Grebe			C-s,m U-w*	Common Goldeneye			R-m
American White Pelican			C-s,m*	Barrow's Goldeneye			R-m
Double-crested Cormorant			C-s,m*	Bufflehead			C-w,m
Great Blue Heron			C-r*	Oldsquaw			Ac-m
Cattle Egret			Ac	Black Scoter			Ac-m
Great Egret			R-s,m	White-winged Scoter			Ac-m
Snowy Egret			C-s,m*	Ruddy Duck			C-r*
Least Bittern			U-s,m	Hooded Merganser			U-w,m
White-faced Ibis			C-s,m*	Common Merganser			C-r*
American Bittern			C-r*	Red-breasted Merganser			C-w,m
Tundra Swan			C-w	Turkey Vulture	C-s,m*	C-s,m*	
Canada Goose			C-r*	Northern Goshawk	U-r*		
Snow Goose			Cas-w,m	Sharp-shinned Hawk	U-s,m*	U-s,m*	
White-fronted Goose			Cas-w	Cooper's Hawk	C-s,m*	C-s,m*	
Ross' Goose			Ac-w	Red-tailed Hawk	C-r*	C-r*	
Mallard			C-r*	Swainson's Hawk	U-s,m*	U-s,m*	
Northern Pintail			C-r*	Rough-legged Hawk		C-w	
Gadwall			A-s,m*	Ferruginous Hawk		C-s,m*	
Green-winged Teal			C-w,m*	Golden Eagle	C-r*	C-r*	

Table E-1
Fish and Wildlife Species that May Occur in the Planning Area

	Forests & Woodlands	Range-lands	Riparian & Wetlands		Forests & Woodlands	Range-lands	Riparian & Wetlands
Birds (Continued)							
Blue-winged Teal			U-s,m*	Bald Eagle	U-w	U-w	U-w,s*
Cinnamon Teal			A-s U-w*	Northern Harrier			C-r*
American Wigeon			C-r	Osprey			R-m
Northern Shoveler			C-r	Prairie Falcon		U-r*	
Wood Duck			Cas-m	Peregrine Falcon		Cas-m	Cas-m
Redhead			A-s, U-w*	Merlin	R-m	R-m	
American Kestrel	C-s,m*	C-s,m*	C-s,m*	Black-necked Stilt			C-s,m*
Blue Grouse	C-r*			Wilson's Phalarope			U-s,m*
Sage Grouse		C-r*		Northern Phalarope			Cas-m
California Quail	C-r*	C-r*	C-r*	California Gull			C-s,m*
Gambel's Quail		C-r*		Ring-billed Gull			C-s,m*
Scaled Quail		C-r*		Franklin's Gull			Cas-s,m
Ring-necked Pheasant		R-r*	R-r*	Bonaparte's Gull			R-m
Chukar		U-r*		Forster's Tern			C-s,m*
Greater Sandhill Crane			A-m	Caspian Tern			Cas-s,m
Virginia Rail			U-s,m	Black Tern			C-s,m*
Sora			U-s,m*	Band-tailed Pigeon	Ac-m		
Yellow Rail			Ac	Rock Dove	A-r*	A-r*	
Common Gallinule			Ac-s	White-winged Dove		Ac-s	
American Coot			C-r*	Mourning Dove	C-s,m*	C-s,m*	C-s,m*
Semipalmated Plover			Ac-m	Common Ground-dove		Ac-s	
Killdeer		C-r*	C-r*	Yellow-billed Cuckoo			Ac-s
Black-bellied Plover			R-s	Greater Roadrunner		Cas-r	
Common Snipe			C-r*	Common Barn Owl	U-s*	C-s*	
Long-billed Curlew			C-s,m*	Flammulated Owl	Ac-m		
Spotted Sandpiper			C-m	Great Horned Owl	C-r*	C-r*	C-r*
Solitary Sandpiper			C-m	Northern Pygmy Owl	U-r*		
Willet			C-s,m*	Burrowing Owl		U-s,m*	
Greater Yellowlegs			Cas-m	Long-eared Owl		R-s,m*	
Lesser Yellowlegs			C-s,m	Short-eared Owl		C-r*	C-r*
Long-billed Dowitcher			C-s,m*	Poorwill	C-s,m*	C-s,m*	
Short-billed Dowitcher			R-m	Common Nighthawk	C-s,m*	C-s,m*	
Semipalmated Sandpiper			C-s,m	Lesser Nighthawk		C-s	
Western Sandpiper			C-m	White-throated Swift	U-m	U-m	
Marbled Godwit			U-m	Costa's Hummingbird	U-m		
American Avocet			C-s,m*	Broad-tailed Hummingbird	C-s,m*	C-s,m*	C-s,m*
Rufous Hummingbird	U-m	U-m	U-m	Scrub Jay	C-r*	C-r*	C-r*
Calliope Hummingbird	U-s,m*	U-s,m*	U-s,m*	Black-billed Magpie	C-r*	C-r*	C-r*
Belted Kingfisher			U-r*	Common Raven	C-r*	C-r*	C-r*
Northern Flicker	C-r*	C-r*	C-r*	American Crow		R-m	R-m
Lewis' Woodpecker	U-s,m*		U-s,m*	Pinyon Jay	C-r*		

Table E-1
Fish and Wildlife Species that May Occur in the Planning Area

	Forests & Woodlands	Range-lands	Riparian & Wetlands		Forests & Woodlands	Range-lands	Riparian & Wetlands
Birds (Continued)							
Yellow-bellied Sapsucker	Cas-s,m			Clark's Nutcracker	C-r*		
Hairy Woodpecker	C-s,m*			Black-capped Chickadee	U-r*		
Downy Woodpecker	U-s,m*			Mountain Chickadee	U-r*		
Three-toed Woodpecker	U-r*			Plain Titmouse	U-r*	U-r*	
Eastern Kingbird	Cas-m	Cas-m		Bushtit	C-r*	C-r*	
Western Kingbird	C-s,m*	C-s,m*	C-s,m*	White-breasted Nuthatch	C-r*		
Ash-throated Flycatcher	U-s,m*		U-s,m*	Red-breasted Nuthatch	C-r*		
Black Phoebe	U-s		U-s	Pygmy Nuthatch	C-r*		
Say's Phoebe	C-s,m*		C-s,m*	American Dipper			U-r*
Willow Flycatcher	C-s		C-s	House Wren		C-s,m*	C-s,m*
Hammond's Flycatcher			U-m	Bewick's Wren		C-s,m*	
Dusky Flycatcher			C-s,m	Marsh Wren			A-r*
Gray Flycatcher	U-s,m	U-s,m	U-s,m	Canyon Wren		U-s,m*	
Western Flycatcher	U-s,m	U-s,m	U-s,m	Rock Wren		C-s,m*	
Western Wood Peewee	U-s,m*	U-s,m*	U-s,m*	Northern Mockingbird		C-r*	C-r*
Olive-sided Flycatcher	U-s,m*		U-s,m*	Gray Catbird		Cas-m	
Vermillion Flycatcher			Ac-m	Bendire's Thrasher		Ac-s	
Horned Lark		A-r*		Sage Thrasher		C-s,m*	
Violet-green Swallow	C-s,m*	C-s,m*	C-s,m*	American Robin	C-r*	C-r*	C-r*
Tree Swallow	C-s,m*		C-s,m*	Hermit Thrush	U-s,m*		U-s,m*
Bank Swallow			C-s,m*	Swainson's Thrush	U-s,m*	U-s,m*	
Rough-winged Swallow	C-s,m*	C-s,m*	C-s,m*	Mountain Bluebird	C-r*	C-r*	
Barn Swallow	C-s,m*	C-s,m*	C-s,m*	Western Bluebird		U-s,m	
Cliff Swallow	C-s,m*	C-s,m*	C-s,m*	Townsend's Solitaire	U-r*	U-r*	
Steller's Jay	C-r*			Blue-gray Gnatcatcher	U-s,m*	U-s,m*	
Golden-crowned Kinglet	U-s,m*			Yellow-headed Blackbird			A-s,m*
Ruby-crowned Kinglet	U-s,m*			Red-winged Blackbird			A-s,m*
American Pipit			U-m	Northern Oriole	C-s,m*		C-s,m*
Bohemian Waxwing	U-m	U-m		Scott's Oriole			Cas-s
Cedar Waxwing	U-m*	U-m*		Brewer's Blackbird		A-s,m*	A-s,m*
Phainopepla		R-s	R-s	Brown-headed Cowbird		A-s,m*	A-s,m*
Northern Shrike		Cas-w		Western Tanager	U-s,m*	U-s,m*	U-s,m*
Loggerhead Shrike		C-r*		Rose-breasted Grosbeak	Ac-m		
European Starling	C-r*	C-r*	C-r*	Black-headed Grosbeak	C-s,m*		C-s,m*
Gray Vireo		Ac-m		Blue Grosbeak	Cas-m		
Solitary Vireo		U-s,m*	U-s,m*	Indigo Bunting	R-m		
Red-eyed Vireo			R-s	Lazuli Bunting	C-s,m*		C-s,m*
Warbling Vireo			U-s,m*	Evening Grosbeak	C-s,m*		C-s,m*
Orange-crowned Warbler	U-s,m*		U-s,m*	Purple Finch	Ac-m		
Virginia's Warbler	U-s,m*		U-s,m*	Cassin's Finch	U-s,m		

Table E-1
Fish and Wildlife Species that May Occur in the Planning Area

	Forests & Woodlands	Range-lands	Riparian & Wetlands
Birds (Continued)			
Yellow Warbler			C-s,m*
Yellow-rumped Warbler	C-s,m*		
Black-throat. Gray Warbler	U-s,m*	U-s,m*	
Townsend's Warbler			R-m
Hermit Warbler			U-m
Blackpoll Warbler			Ac-m
Northern Waterthrush			R-m
MacGillivray's Warbler			U-s,m*
Common Yellowthroat			U-s,m*
Yellow-breasted Chat			C-s
Wilson's Warbler	C-s,m*		C-s,m*
American Redstart			Cas-m
House Sparrow		A-r*	A-r*
Bobolink		Cas-m	
Western Meadowlark		C-r*	C-r*
Lark Sparrow		C-m	
Black-throated Sparrow	C-s,m*	C-s,m*	
Dark-eyed Junco	C-s,m*		
Tree Sparrow	Cas-w		
Chipping Sparrow	A-s,m*	A-s,m*	
Harris' Sparrow		Ac-m	
White-crowned Sparrow	C-r*	C-r*	
Golden-crowned Sparrow	R-m		
Fox Sparrow		C-s*	
Lincoln's Sparrow		U-m	
Song Sparrow	C-s,m*	C-s,m*	C-s,m*

	Forests & Woodlands	Range-lands	Riparian & Wetlands
House Finch		C-s,m*	C-s,m*
Rosy Finch	U-w		
Pine Siskin	A-m		
American Goldfinch	C-s,m*	C-s,m*	
Lesser Goldfinch		C-s,m*	C-s,m*
Red Crossbill	C-s,m*		
Green-tailed Towhee	C-s,m*	C-s,m*	
Rufous-sided Towhee		C-s,m*	C-s,m*
Brown Towhee		U-s	
Abert's Towhee		Ac-s	
Lark Bunting		R-w	
Savannah Sparrow		C-s,m*	
Grasshopper Sparrow		U-s,m*	
Vesper Sparrow		U-s,m*	
Brewer's Sparrow		C-s,m*	
Mammals			
Broad-footed mole			
Dwarf shrew			Ur*
Dusky shrew			Ur*
Merriam's shrew	Ur*	Ur*	
Trowbridge's shrew	Ur*		
Vagrant shrew			Cr*
Northern water shrew	Cr*		Cr*
Little brown bat	C		
Long-eared myotis	U-m,s*		
Yuma myotis	C-m,s*		
Western small-footed myotis		C-M,s*	
Fringed myotis	C-m,s*		
Pallid bat		C-m,s*	
California myotis	U-m,s*	U-m,s*	
Long-legged myotis	U-m,s*	U-m,s*	
Spotted bat	R-?	R-?	
Western Pipistrelle		C-m,s*	
Silver-haired bat	U-m,s*		
Hoary bat	C-m,s*		C-m,s*
Townsend's big-eared bat	R-m,s*	R-m,s*	R-m,s*
Big brown bat		C-m,s*	
Brazilian free-tailed bat		C-?	
Big free-tailed bat	R-?	R-?	

Table E-1
Fish and Wildlife Species that May Occur in the Planning Area

	Forests & Woodlands	Range-lands	Riparian & Wetlands		Forests & Woodlands	Range-lands	Riparian & Wetlands
Mammals (Continued)							
Nuttall's cottontail	U-r*			Red bat	U-?		
Yellow-bellied marmot	C-r*	C-r*		Pika	C-r*		
Townsend's ground squirrel		C-r*		White-tailed jackrabbit		U-r*	
Belding's ground squirrel	C-r*	U-r*		Black-tailed jackrabbit		C-r*	
Calif. Ground squirrel		C-r*		Snowshoe hare	R-r*		
Antelope squirrel		C-r*		Pygmy rabbit		R-?	
Gold.-mant.ground squirrel	C-r*	U-r*		Desert cottontail		C-r*	
Least chipmunk	C-r*	C-r*		Canyon mouse		C-r*	
Panamint chipmunk	U-r*			Deer mouse	C-r*	C-r*	
Yellow-pine chipmunk	C-r*			Brush mouse		?	
Townsend's chipmunk	C-r*			Pinyon mouse	C-r*		
Long-eared chipmunk	C-r*			Desert woodrat		C-r*	
Lodgepole chipmunk	C-r*			Bushy-tailed woodrat	C-r*	C-r*	
Uinta chipmunk	U-r*			Heather vole	R-?		
Douglas' squirrel	C-r*			Mountain vole	C-r*		C-r*
Western gray squirrel	U-r*			Long-tailed vole			C-r*
Northern flying squirrel	R-?			Sagebrush vole		C-r*	
Little pocket mouse		C-r*		Black rat			U-r*
Great Basin pocket mouse	C-r*	C-r*		House mouse		U-r*	C-r*
Dark kangaroo mouse		U-r*		Western jumping mouse			U-r*
Pale kangaroo mouse		U-r*		Mountain beaver	U-r*		
Desert kangaroo rat		U-r*		Muskrat			C-r*
Merriam's kangaroo rat		C-r*		Porcupine	C-r*	C-r*	
Ord's kangaroo rat		U-r*		Beaver			C-r*
Northern pocket gopher		C-r*	C-r*	Black bear	C-r*		
Botta's pocket gopher		C-r*		Raccoon	C-r*		C-r*
Townsend's pocket gopher			C-r*	Ringtail	U-r*	U-r*	
Mountain pocket gopher	C-r*			Ermine	U-r*		
Northern grasshopper mouse		U-r*		Long-tailed weasel	C-r*	C-r*	C-r*
Western harvest mouse		C-r*		Mink			U-r*
Kit fox		R-r*		Stripped skunk		U-r*	C-r*
Coyote	C-r*	C-r*	C-r*	Spotted skunk		U-r*	
Mountain lion	U-r*	U-r*		Badger	C-r*	C-r*	
Bobcat	U-r*	U-r*		River otter			R-r*
Mule deer	C-r*	C-r*	C-r*	Marten	U-r*		
Pronghorn		U-r*		Red fox	U-r*		
Desert bighorn		R-r*		Gray fox	U-r*	C-r*	
California bighorn	R-r*	R-r*					

Table E-1
Fish and Wildlife Species that May Occur in the Planning Area

	Forests & Woodlands	Range-lands	Riparian & Wetlands		Forests & Woodlands	Range-lands	Riparian & Wetlands
Reptiles and Amphibians							
Southern Long-toed salamander	U-r*			California toad	U-r*		U-r*
Sierra Nevada salamander	C-r*			Pacific treefrog	C-r*		C-r*
Great Basin spadefoot	C-r*	C-r*		Red-legged frog			U-r*
Boreal toad	C-r*		C-r*	Bullfrog			C-r*
Mojave Desert sidewinder		U-r*		Spotted frog			R-r*
North. Pacific rattlesnake	U-r*			Mt. Yellow-legged frog	R-r*		R-r*
Great Basin rattlesnake		U-r*		Northwestern pond turtle			U-r*
Panamint rattlesnake		U-r*		Desert banded gecko		R-r*	
Great Basin gopher snake				Western chuckwalla		R-r*	
California kingsnake	C-r*	C-r*	C-r*	Long-nosed leopard lizard		C-r*	
Western long-nosed snake		C-r*		Collared lizard		C-r*	
Valley garter snake			C-r*	Zebra-tailed lizard		C-r*	
Mountain garter snake	C-r*		C-r*	Northern side-botched lizard		C-r*	
Sierra garter snake	C-r*		C-r*	Northern sagebrush lizard	C-r*	C-r*	
Wandering garter snake			C-r*	Great Basin fence lizard		C-r*	
Ground snake		U-r*		Desert spiny lizard	C-r*	C-r*	
Desert night snake		U-r*		Desert horned lizard		C-r*	
Western leaf-nosed snake		R-r*		Western skink	C-r*	C-r*	
Nevada shovel-nosed snake		U-r*		Great Basin whiptail		C-r*	
Utah black-headed snake		U-r*		Sierra alligator lizard	U-r*		
California lyre snake		R-r*		Rocky Mt. Rubber boa	C-r*	U-r*	C-r*
				Western yellow-bellied racer			C-r*
				Red racer		U-r*	
				Desert striped whipsnake	U-r*	U-r*	U-r*
				Mohave patch-nosed snake		C-r*	

Table E-1
Fish and Wildlife Species that May Occur in the Planning Area

	Forests & Woodlands	Range-lands	Riparian & Wetlands		Forests & Woodlands	Range-lands	Riparian & Wetlands
Fishes			R-r*	Black crappie			C-r*
Mosquito fish							
White bass			R-r*	Sacramento perch			R-r*
Largemouth bass			C-r*	Green sunfish			C-r*
White crappie			C-r*				
Bluegill			U-r*				
Piute sculpin			U-r*				
Threadfin shad			U-r*				
Kokanee salmon			U-r*				
Coho salmon			U-r*				
Rainbow trout			C-r*				
Lake trout			U-r*				
Cutthroat trout			C-r*				
Brook trout			C-r*				
Brown trout			C-r*				
Mountain whitefish			U-r*				
Railroad Valley springfish			R-r*				
Northern pike			U-r*				
Carp			C-r*				
Speckled dace			C-r*				
Lahontan tui chub			C-r*				
Redsided shiner			C-r*				
Cui ui			U-r*				
Tahoe sucker			C-r*				
Lahontan sucker			U-r*				
White catfish			U-r*				
Brown bullhead			C-r*				
Hiko White River springfish			R-r*				

Table Legend:

Vegetation Types: These are based on the information presented in Chapter 3 Vegetation Communities and additional species identification is included there.

Forests & Woodlands
- Pinyon-juniper and pure stands of either
-Subalpine Forests
-Sierra Nevada Forests

Rangelands
-Sagebrush
-Salt Desert Scrub
-Greasewood
-Creasote Bush
-Grasslands
-Bitterbrush
-Mountain Sagebrush
-Sagebrush/Perennial Grass
-Blackbrush
-Dry Meadows
-Mojave Mixed Scrub
-Mountain Shrub

Riparian & Wetlands

Relative Abundance and Season: the following legend indicates the relative abundance in the proper habitat in the proper season and season of use.

A = Abundant: Observed in large numbers on every visit.
C = Common: Observed in lesser numbers on more than 50 percent of visits.
U = Uncommon: Observed in lesser numbers on less than 50 percent of visits.
R = Rare: Either of very local distribution, or if of more general distribution, observed on less than 10 percent of visits.
Cas = Casual: Observed infrequently due to irregular occurrence.
Ac = Accidental: Observed once or twice, or birds that are out of their normal distribution.
r = Resident: Species is present in the area throughout the year, even though individuals may occur as migrants.
s = Summer visitant: June-August.
w = Winter visitant: December-February.
m = Migrant: March-Mat; September-November.
* = Breeds within planning area.
? = Status unknown.

Table E-2
Sensitive Species that May Occur in the Planning Area

Common Name	Scientific Name	Status			Occurrences Within the Planning Area by County
		Federal	State	BLM	
Sensitive Taxa					
Plants					
adobe parsley	*Lomatium roseanum*	-		c	9
alkali mariposa lily	*Calochortus striatus*	xC2		nc	6
alpine goldenhead	*Tonestus alpinus*	xC2		-	6
altered andesite buckwheat	*Eriogonum robustum*	-		n	8, 9
altered andesite popcornflower	*Plagiobothrys glomeratus*	-		n	8, 9
Ames milkvetch	*Astragalus pulsiferae* var. *pulsiferae*	-		c	9
Ash Meadows lady's tresses	*Spiranthes infernalis*	xC2		-	6
bashful beardtongue	*Penstemon pudicus*	xC2		n	6
Beatley milkvetch	*Astragalus beatleyae*	-		s	6
Beatley scorpionflower	*Phacelia beatleyae*	xC2		n	6
black woollypod	*Astragalus funereus*	xC2		nc	6
Blaine pincushion	*Sclerocactus blainei*	xC2	CY	n	6
Bodie Hills draba	*Cusickiella quadricostata*	xC2		nc	3, 4, 5
Bodie Hills rockcress	*Arabis bodiensis*	xC2		nc	5
Cane Spring suncup	*Camissonia megalantha*	xC2		n	6
Charleston grounddaisy	*Townsendia jonesii* var. *tumulosa*	xC2		n	6
Churchill Narrows buckwheat	*Eriogonum diatomaceum*	C	CE#	n	4
Clarke phacelia	*Phacelia filiae*	-		n	6
Clokey buckwheat	*Eriogonum heermannii* var. *clokeyi*	-		n	6
Clokey eggvetch	*Astragalus oophorus* var. *clokeyanus*	RA		s	6
Crosby buckwheat	*Eriogonum crosbyae*	RA		nc	9
Currant milkvetch	*Astragalus uncialis*	xC2		n	6
Currant Summit clover	*Trifolium andinum* var. *podocephalum*	xC2		n	6
dainty moonwort	*Botrychium crenulatum*	xC2		n	4, 5, 6
Death Valley beardtongue	*Penstemon fruticiformis* ssp. *amargosae*	xC2		nc	6
desert whitlowcress	*Draba arida*	xC2		-	6
Eastwood milkweed	*Asclepias eastwoodiana*	xC2		n	6
Goodrich biscuitroot	*Cymopterus goodrichii*	xC2		n	6, 7
grimy mousetails	*Ivesia rhypara* var. *rhypara*	RI		nc	9
halfring milkvetch	*Astragalus mohavensis* var. *hemigyrus*	xC2	CE	sc	6
hermit cactus	*Sclerocactus polyancistrus*	-	CY	-	5, 6
Holmgren lupine	*Lupinus holmgrenianus*	-		n	6
Kingston Mountains bedstraw	*Galium hilendiae* ssp. *kingstonense*	xC2		nc	6
Lahontan beardtongue	*Penstemon palmeri* var. *macranthus*	-		n	2, 6, 7
Lavin eggvetch	*Astragalus oophorus* var. *lavinii*	xC2		n	3, 4, 5
Lemmon milkvetch	*Astragalus lemmonii*	-		c	9
Maguire bitterroot	*Lewisia maguirei*	xC2		-	6
Masonic Mountain jewelflower	*Streptanthus oliganthus*	xC2		nc	4, 5
Mono County phacelia	*Phacelia monoensis*	xC2		nc	4, 5

Table E-2
Sensitive Species that May Occur in the Planning Area *(continued)*

Common Name	Scientific Name	Status			Occurrences Within the Planning Area by County
		Federal	State	BLM	
Nachlinger catchfly	*Silene nachlingerae*	xC2		n	6
Needle Mountains milkvetch	*Astragalus eurylobus*	xC2		n	6
Nevada dune beardtongue	*Penstemon arenarius*	xC2		n	2, 5, 6
Nevada primrose	*Primula cusickiana* var. *nevadensis*	xC2		-	6
obscure scorpionflower	*Phacelia inconspicua*	xC2	CE	s	7
Ophir rockcress	*Arabis ophira*	xC2		-	6
oryctes	*Oryctes nevadensis*	xC2		n	2, 5, 7, 8, 9
Owyhee prickly phlox	*Leptodactylon glabrum*	xC2		n	7
Pahrump Valley buckwheat	*Eriogonum bifurcatum*	xC2		nc	6
Pahute green gentian	*Frasera pahutensis*	xC2		-	6
Pahute Mesa beardtongue	*Penstemon pahutensis*	xC2		n	6
Parish phacelia	*Phacelia parishii*	xC2		nc	6
Pine Nut Mountains mousetails	*Ivesia pityocharis*	xC2		n	3
playa phacelia	*Phacelia inundata*	-		nc	9
prostrate buckwheat	*Eriogonum prociduum*	xC2		nc	9
Railroad Valley globemallow	*Sphaeralcea caespitosa* var. *williamsiae*	-		n	6
Rams Horn Spring milkvetch	*Astragalus pulsiferae* var. *coronensis*	xC2		c	9
rock purpusia	*Ivesia arizonica* var. *saxosa*	-		n	6
rock violet	*Viola lithion*	xC2		n	6
Rollins clover	*Trifolium rollinsii*	xC2		-	6
rosy twotone beardtongue	*Penstemon bicolor* ssp. *roseus*	xC2		n	6
rough dwarf greasebush	*Glossopetalon pungens* var. *pungens*	-		n	6
sand cholla	*Opuntia pulchella*	-	CY	-	2, 3, 4, 5, 6, 7, 8, 9
sanicle biscuitroot	*Cymopterus ripleyi* var. *saniculoides*	xC2		nc	6
Schoolcraft catseye	*Cryptantha schoolcraftii*	xC2		nc	9
Sierra Valley mousetails	*Ivesia aperta* var. *aperta*	xC2		nc	8, 9
Sodaville milkvetch	*Astragalus lentiginosus* var. *sesquimetralis*	RA	CE	s	5, 6
Steamboat buckwheat	*Eriogonum ovalifolium* var. *williamsiae*	E	CE	s	9
Sunnyside green gentian	*Frasera gypsicola*	xC2	CE	s	6
Tecopa birdbeak	*Cordylanthus tecopensis*	xC2		nc	6
Tiehm blazingstar	*Mentzelia tiehmii*	-		n	6
Tiehm milkvetch	*Astragalus tiehmii*	xC2		nc	9
Tiehm peppercress	*Stroganowia tiehmii*	xC2		n	4
Tiehm rockcress	*Arabis tiehmii*	xC2		-	9
Tonopah milkvetch	*Astragalus pseudiodanthus*	-		c	2, 4, 5, 6
Tonopah pincushion	*Sclerocactus nyensis*	-	CY	n	6
Toquima milkvetch	*Astragalus toquimanus*	-		n	6
Washoe pine	*Pinus washoensis*	-	CY	n	9
waxflower	*Jamesia tetrapetala*	xC2		n	6
weasel phacelia	*Phacelia mustelina*	-		c	6
Webber ivesia	*Ivesia webberi*	C	CE	sc	3, 9

Table E-2
Sensitive Species that May Occur in the Planning Area *(continued)*

Common Name	Scientific Name	Status			Occurrences Within the Planning Area by County
		Federal	State	BLM	
white bearpoppy	*Arctomecon merriamii*	xC2		n	6
White River catseye	*Cryptantha welshii*	xC2		n	6
white-margined beardtongue	*Penstemon albomarginatus*	xC2		nc	6
Williams combleaf	*Polyctenium williamsiae*	-	CE	sc	3, 4, 5, 6, 9
windloving buckwheat	*Eriogonum anemophilum*	xC2		n	7
Mollusks					
Amargosa tryonia	*Tryonia variegate*	xC2		n	6
Ash Meadows pebblesnail	*Pyrgulopsis erythropoma*	xC2		-	6
Big Warm Spring pyrg	*Pyrgulopsis papillata*	-		n	6
California floater	*Anodonta californiensis*	xC2		n	9
Crystal Spring springsnail	*Pyrgulopsis crystalis*	xC2		-	6
distal-gland springsnail	*Pyrgulopsis nanus*	xC2		-	6
Dixie Valley pyrg	*Pyrgulopsis dixensis*	-		n	7
Duckwater pyrg	*Pyrgulopsis aloba*	-		n	6
Duckwater warm springs pyrg	*Pyrgulopsis villacampae*	-		n	6
elongate-gland springsnail	*Pyrgulopsis isolate*	xC2		-	6
Fairbanks springsnail	*Pyrgulopsis fairbanksensis*	xC2		-	6
Fly Ranch pyrg	*Pyrgulopsis bruesi*	-		n	9
grated tryonia	*Tryonia clathrata*	xC2		n	6
median-gland Nevada springsnail	*Pyrgulopsis pisteri*	xC2		-	6
minute tryonia	*Tryonia ericae*	xC2		-	6
Oasis Valley pyrg	*Pyrgulopsis micrococcus*	xC2		n	6
Pahranagat pebblesnail	*Pyrgulopsis merriami*	xC2		-	6
Point of Rocks tryonia	*Tryonia elata*	xC2		-	6
southern Duckwater pyrg	*Pyrgulopsis anatine*	-		n	6
sportinggoods tryonia	*Tryonia angulata*	xC2		-	6
Wongs pyrg	*Pyrgulopsis wongi*	xC2		n	3, 5
Insects					
Ash Meadows alkali skipper	*Pseudocopaeodes eunus alinea*	-		n	6
Big Dune miloderes weevil	*Miloderes* sp. (unnamed)	xC2		n	6
Big Smoky wood nymph	*Cercyonis oetus alkalorum*	-		n	6
Carson Valley silverspot	*Speyeria nokomis carsonensis*	xC2		n	1, 3, 9
Carson Valley wood nymph	*Cercyonis pegala carsonensis*	xC2		n	1, 3
Carson wandering skipper	*Pseudocopaeodes eunus obscurus*	E		-	1, 9
Crescent Dunes aegialian scarab	*Aegialia crescenta*	xC2		n	6
Crescent Dunes serican scarab	*Serica ammomenisco*	xC2		n	6
Devils Hole warm spring riffle beetle	*Stenelmis calida calida*	xC2		n	6
early blue	*Euphilotes enoptes primavera*	-		n	5
Giuliani's blue	*Euphilotes ancilla giulianii*	-		n	6
Giuliani's dune scarab	*Pseudocotalpa giulianii*	xC2		n	6
Hardy's aegialian scarab	*Aegialia hardyi*	xC2		n	2
large aegialian scarab	*Aegialia magnifica*	xC2		n	6

Table E-2
Sensitive Species that May Occur in the Planning Area *(continued)*

Common Name	Scientific Name	Status			Occurrences Within the Planning Area by County
		Federal	State	BLM	
Mono checkerspot	*Euphydryas editha monoensis*	xC2		n	1, 3, 4, 9
Nevada admiral	*Limenitis weidemeyerii nevadae*	xC2		-	6
Nevada viceroy	*Limenitis archippus lahontani*	xC2		-	2, 4, 7, 8, 9
Railroad Valley skipper	*Hesperia uncas fulvapalla*	xC2		n	6
Sand Mountain blue	*Euphilotes pallescens arenamontana*	xC2		n	2
Sand Mountain serican scarab	*Serica psammobunus*	xC2		n	2
Spring Mountains acastus checkerspot	*Chlosyne acastus robusta*	-		n	6
Spring Mountains comma skipper	*Hesperia colorado mojavensis*	xC2		-	6
Tahoe benthic stonefly	*Capnia lacustra*	xC2		-	3
White Mountains icarioides blue	*Icaricia icarioides albihalos*	xC2		-	5
White River wood nymph	*Cercyonis pegala pluvialis*	xC2		n	6
Fishes					
Big Smoky Valley speckled dace	*Rhinichthys osculus lariversi*	-	yes	n	6
Big Smoky Valley tui chub	*Gila bicolor* ssp. (unnamed)	xC2	yes	n	6
cui-ui	*Chasmistes cujus*	E	yes	s	9
Dixie Valley tui chub	*Gila bicolor* ssp. (unnamed)	xC2		-	2, 7
Duckwater Creek tui chub	*Gila bicolor* ssp. (unnamed)	xC2		-	6
Hiko White River springfish	*Crenichthys baileyi grandis*	E	yes	s	5
Hot Creek Valley tui chub	*Gila bicolor* ssp. (unnamed)	xC2	yes	n	6
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	T	yes	s	2, 5, 6, 9
Little Fish Lake Valley tui chub	*Gila bicolor* ssp. (unnamed)	-	yes	-	6
Monitor Valley speckled dace	*Rhinichthys osculus* ssp. (unnamed)	xC2		n	6
Moorman White River springfish	*Crenichthys baileyi thermophilus*	xC2	yes	n	6
Oasis Valley speckled dace	*Rhinichthys osculus* ssp. (unnamed)	xC2		n	6
Railroad Valley springfish	*Crenichthys nevadae*	T	yes	s	5, 6
Railroad Valley tui chub	*Gila bicolor* ssp. (unnamed)	xC2	yes	n	6
Sheldon tui chub	*Gila bicolor eurysoma*	xC2		-	9
Wall Canyon sucker	*Catostomus* sp. (unnamed)	xC2		n	9
Warner Valley redband trout	*Oncorhynchus mykiss pop*	xC2	yes	-	9
White River desert sucker	*Catostomus clarki intermedius*	xC2	yes	n	6
White River speckled dace	*Rhinichthys osculus* ssp. (unnamed)	xC2		n	6
Amphibians					
Amargosa toad	*Bufo nelsoni*	-		n	6
mountain yellow-legged frog	*Rana muscosa*	C		-	1, 3, 9
Reptiles					
banded Gila monster	*Heloderma suspectum cinctum*	xC2N	yes	nc	6
desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	LTNL	yes	s	6
Sierra alligator lizard	*Elgaria coerulea palmeri*	-		n	1, 3, 9
Mammals					
American marten	*Martes Americana*	-	yes	-	1, 3, 9
Ash Meadows montane vole	*Microtus montanus nevadensis*	xC2		n	6

Table E-2
Sensitive Species that May Occur in the Planning Area *(continued)*

Common Name	Scientific Name	Status			Occurrences Within the Planning Area by County
		Federal	State	BLM	
California myotis	*Myotis californicus*	-		n	all
Fish Spring pocket gopher	*Thomomys bottae abstrusus*	xC2		n	6
Fletcher dark kangaroo mouse	*Microdipodops megacephalus nasutus*	xC2		n	5
fringed myotis	*Myotis thysanodes*	xC2		nc	all
little brown myotis	*Myotis lucifugus*	-		n	all
Mono Basin mountain beaver	*Aplodontia rufa californica*	xC2N	yes	-	1, 9
Preble's shrew	*Sorex preblei*	xC2		n	9
pygmy rabbit	*Brachylagus idahoensis*	xC2	yes	n	2, 6, 9
river otter	*Lontra Canadensis*	-	yes	n	1, 2, 3, 4, 7, 8
San Antonio pocket gopher	*Thomomys bottae curtatus*	xC2		n	6
spotted bat	*Euderma maculatum*	xC2	yes	s	all
Townsend's big-eared bat	*Corynorhinus townsendii*	-		nc	1, 2, 4, 5, 6, 7, 8, 9
western red bat	*Lasiurus blossevillii*	-		n	2, 9
western small-footed myotis	*Myotis ciliolabrum*	xC2		nc	all
Birds					
Bald Eagle (contiguous US pop)	*Haliaeetus leucocephalus*	LTPD	yes	s	2, 4, 5
Black Tern	*Chlidonias niger*	xC2	yes	n	1, 2, 4, 5, 6, 7, 8, 9
California Spotted Owl	*Strix occidentalis occidentalis*	xC2	yes	c	1, 4, 9
Common Loon	*Gavia immer*	-	yes	-	1, 9
Ferruginous Hawk	*Buteo regalis*	xC2	yes	n	all
Flammulated Owl	*Otus flammeolus*	-	yes	n	all
Great Gray Owl	*Strix nebulosa*	-	yes	-	9
Mountain Quail	*Oreortyx pictus*	-	yes	n	1, 3, 6, 9
Northern Goshawk	*Accipiter gentiles*	xC2	yes	n	1, 2, 4, 6, 7, 8, 9
Peregrine Falcon	*Falco peregrinus*	ENL	yes	n	3, 4, 5
Phainopepla	*Phainopepla nitens*	-	yes	n	6
Sage Grouse	*Centrocercus urophasianus*	-	yes	nc	2, 4, 5, 6, 7, 8, 9
Swainson's Hawk	*Buteo swainsoni*	-	yes	n	all
Western Burrowing Owl	*Athene cunicularia hypugaea*	xC2	yes	nc	all
Western Least Bittern	*Ixobrychus exilis hesperis*	xC2	yes	n	6
Western Snowy Plover	*Charadrius alexandrinus nivosus*	LTNL	yes	n	2, 4, 5, 6, 7, 9
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	C	yes	s	2, 4, 6, 9
White-faced Ibis	*Plegadis chihi*	xC2	yes	p	2, 4, 5, 6, 7, 8, 9
Watch List Taxa					
Plants					
armored hedgehog cactus	*Echinocereus engelmannii* var. *armatus*	-	CY	-	6
Mojave barrel cactus	*Ferocactus cylindraceus* var. *lecontei*	-	CY	-	6
sagebrush pygmyleaf	*Loeflingia squarrosa* ssp. *artemisiarum*	-		c	1, 4, 9
scorpion milkvetch	*Astragalus lentiginosus* var. *scorpionis*	xC2		-	2, 5, 6
Shevock bristlemoss	*Orthotrichum shevockii*	-		c	1, 3, 9
Susanville beardtongue	*Penstemon sudans*	-		c	9

Table E-2
Sensitive Species that May Occur in the Planning Area *(continued)*

Common Name	Scientific Name	Status			Occurrences Within the Planning Area by County
		Federal	State	BLM	
Insects					
Big Dune aphodius scarab	*Aphodius* sp. (unnamed)	xC2		n	6
Crescent Dunes aphodius scarab	*Aphodius* sp. (unnamed)	xC2		n	6
Sand Mountain aphodius scarab	*Aphodius* sp. (unnamed)	xC2		n	2
Amphibians					
northern leopard frog	*Rana pipiens*	-		n	all
Reptiles					
common chuckwalla	*Sauromalus obesus*	xC2		n	6
northwestern pond turtle	*Emys marmorata marmorata*	xC2		-	1, 3, 4, 8, 9
short-horned lizard	*Phrynosoma douglasii*	-		n	6, 9
Mammals					
American pika	*Ochotona princeps*	-	yes	-	all
Brazilian free-tailed bat	*Tadarida brasiliensis*	-		n	all
hoary bat	*Lasiurus cinereus*	-		n	all
long-eared myotis	*Myotis evotis*	xC2		nc	all
long-legged myotis	*Myotis volans*	xC2		n	all
northern flying squirrel	*Glaucomys sabrinus*	-	yes	-	1, 3, 9
pallid bat	*Antrozous pallidus*	-		nc	2, 4, 5, 6, 7, 9
Sierra Nevada snowshoe hare	*Lepus americanus tahoensis*	xC2	yes	-	3, 9
silver-haired bat	*Lasionycteris noctivagans*	-		n	2, 5, 6, 9
western pipistrelle	*Pipistrellus Hesperus*	-		n	2, 5, 6, 9
Yuma myotis	*Myotis yumanensis*	xC2		nc	all
Birds					
American White Pelican	*Pelecanus erythrorhynchos*	-	yes	p	1, 2, 3, 4, 5, 7, 8, 9
Black Rosy-finch	*Leucosticte atrata*	-		n	2, 6, 7
Common Yellowthroat	*Geothlypis trichas*	-	yes	p	all
Crissal Thrasher	*Toxostoma crissale*	-	yes	n	6
Golden Eagle	*Aquila chrysaetos*	-	yes	n	all
Gray Vireo	*Vireo vicinior*	-	yes	nc	6
Greater Sandhill Crane	*Grus canadensis tabida*	-	yes	n	2, 6, 7, 9
Harlequin Duck	*Histrionicus histrionicus*	xC2	yes	-	5, 9
Juniper Titmouse	*Baeolophus griseus*	-	yes	n	all
Lewis' Woodpecker	*Melanerpes lewis*	-	yes	n	all
Loggerhead Shrike	*Lanius ludovicianus*	xC2N	yes	n	all
Long-billed Curlew	*Numenius americanus*	-	yes	n	all
Long-eared Owl	*Asio otus*	-	yes	n	all
Lucy's Warbler	*Vermivora luciae*	-	yes	n	6
Macgillivray's Warbler	*Oporornis tolmiei*	-	yes	p	all
Orange-crowned Warbler	*Vermivora celata*	-	yes	p	all
Osprey	*Pandion haliaetus*	-	yes	p	1, 2, 3, 4, 6, 7, 8, 9
Pinyon Jay	*Gymnorhinus cyanocephalus*	-	yes	n	all

Table E-2
Sensitive Species that May Occur in the Planning Area *(continued)*

Common Name	Scientific Name	Status			Occurrences Within the Planning Area by County
		Federal	State	BLM	
Prairie Falcon	*Falco mexicanus*	-	yes	n	all
Red-naped Sapsucker	*Sphyrapicus nuchalis*	-	yes	n	all
Short-eared Owl	*Asio flammeus*	-	yes	n	1, 2, 3, 4, 7, 8, 9
Tricolored Blackbird	*Agelaius tricolor*	xC2	yes	nc	1, 3, 4, 5, 8, 9
Vesper Sparrow	*Pooecetes gramineus*	-	yes	n	all
Wilson's Warbler	*Wilsonia pusilla*	-	yes	p	1, 3, 4, 5, 9
Wood Stork	*Mycteria Americana*	LENL	yes	s	2
Yellow Warbler	*Dendroica petechia*	-	yes	p	all
Yellow-breasted Chat	*Icteria virens*	-	yes	n	1, 2, 3, 4, 6, 7, 8, 9

Notes: NNHP 2004

Federal Status:
NL Not Listed (no status) in a portion of the species' range
RI Former Candidate or Proposed species; current information does not support proposal to list because species lacks sufficient evidence of vulnerability and threats; still a "species of concern"
xC1 Former Category-1 Candidate, now "species of concern"
xC2 Former Category-2 Candidate, now "species of concern"

Nevada State Status:
Fauna:
YES Species protected under NRS 501
Flora:
CE Critically endangered species threatened with extinction whose survival requires assistance because of overexploitation, disease, or other factors or because their habitat is threatened with destruction, drastic modification, or severe curtailment (NRS 527.260-.300)
CE# Recommended for listing as critically endangered
CY Protected as a cactus, yucca, or Christmas tree (NRS 527.060-.120)

BLM Status:
S Nevada Special Status Species - USFWS listed, proposed, or candidate for listing, or protected by Nevada State Law
N Nevada Special Status Species - designated Sensitive by State Office
P Proposed Nevada Special Status Species - designated proposed Sensitive by BLM State Office
C BLM California Special Status Species (see definitions S and N)

Counties:

1	Carson City	7	Pershing
2	Churchill	8	Storey
3	Douglas	9	Washoe
4	Lyon	10	Lassen
5	Mineral	11	Alpine
6	Nye		