CHAPTER 3
AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter identifies and describes the current condition and trend of elements or resources in the human environment which may be affected by the Proposed Action or Alternatives.

Scoping and Issues Identification

In accordance with NEPA, this document has been prepared with input from interested agencies, organizations, tribes, and individuals. Details of the scoping and public involvement process are discussed in detail in **Section 1.4**, Public Involvement, and **Chapter 7**, Consultation, Coordination and Preparation. In addition to the public scoping, the BLM's Interdisciplinary Team and the cooperating agencies were consulted to determine specific resource concerns. The issues and concerns identified during scoping, which were outlined in Table 1-2, have been considered in the preparation of this EIS. The general topic issues include the following:

- Energy supply to the Fallon area;
- Increased risk for earthquakes;
- Visual/aesthetic impacts;
- Water rights;
- Water supply;
- Water quality;
- Current and future management of Carson Lake and Pasture;
- Protection of Newlands Project facilities;
- Geothermal resource drainage; and
- Effects on operations at NAS Fallon.

Setting

The Salt Wells Energy Projects Area is located south of Fallon, in Churchill County, Nevada. This area lies between approximately 3,900 and 4,600 feet above mean sea level (amsl) with distinct topographic changes between the flat playas, agricultural areas, and steep terrain of the Bunejug Mountains. Climate is

arid with an average annual precipitation of five to seven inches. Vegetation in the area is typical of lowland and foothill areas of the Great Basin, with sparse vegetation and saline soils. Agricultural uses are prevalent in the western portion of the Project Area.

Supplemental Authorities

Appendix 1 of BLM's NEPA Handbook H-1790-1 (BLM 2008) identifies Supplemental Authorities that are subject to requirements specified by statute or executive order and must be considered in all BLM environmental documents. **Table 3-1**, Supplemental Authorities, lists the Supplemental Authorities and their status in the Salt Wells Energy Projects Area. In addition, the rationale that was used to determine that a Supplemental Authority present in the Projects Area would not be affected as a result of the implementation of the Proposed Actions or Alternative is included in Table 3-1. Supplemental Authorities that may be affected by the Proposed Actions or Alternative are further described in this EIS. There are no Wilderness, Wilderness Study Areas, Areas of Critical Environmental Concern, or other special designation areas near the Salt Wells Energy Projects Area. The closest Wilderness Study Area is the Job Peak Wilderness Study Area, which is located approximately 18 miles northeast of the Projects Area. The Pah Rah Petroglyph Area of Critical Environmental Concern is the closest Area of Critical Environmental Concern, located approximately 53 miles northwest of the Salt Wells Energy Projects Area. The Black Rock Desert Wilderness is approximately103 miles north of the Projects Area. These areas would not be affected by the Proposed Actions or Alternatives and are not discussed further in this EIS.

Resources or Uses Other Than Supplemental Authorities

The following resources or uses which are not Supplemental Authorities as defined by BLM Handbook H-1790-1 are present in the Projects Area or were identified during scoping. The potential impact of the Proposed Action and Alternative on these resources has been documented in **Table 3-2**, Resources or Uses Other Than Supplemental Authorities. Resources or uses that may be affected by the Proposed Actions or Alternative are further described in this EIS.

3.2 LAND USE AUTHORIZATIONS, AIRSPACE, AND ACCESS

This section discusses the current land ownership and use, air space requirements, and access within the Survey Area for the Salt Wells Energy Projects Proposed Actions and Alternative.

Regional Overview

Land Use

The Salt Wells Energy Projects are located in Churchill County, Nevada, covering an area just southwest of the City of Fallon to approximately 20 miles

Table 3-1
Supplemental Authorities

Supplemental Authority	Not Present	Present/ Not Affected	Present/ May Be Affected	Rationale
Air Quality			X	See Section 3.3
Areas of Critical Environmental Concern	X			Element is not present.
Cultural Resources			X	See Section 3.14
Environmental Justice		X		See Section 3.26
Farm Lands (Prime or Unique)			X	See Section 3.6
Fish Habitat	X			Element is not present, as there are no waterways in the Projects Area
Floodplains		X		See Section 3.8
Invasive, Nonnative Species			X	See Section 3.10
Migratory Birds			X	See Section 3.12
Native American Religious Concerns			X	See Section 3.15
Threatened or Endangered Species	X			Consulting with the USFWS, the BLM wildlife biologist, and the USFWS website for Nevada determined that there are no federally listed threatened or endangered species within the Projects Area
Wastes, Hazardous or Solid		X		See Section 3.24
Water Quality (Surface/Ground)			X	See Section 3.7
Wetlands/Riparian Zones			X	See Section 3.8
Wild and Scenic Rivers	X			Element is not present.
Wilderness	X			Element is not present.

Table 3-2
Resources or Uses Other Than Supplemental Authorities

Resource or Use	Not Present	Present/Not Affected	Present/May Be Affected	Rationale
Land Use Authorizations, Air Space, and Access			X	See Section 3.2
Livestock/Grazing			X	See Section 3.18
Minerals/Geology			X	See Section 3.4
National Scenic and Historic Trails			X	See Section 3.20
Noise			X	See Section 3.21
Paleontology			X	See Section 3.16
Public Health and Safety and Fire Management		X		See Sections 3.22 and 3.23
Recreation			X	See Section 3.19
Social and Economic Values			X	See Section 3.25
Soils			X	See Section 3.5
Special Designations and Lands with Wilderness Characteristics	X			Element is not present.
Vegetation			X	See Section 3.9
Visual Resources			X	See Section 3.17
Wild horse and burros	X			No Herd Management Areas are present within the Projects Area
Wildlife			X	See Section 3.11

southeast of Fallon. The three proposals cover an area of approximately 23,764 acres. The primary uses within the area include agriculture, the Newlands Project, recreation, wildlife conservation, naval/air operations, and ROWs for natural gas pipelines, transmission lines, and communication facilities. In addition, the ENEL Geothermal Power Plant overlaps the Project Area.

Churchill County encompasses approximately 5,000 square miles, of which approximately 91 percent is publicly owned. As shown on Figure 1-1**,** the Salt Wells Energy Projects Area consists of private, state, and federally administered lands. The Department of Defense (DOD), USFWS, BLM, Reclamation, and

Bureau of Indian Affairs administer lands within and adjacent to the Salt Wells Energy Projects Area. Land management and ownership percentages are shown in **Table 3-3**, Land Ownership and Management in Churchill County.

Table 3-3
Land Ownership and Management in Churchill County

Land Owner/Administrator	Percentage of Ownership/Management
Bureau of Land Management	71
Bureau of Reclamation	13
Department of Defense	4
US Fish and Wildlife Service	.5
State of Nevada and Churchill County	1
Bureau of Indian Affairs (Includes Fallon Reservation)	1.5
Southern Pacific Railroad	8
Private (Includes City of Fallon)	1.5

The Churchill County Master Plan identifies the following zoning within the Salt Wells Energy Projects Area (Churchill County 2005):

- A-5 Agricultural District – One house per 5-acre parcel with septic and well; No Planned Unit Developments (PUDs).
- A-10 Agricultural District – One house per 10-acre parcel with septic and well; No PUDs.
- I Industrial District – One-acre minimum parcel size; no new residential use unless within a PUD or under certain circumstances a special use permit; PUDs allowed.
- RR-20 Rural Resource District – One house per 20-acre parcel with septic and well; No PUDs.
- R-1 Single Family Residential – One house per 7,000-square foot parcel; PUDs allowed.

As discussed in **Section 1.3.2**, Relationship to BLM and Non-BLM Policies, Plans, and Programs, the 2005 Churchill County Master Plan directs the County to support development and use of renewable energy sources, such as geothermal (Churchill County 2005).

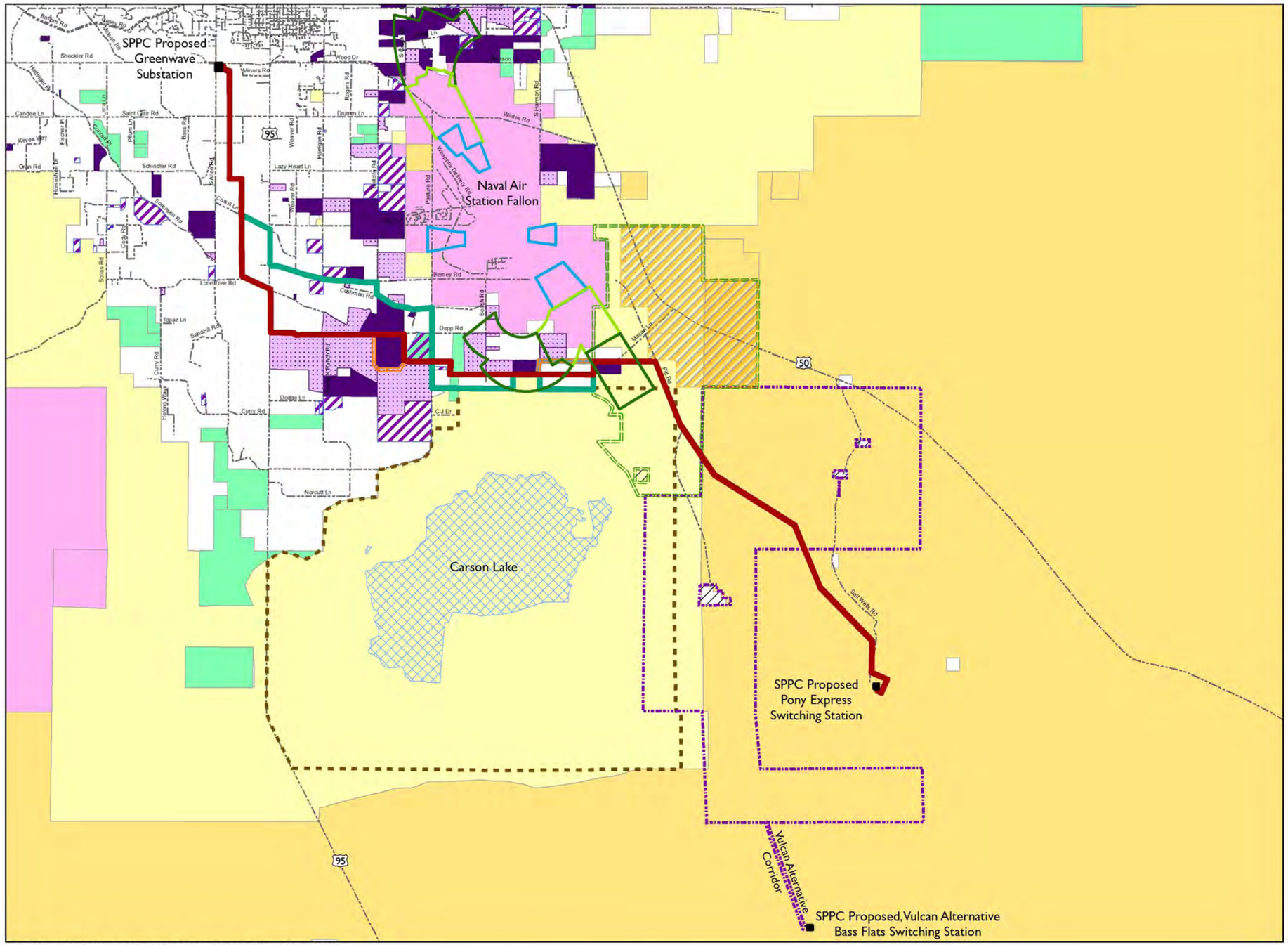
The plan classifies geothermal as one of the four main industry sectors within the County and calls for the County to, "Retain existing geothermal and mining areas and promote and encourage the expansion of these operations and areas."

The Churchill County Master Plan also outlines five policies related to energy development on federal lands. These policies are outlined in **Section 1.3.2**. The Churchill County Plan also addresses energy transmission and the development of corridors with consideration for other uses on public lands.

The federally administered lands in the vicinity of the Salt Wells Energy Projects Area include Carson Lake and Pasture, Stillwater National Wildlife Refuge, Grimes Point Archaeological Site, the Fallon Indian Reservation, and NAS Fallon. Conservation easements deeded to Churchill County or the Nevada Lands Conservancy (NVLC) and the Navy are also adjacent to the Projects Area (**Figure 3-1**, Land Use Authorizations, Airspace, and Access). The BLM-administered lands are managed for multiple-use, with the exception of the area designated for no surface occupancy for the protection of sensitive resources. The Pony Express National Historic Trail crosses the Vulcan Project Area in the southern portion where a transmission line is proposed. A search of the LR2000 database shows that other land uses in the area include oil and gas leases; geothermal leases; minerals/materials leases; ROWs for roads, highways, telephone lines, and power lines; and other unspecified federal ROWs. A list of the current land use authorizations in the Projects Area is included in **Appendix F**, Land Use Authorizations in the Salt Wells Energy Project Area. BLM-designated off-highway vehicle (OHV) race routes traverse the Projects Area. Recreational uses are discussed in detail in **Section 3.19**, Recreation. No additional land use authorizations, issues, or constraints were identified.

The Navy INRMP for Certain Federal Lands in Churchill County, Nevada (September 2006), outlines how resources on the Navy lands in the project vicinity are to be managed by the DOD. Portions of the Ormat Project Area, including the Reclamation lands Sections 19 and 30 of T18N R30E, are adjacent to NAS Fallon.

Reclamation-managed lands in the area are all part of the Newlands Project, one of the first projects built by Reclamation. The Newlands Project is operated by the TCID through a contract with Reclamation. The Lahontan Basin Area Office of Reclamation administers the operation of the Newlands Project in consultation with TCID, Pyramid Lake Paiute Tribe, the USFWS, the Fallon Paiute-Shoshone Tribe, and the Federal Water Master. As stated previously, the Reclamation use authorizations are at 43 CFR 429. The Memorandum of Understanding for the Salt Wells Energy Projects between BLM and Reclamation is included in **Appendix C**, Interagency Agreement Between the Bureau of Reclamation and the Bureau of Land Management. Carson Lake and Pasture is a 30,000-acre wetland within Reclamation's Newlands Project. The wetland is a component of the Western Hemisphere Shorebird Reserve Network and is one of the most important wetlands in northern Nevada. The Carson Lake and Pasture area immediately west of the Ormat and Vulcan Project Areas was approved for conveyance to the State of Nevada in the



Land Use Authorizations, Airspace, and Access

Churchill County, Nevada

Airspace Accident Potential Zone
- APZ-I
- APZ-II
- Clear Zone

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching and Substations
- CLP Title Transfer
- Excluded from Lease Area
- Existing Conservation Easement
- Approved, Pending Conservation Easement
- Proposed Conservation Easement
- No Surface Occupancy
- Open Water
- Existing Roads

Land Ownership
- Bureau of Land Management
- Bureau of Reclamation
- Department of Defense
- Fish and Wildlife Service
- Private Land (Including city and county lands)

Source: BLM, Ormat, SPPC, Vulcan 2010, Churchill County 2010, USFWS 2011, US Navy 2011a, US Navy 2011b

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Miles

July 2011

NAD 1983 HARN State Plane Nevada West

Disclaimer: 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.

*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-1

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Settlement Act, Pub. L. 101-618, for use as a wildlife management area. Carson Lake and Pasture is in the process of being transferred to the state and is managed by NDOW according to Reclamation procedures and directives outlined in PL101-618 and by the Management Agreement (05-LC-20-8359) dated October 28, 2004.

The conservation easements shown in Figure 3-1 have two deeds. First, the easements were purchased by the County, or the Nevada Land Conservancy in the case of the Corkill property, then the County or Nevada Land Conservancy entered into a restrictive use easement with the Navy. The purpose of the conservation easements held by Churchill County and the Navy are as follows:

> "to preserve, protect, and monitor in perpetuity the Conservation Values (to include agricultural use and benefit of agriculture) of the Property ('Conservation Purpose'), and to prohibit additional residential and any commercial development (except for commercial agriculture activities) and industrial development and/or use of the Property that would otherwise be incompatible with the mission of NAS Fallon, or might interfere, whether directly or indirectly, with current or future military training, testing or operations on or adjacent to NAS Fallon…"

The prohibited uses in the deed state that "Any activity or use of the Property inconsistent with the Conservation Purpose of this Conservation Easement is prohibited." Specific prohibitions that may be relevant to the proposed transmission line include the following:

- No structure, building, antenna tower or other obstruction would exceed 80 feet above ground level;
- No lighting would be permitted that may be dangerous, distracting or misleading to aircraft operating at NAS Fallon; and
- No operations of any type would be permitted that produce glare or other visual hazards, or encourage concentrations of birds that may be dangerous to aircraft operating from NAS Fallon. (Dirickson 2010)

The USFWS administers dispersed parcels within the Salt Wells Energy Projects Area in Sections 33 through 36 of Township 18N, Range 29E (Figure 3-1). According to Mr. Carl Lunderstand of the USFWS, these parcels are not part of the main Stillwater Wildlife Refuge and are not necessarily managed under the Final EIS for the Stillwater National Wildlife Refuge Complex Comprehensive Conservation Plan prepared May 2002 (Lunderstand 2010). The individual parcels are subject to the same constraints as the wildlife refuge but they are not managed the same because these parcels are purchased to meet the objectives of the USFWS Water Rights Acquisition Program. The lands and

associated water rights are purchased, and then the water rights are diverted to the main Stillwater Wildlife Refuge. These lands are managed by the USFWS until they are sold to other parties.

Airspace

NAS Fallon is the Navy's primary air-to-air and air-to-ground training facility. The Proposed Action would occur near and adjacent to the NAS Fallon main station, which contains a 14,000-foot runway in a northwest-southeast configuration (see Figure 3-1). Land uses off the ends of the runway are primarily agriculture and open space to ensure compatibility with flight take-off and landing operations.

Through the Air Installations Compatibility Use Zones Program, the Navy has modeled noise contours and Accident Potential Zones (APZs) at its air facilities. Noise contours and APZs give land use planners a tool to promote development compatible with airfield operations. There are three APZ classifications:

1) Clear Zones, which have the greatest accident potential and are areas where no structures except navigational aids and airfield lighting are allowed;

2) APZ1, which is the area beyond the clear zone that still possesses a measurable potential for accidents relative to the clear zone. Utilities are generally compatible in APZ1 areas except for major transmission lines; and

3) APZ2, which has a measurable but lower potential for aircraft accidents relative to Clear Zones and APZ1. Utilities and transmission lines may be compatible uses in APZ2 (US Navy 2008).

Noise contours and APZs for NAS Fallon are shown on Figure 3-1.

Churchill County Code 16.08.240 contains provisions for land uses in the NAS Fallon notification area, which includes lands around the NAS Fallon main station. Section 16.08.240(J) requires notification for actions on County lands of any proposal for a structure greater than 200 feet in height between one and nine miles from the NAS Fallon boundary. The planning department must also notify the NAS Fallon Commanding Office of any special use permit or variance involving any structure greater than 95 feet in height within one mile of the boundary of NAS Fallon (Churchill County 2010a).

Height restrictions on conservation easement lands were described previously under land use.

Access

The Salt Wells Energy Projects Area can be accessed via Highway 50 and Highway 95, utilizing Allen Road, Pasture Road, Corkill Lane, Shaffer Lane, or Macari Lane to access various portions of the Projects Area. The Lincoln Highway or the old Highway 50 is considered a historical roadway, and segments of the roadway are subject to certain use regulations, including the maintenance and restoration of the roadway if it is damaged during construction and operation of any development project. Two sections of the highway exist in the Projects Area, connecting Highway 50 to Berney Road. The southern section has been structurally altered and does not require restoration and maintenance if used. Local arterials in the Projects Area include Berney Road, Macari Lane, and Shaffer Lane. Roads proposed for use for the Salt Wells Energy Projects could be listed as designated routes of travel when the travel management plan for Churchill County is completed.

SPPC Project Area

Land Use

The SPPC Project Area covers approximately 1,194 acres. The primary land use adjacent to the proposed and alternative transmission line routes is agriculture, including the Newlands Project canals and roads. The proposed and alternative corridors would also be adjacent to Carson Lake and Pasture, NAS Fallon, and several conservation easements. Deed restrictions for the conservation easements limit the use of these lands for agricultural purposes and include a height restriction of 80 feet for any new construction on these parcels. As discussed previously, the proposed routes and some of the Alternative cross parcels managed by the USFWS. The parcel in Section 35 is part of the current land sale being conducted by the USFWS. The USFWS issued SPPC a special use permit to conduct studies on these lands. The ENEL Geothermal Power Plant overlaps with the SPPC Project Area where the proposed transmission line corridor connects to the Pony Express Switching Station (Figure 2-1). The SPPC Project Area includes lands zoned A-5, A-10, Industrial, RR-20 and R-1 (Churchill County 2005). The proposed ROW distances for the Proposed Action and Alternative are outlined in **Table 3-4**, ROW Distance on Private Land and Federally Administered Land, and have been broken out by the length of ROW on private and federally administered land.

Table 3-4
ROW Distance on Private Land and Federally Administered Land

Route	Total Length of ROW (In Feet)	Length of ROW on Private Land (In Feet)	Length of ROW on Federally Administered Land (In Feet)
Proposed Action	114,576	69,168	45,408
Alternative 1	118,272	57,552	60,720
Alternative 2	114,576	69,168	45,408
Alternative 3	115,632	70,224	45,408

Airspace

The proposed and alternate transmission line corridors run approximately three miles west and 0.25 mile south of the NAS Fallon boundary at their closest points. The routes south of NAS Fallon are in the NAS Fallon notification area in which the county must notify NAS Fallon of structures greater than 95 feet. Portions of the proposed route in Sections 35 and 36 of T18N R29E and in Section 31of T18N R30E are within APZ2.

Crop dusting is conducted in the agricultural areas adjacent to the Proposed Action and alternative transmission line routes. The aerial spraying company that conducts the majority of crop dusting in the SPPC Project Area was contacted during preparation of this EIS. According to the owner of the company, transmission lines are not an issue for pilots conducting crop dusting because the pilots are used to maneuvering around them. In addition, if the transmission lines are higher than 20 feet, the pilots can fly under them (Frey 2010).

Access

The SPPC Project Area would be accessed via Highway 50 and Highway 95, utilizing Allen Road, Pasture Road, Corkill Lane, Shaffer Lane, or Macari Lane to access various portions of the Project Area. As discussed in **Section 2.2**, SPPC would utilize existing roads whenever feasible. Addition access would be via temporary access roads, spur roads, and centerline roads constructed for use during construction of the transmission line.

Ormat Project Area

Land Use

The Ormat Project Area is approximately five miles southeast of Fallon, Nevada. The project encompasses approximately 6,948 acres of land. Lands within and adjacent to the Project Area are private, or are administered by Reclamation, BLM, or DOD (NAS Fallon). The private land in the project vicinity is zoned by Churchill County for agricultural uses. Lands within the Project Area administered by Reclamation were leased for geothermal development to Ormat in 2006. The effects of leasing were analyzed in an EA prepared by the BLM (BLM 2008). The private lands in the Ormat Project Area are zoned RR-20 by Churchill County (Churchill County 2005).

The Pony Express National Historic Trail is within the vicinity of the Project Area but does not cross it. The Grimes Point Archaeological Site and the Fallon Indian Reservation are also in the vicinity of the Project Area. The Stillwater National Wildlife Refuge is adjacent to and north of the Project Area. The BLM has designated the eastern portion of the Project Area as a no surface occupancy area to protect cultural and natural resources. One well pad is approved in this area.

Airspace

The Ormat Project Area lies adjacent to the eastern boundary of the NAS Fallon main station. As described previously, adjacent the Ormat Project Area is adjacent to NAS Fallon in Sections 19 and 30 of T18N R30E. In addition, portions of the Project Area adjacent to the southeast boundary of the NAS Fallon main station lie within APZ1 and APZ2. These lands are within Sections 30 and 31 of T18N R30E.

Access

The Ormat Project Area is accessed via Highway 50 (Figures 2-7 and 3-1). Various unimproved graded roads also provide access within the proposed Project Area. Temporary access and pipeline roads would be constructed as outlined in Section 2.

Vulcan Project Area

Land Use

The Vulcan Project Area is located approximately ten miles southeast of Fallon, Nevada. The project encompasses an area of approximately 15,622 acres. Lands within and adjacent to the Project Area are private or are administered by Reclamation or BLM. The private land in the project vicinity is zoned by Churchill County for agricultural uses. The Grimes Point Archaeological Site and the Fallon Indian Reservation are also in the vicinity of the Project Area. The Pony Express National Historic Trail crosses the Project Area and the transmission line corridor proposed under Alternative 1 (Figure 2-8). The ENEL Geothermal Power Plant, which includes wells, a power plant, and a mineral material site are within and adjacent to the Vulcan Project Area. The Vulcan Project Area also overlaps with navy and SPPC ROWs. The private lands in the Vulcan Project Area are zoned RR-20 by Churchill County (Churchill County 2005).

Airspace

The Vulcan Project Area lies over two miles southeast of the southeast corner of NAS Fallon. These lands are not within an APZ.

Access

The Vulcan Project Area is accessed via Highway 50 (Figure 2-8 and 3-1). Various unimproved graded roads also provide access within the proposed Project Area. Temporary access roads and pipeline roads would be constructed as outlined in Section 2.

3.3 AIR QUALITY

Ambient air quality is affected by the type and amount of air pollutants emitted into the atmosphere, prevailing meteorological conditions, and the conversion of air pollutants and other compounds by a complex series of chemical and photochemical reactions in the atmosphere.

Regional Overview

The Salt Wells Energy Projects Area is dominated by recurring high and low pressure systems. Winters are moderately cold, with recordable amounts of snowfall. Summers are moderate, with occasional high temperatures of 90 to 100°F. The average annual maximum temperature for the Projects Area is 67.6°F. The average annual minimum temperature is 34.9°F. The warmest month is July, with an average maximum temperature above 90°F and average minimum of 54°F. The coldest month is January, when the average maximum temperature is close to 44°F and the average minimum temperature is 18°F. Average annual rainfall is nearly 5 inches, and average annual snowfall is 5.7 inches (Western Regional Climate Center 2010a).

Winds generally come from the south from November through March, as measured at NAS Fallon. Winds are predominantly from the north or west in the other months (Western Regional Climate Center 2010b). The average annual wind speed is 6.9 miles per hour, with the highest average wind speed occurring in April and the lowest occurring in November (Western Regional Climate Center 2010c).

Air Quality

Ambient Air Quality Standards

The CAA established the principal framework for national, state, and local efforts to protect air quality in the US (42 USC §§ 7401−7642). Under the CAA the US Environmental Protection Agency (EPA) has set time-averaged standards known as National Ambient Air Quality Standards (NAAQS) for six air pollutants considered to be key indicators of air quality: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), lead (Pb), and two categories of particulate matter (particulate matter with an aerodynamic diameter of 10 microns or less [PM_{10}] and particulate matter with an aerodynamic diameter of 2.5 microns or less [$PM_{2.5}$]). The standards are two-tiered and may include primary and secondary standards. Primary standards set limits to protect public health, including the health of sensitive populations, such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Averaging periods vary by pollutant, based on potential health and welfare effects of each pollutant. States may set their own ambient air quality standards, but these standards must be at least as stringent as the national standards. The State of Nevada has adopted most of the national ambient air quality standards to regulate air pollution in the state. The state has adopted a more stringent CO standard for areas above 5,000 feet amsl, a more stringent SO_2 standard, and a standard for hydrogen sulfide, for which there is no national standard (Nevada Administrative Code 445B.22097).

Regional Air Quality Conditions

Based on measured ambient criteria for air pollutant concentrations, the EPA classifies areas of the US according to whether they meet the NAAQS. Areas that violate air quality standards are designated as nonattainment areas for the relevant criteria air pollutants. Areas that comply with air quality standards are designated as attainment areas for the relevant criteria air pollutants. Areas that have been redesignated from nonattainment to attainment are considered maintenance areas. Areas of uncertain status are generally designated as unclassifiable but are treated as attainment areas for regulatory purposes. Churchill County is designated unclassifiable or in attainment for all NAAQS.

Regulatory Considerations

Section 176(c) of the CAA requires federal agencies to ensure that their Proposed Actions are consistent with the CAA. The EPA has promulgated rules establishing conformity analysis procedures for transportation-related actions and for other general federal agency actions. The EPA general conformity rule requires preparation of a formal conformity determination document for federal agency actions undertaken, approved, or funded in federal nonattainment or maintenance areas where the total net change in direct and indirect emissions of nonattainment pollutants or their precursors exceed specified thresholds. Because the Projects Area is not in a designated nonattainment area, CAA conformity guidelines do not apply.

Greenhouse Gases and Climate Change

Greenhouse gases are gases that allow short-wave solar radiation to enter the Earth's atmosphere, but absorb long-wave infrared radiation re-emitted from the Earth's surface. Over time the amount of energy sent from the sun to the Earth's surface should be approximately the same as the amount of energy radiated back into space, leaving the temperature of the Earth's surface roughly constant. Most studies, however, indicate that the Earth's climate has warmed over the past century and that human activities producing greenhouse gases are likely an important contributing factor.

Gases exhibiting greenhouse properties come from both natural and human sources. Water vapor, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are examples of greenhouse gases that have both natural and manmade sources, while other greenhouse gases, such as chlorofluorocarbons, are exclusively manmade. In the US, greenhouse gas emissions come mostly from energy use. Such emissions result from combustion of fossil fuels used for electricity generation, transportation, industry, heating, and other needs. Energy-related CO_2 emissions represent 82 percent of total manmade greenhouse gas emissions in the US (US Energy Information Administration 2009).

The Final Mandatory Reporting of Greenhouse Gases Rule issued by the EPA on September 22, 2009, requires suppliers of fossil fuels or industrial greenhouse

gases, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of greenhouse gas emissions to submit annual reports to the EPA. In 2007, the Nevada Legislature passed a requirement that electrical generating power plants in the state with a maximum design output of 5 MW or greater must report their greenhouse gas emissions; however, units that use renewable energy sources are specifically exempted from the reporting requirement (NDEP, Bureau of Air Quality Planning 2010).

SPPC Project Area

Climate and air quality conditions along the SPPC Project Area would be the same as described in the regional overview. The transmission line would cross private and federal lands.

Ormat Project Area

Climate and air quality conditions at the Ormat Project Area would be the same as described in the regional overview. The Project Area is primarily on federal lands, though the proposed injection site and a small portion of the pipeline corridors from the injection site are on private lands owned by Ormat.

Vulcan Project Area

Climate and air quality conditions at the Vulcan Project Area would be the same as described in the regional overview. The Project Area is on federal lands.

3.4 MINERALS/GEOLOGY

This section presents an overview of the regional and local geology and mineral resources that occur within the Salt Wells Energy Projects Area. The purpose of this analysis is to identify any locatable, leasable, and saleable mineral deposits that may be impacted by the Project. The Salt Wells Energy Projects Area is located in the western portion of the Basin and Range physiographic province, southwest of NAS Fallon, including the northwestern portion of the Salt Wells Basin, Churchill County, Nevada. The Projects are located on the Fallon, Carson Lake, and Grimes Point US Geological Survey (USGS) 7.5-minute quadrangle topographic maps.

Regional Overview

The Salt Wells Energy Projects Area is located within the Lahontan Valley, Carson Desert, and northwestern portion of the Salt Wells Basin in west-central Nevada, in the western part of the Basin and Range physiographic province (Fenneman 1931). The Basin and Range physiographic province is characterized by north-south trending mountain ranges separated by alluvium-filled, nearly flat to gently sloping valleys. Mountain ranges surrounding the Salt Wells Energy Projects Area consist of Tertiary volcanic rocks, including basalt, rhyolite, silicic tuffs, and other related rocks. Also present in the mountain ranges are Tertiary and Mesozoic intrusive rocks, such as granite and dioritic rocks (**Figure 3-2**, Geologic Resources and Authorized Leases). These rocks may also include Tertiary silicic, intermediate, and mafic porphyritic or aphanitic

intrusive rocks. Valleys contain Quaternary alluvial deposits that may include parent materials of Tertiary age (Stewart 1980).

The Basin and Range Province formed through regional, crustal extension of the western part of the North American continental plate, with fault blocks sliding downward, forming basins separated by mountain ranges (Eaton 1982). The eastern side of the Projects Area is bounded by the Lahontan, Cocoon, and Bunejug Mountain Ranges. The Dead Camel Mountains and Virginia Range lie southwest and west of the Projects Area, respectively. The Hot Springs Mountains are located north and east of the proposed Projects Area.

The Lahontan Valley is a portion of Pleistocene Lake Lahontan, which existed in northwestern Nevada between 20,000 and 9,000 years before present (BP). At its peak approximately 12,700 years BP, Lake Lahontan had a surface area of over 8,500 square miles, with its largest component centered at the location of the Lahontan Valley and Carson Sink. The Carson Lake Wetland area, immediately west of the Vulcan Project Area, encompasses a portion of the Lahontan Valley wetland at the terminus of the Carson River. This wetland is one of the remaining natural features of Lake Lahontan.

The Carson River originates in the Sierra Nevada Mountains of California and flows northeast into Nevada, emptying into the enclosed Carson Sink, just west of the proposed Projects Area. The Carson River is impounded by the Lahontan Dam, approximately 30 miles west of Carson Lake. Downstream from the dam the river flows east past Fallon, then northeast into the Carson Sink. Elevation in the Projects Area ranges from 3,900 feet amsl at the floor of Salt Wells Basin to over 4,600 feet amsl at the top of Sehoo Mountain.

SPPC Project Area

The SPPC Project Area would be located primarily on Quaternary alluvial and playa deposits, which are common geological units within the Carson Desert and Lahontan Valley. At the western edge of the southeastern portion of the corridor, a Tertiary upper volcanic deposit with geological units (1) Alluvial and Playa Deposits (Qya and Qs); and (2) Upper Volcanic Rocks (Tyb) mapped by Stewart and Carlson (1977). The Qya and Qs are part of the Carson Desert on the west side of the Project Area and the Salt Wells Basin on the southeast side of the Project Area (Stewart and Carlson 1977). These deposits consist of deep deposits of silt, sand, gravel, and cobbles. These deposits are Holocene to Recent in age (10,000 years old to present) and consist of Tertiary age parent material from the surrounding volcanic mountain ranges.

Tyb, located on the west side of the southeastern portion of the SPPC Project Area, consist of a northwest/southeast trending outcrop of basalt, andesite, rhyolite, silicic tuff, and related rocks (Stewart and Carlson 1977). These rocks form the Bunejug and Cocoon Mountain ranges.

Mineral Resources

Active mining claims and mineral-materials areas within the SPPC transmission line corridor are documented by the GeoCommunicator online mapping system maintained by BLM and USFS. Circulation of heated, mineral-laden groundwater (hydrothermal fluids) through fractured rock has resulted in precipitation and concentration of minerals, including gold, silver, copper, zinc, mercury, in the region. Most of the survey area is underlain by basin fill deposits with no identified metallic ore deposits (BLM and USFS 2010).

Locatable Mineral Resources

Two active claims are located in the Project Area (BLM and USFS 2010). The locations of these claims are listed in **Table 3-5**, Locatable Mineral Resources in the SPPC Project Area.

Table 3-5
Locatable Mineral Resources in the SPPC Project Area

Claim No.	Section	Township	Range	Commodity	Claim Type
NMC80228	16 (north ½)	16 North	31 East	None Listed	Placer
NMC987959 (Neva-Rite 13)	31 and 32	18 North	30 East	None Listed	Lode

Leasable Mineral Resources

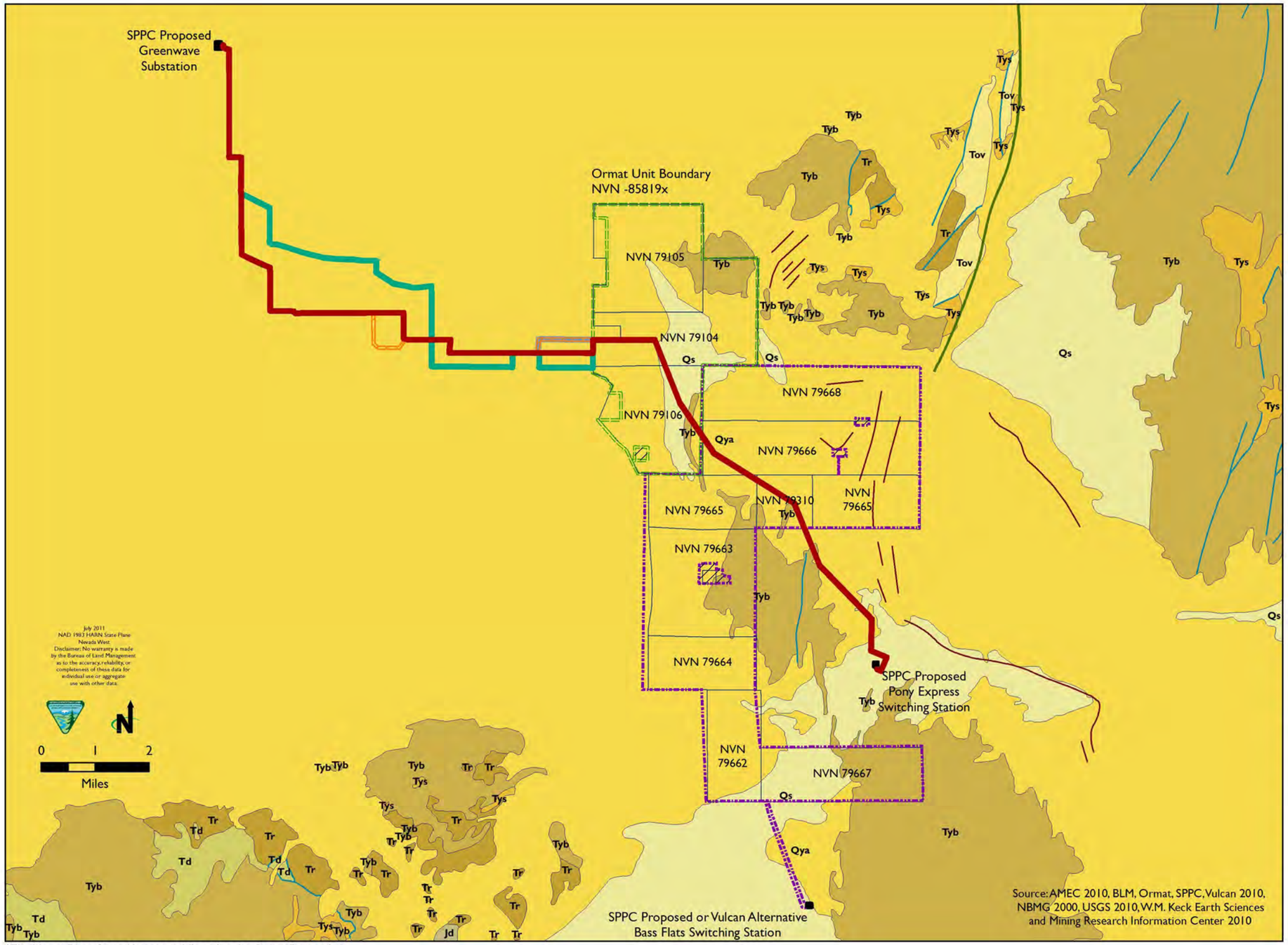
There is one active lease for oil and gas (NVN-82134) in the Project Area. No active coal leases are located within the Project Area. Active geothermal leases exist for Ormat, and Vulcan in those areas where the SPPC Project Area intersects with the Project Areas of those two companies. There is also an active geothermal lease for ENEL intersected by the SPPC Project Area.

Salable Mineral Resources

No existing mineral-material contracts for salable mineral resources are recorded within the SPPC Project Area (BLM and USFS 2010).

Ormat Project Area

The Ormat Project Area consists primarily of deep deposits of silt, sand, gravel, and cobbles (Qya and Qs), which is common across the Carson Desert and Lahontan Valley. These deposits are Holocene to Recent in age (10,000 years old to present) and generally consist of Tertiary age alluvium from the surrounding volcanic mountain ranges. The east side of the Ormat Project Area consists of an east/west trending outcrop of basalt, andesite, rhyolite, silicic tuff, and related rocks (Tyb) (Stewart and Carlson 1977). These rocks are part of Grimes Point and Sehoo Mountain.



Geologic Resources and Authorized Leases

Churchill County, Nevada

Fault Types
- Control Fault
- Zone of faulting thought to control shallow groundwater flow (Seiler & Alexander 1993)
- USGS Reno Quad Faults
- Faults (NBMG 1996 and Greene et al 1991)

Geologic Formation
- JTRls, Limestone and marble
- JTRvl, Volcaniclastic rocks and limestone
- Jd, Dioritic rocks
- Jv, Mafic volcanic rocks
- Kg, Granitic rocks
- Qb, Basalt and basaltic sediments
- Qoa, Older alluvium
- Qog, Older gravels
- Qs, Dune sand
- Qya, Younger alluvium
- TRld, Limestone and dolomite
- TRs, undivided shale, sand, and siltstone
- Ta, andesite flows
- Td, principally flows
- Tdi, intrusive bodies
- Tg, Granitic rocks
- Tol, latite welded tuffs. In Stillwater Range
- Tor, rhyolite to rhyodacite welded tuffs
- Tov, undivided volcanic rocks, mostly basalt and andesite
- Tr, extrusive rhyolite units
- Tyb, Younger basalt and andesite
- Tys, Younger sedimentary rocks
- Is, limestone

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Authorized Geothermal Lease with Lease Number Label
- Excluded from Lease Area

*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-2

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Mineral Resources

Active mining claims and mineral-materials areas within the Ormat Project Area are also documented online at the GeoCommunicator online mapping system. Most of the Ormat Project Area is underlain by basin fill deposits with no identified metallic ore deposits (BLM and USFS 2010).

Locatable Mineral Resources

Table 3-6, Locatable Mineral Resources in the Ormat Project Area, lists one active mining claim in the Ormat Project Area (BLM and USFS 2010).

Table 3-6
Locatable Mineral Resources in the Ormat Project Area

Claim No.	Section	Township	Range	Commodity	Claim Type
NMC987959 (Neva-Rite 13)	31 and 32	18 North	30 East	None Listed	Lode

Leasable Mineral Resources

No active leases for oil, gas, or coal are recorded within the Project Area. Ormat has three active geothermal leases NVN-097104, NVN-079105, and NVN-079106 within the Geothermal Unit NVN-85819X that cover the Project Area and which serves as the basis for Ormat's Proposed Action in this EIS (BLM and USFS 2010).

Salable Mineral Resources

No current mineral-material contracts for salable mineral resources are recorded within the Project Area (BLM and USFS 2010).

Vulcan Project Area

The majority of the Vulcan Project Area consists of deep deposits of silt, sand, gravel, and cobbles. The deep deposits mentioned previously are part of Carson Lake on the west side of the Project Area and the Salt Wells Basin to the northeast of the Project Area, and as described earlier, are Holocene to Recent in age (10,000 years old to present) and generally consist of Tertiary-age parent material from the surrounding volcanic mountain ranges. The central portion of the Vulcan Project Area, consisting of basalt, andesite, rhyolite, silicic tuff, and related rocks, form the Bunejug and Cocoon Mountain ranges. These mountain ranges separate the northern portion of the Vulcan Project Area from the southern portion of the Project Area.

The Vulcan Project Area consists of Qya and Qs, separated in the central portion of the Project Area by Tyb. The Qya and Qs are part of Carson Lake on the west side of the Project Area and the Salt Wells Basin to the northeast of the Project Area (Stewart and Carlson 1977). These deep deposits consist of silt, sand, gravel, and cobbles. The Qya and Qs deposits are Holocene to Recent

in age (10,000 years old to present) and generally consist of Tertiary-age parent material from the surrounding volcanic mountain ranges.

The central portion of the Vulcan Project Area consists of Tyb. These rocks are part of a northwest/southeast trending outcrop of basalt, andesite, rhyolite, silicic tuff, and related rocks (Stewart and Carlson 1977) which form the Bunejug and Cocoon Mountain ranges. These mountain ranges separate the northern portion of the Vulcan Project Area from the southern portion of the Project Area.

Mineral Resources

Active mining claims and mineral-materials areas within the Vulcan Project Area are documented by the GeoCommunicator online mapping system. Most of the Survey Area is underlain by basin fill deposits with no identified metallic ore deposits (BLM and USFS 2010).

Locatable Mineral Resources

Active claims in the Project Area are shown in **Table 3-7**, Locatable Mineral Resources in the Vulcan Project Area (BLM and USFS 2010).

Table 3-7
Locatable Mineral Resources in the Vulcan Project Area

Claim No. (Claim Name)	Section	Township	Range	Commodity	Claim Type
NMC1016569 (ION 7109)	3 (NW QTR)	17 North	29 East	None Listed	Placer
NMC1016568 (ION 7108)	3 (NW QTR)	17 North	29 East	None Listed	Placer
NMC1012455 (ION 6115)	2 (SE QTR)	17 North	30 East	None Listed	Placer
NMC1012447 (ION 5115)	11 (NE QTR)	17 North	30 East	None Listed	Placer
NMC1012446 (ION 5114)	11 (NE QTR)	17 North	30 East	None Listed	Placer
NMC1012454 (ION 6114)	2 (SE QTR)	17 North	30 East	None Listed	Placer
NMC1012441 (ION 4115)	11 (SE QTR)	17 North	30 East	None Listed	Placer
NMC1012440 (ION 4114)	11 (SE QTR)	17 North	30 East	None Listed	Placer

Leasable Mineral Resources

No active leases for oil, gas, or coal are recorded within the Project Area. Vulcan has active geothermal leases covering much of the Project Area (BLM and USFS 2010). The leases within the Project Area include the following: NVN-079666; NVN-079310; NVN-079665; NVN-079667, NVN-079668; NVN-079663, NVN-079662; and NVN-079664.

Salable Mineral Resources

No mineral-material contracts for salable mineral resources are recorded within the Project Area (BLM and USFS 2010).

3.5 SOILS

This section includes a discussion of soil and other surface materials present in the Salt Wells Energy Projects Area (Figure 1-1), including a discussion of the susceptibility of soil to erosion, and the quantity of growth medium available for reclamation.

Regional Overview

The Soil Survey of Churchill County Area published by the Natural Resources Conservation Service (NRCS) (NRCS 2001) provides an introduction to the soil parent materials in the Salt Wells Energy Projects Area, and these parent materials are summarized for each project area. The soils of the Salt Wells Energy Projects Area, similar to much of Churchill County, have formed in areas that were once ancient Lake Lahontan. Lake terraces are common, particularly in the area directly south of the city of Fallon. Stream terraces and floodplains have since formed in the originally lacustrine landscape, and more recent alluvium frequently overlies these erosional surfaces. Mountains and hills in the Salt Wells Energy Projects Area, such as the Bunejug Mountains, generally have thin residual soil overlying shallow rock.

SPPC Project Area

Soil types in the SPPC Project Area are described in the NRCS online database (NRCS 2010). Soil patterns across the landscape are different in the southern, central, and northern portions of the Project Area.

Soil in the southern portion of the Project Area is primarily saline-sodic sandy loam on the footslopes to the northeast of the Bunejug Mountains in NRCS map unit 7017. The southern portion of the proposed transmission line also crosses areas with shallow bedrock beneath gravelly surface materials higher up the slopes of the Bunejug Mountains (NRCS map units 7099 and 7201). Near the northern tip of the Bunejug Mountains, the proposed route crosses areas of dune sand (NRCS map unit 7026) and seasonally water-inundated playas (NRCS map unit 192).

The central portion of the SPPC Project Area runs from the Newlands Project canal west to Highway 95 and Allen Road. Soil formed in lacustrine parent materials is present near the Newlands Project canal (NRCS map units 119, 120

and 121), with sandy mixed alluvium to the west (NRCS map unit 186). Approximately 2 miles west of the Newlands Project canal, the floodplain alluvium becomes fine-grained with surface texture ranging from clay to clay loam (NRCS map units 129, 215, and 216). This clayey floodplain material extends westward approximately 3.5 miles before loamy stream terraces (NRCS map units 132 and 133) are interspersed among the clayey floodplain. The area with interspersed loamy stream terraces extends to Highway 95, and then northward paralleling Highway 95.

The northern portion of the Project Area parallels the Shurz Highway south of the city of Fallon. Loamy stream terraces formed in mixed alluvium (NRCS map units 132, 133, 140, and 149), with smaller areas of sandy stream terraces (NRCS map unit 154) occur in this portion of the Project Area, which includes the proposed transmission line route. Soil map units in this area are similar in size to map units in the complex floodplain of the central portion of the corridor toward the Newlands Project canal, but the area along Highway 95 has more consistency of parent material and surface soil texture. Soil on the east-west route towards the Newland Project canal is saline or saline-sodic with little vegetation. Soil in the northern portion of the corridor parallel to the Highway 95 consists of loamy stream terraces formed in mixed alluvium which allows growth of a wider variety of vegetation than in salt-affected areas.

Soil features relevant to reclamation and erosion are listed in **Appendix G**, Soils, **Table G-1**, Soil Map Units in Proposed Areas of Disturbance – SPPC Project Area. Features are listed for each of the soil map units encountered along the proposed transmission line corridor. Surface texture (clay to sand), salinity or sodicity, and depth to groundwater are listed, along with Whole Soil Erodibility Factor (Kw) and Wind Erodibility Group (WEG) for each map unit. All values were obtained from the NRCS database (NRCS 2010). Listed values for Kw and WEG are general values assigned by NRCS to each soil map unit. As shown in Table G-1, almost all soil in the transmission corridor is salt-affected and is described by NRCS as being saline or sodic. Depth to groundwater is 60 inches or less for most of the map units, including two areas with frequent ponding or groundwater close to the ground surface (NRCS map units 186 and 192). Areas with ponding intersect the proposed transmission line corridor briefly in the southern and central portions of the Project Area.

The relative potential for water erosion is indicated by the Kw of each soil map unit. The Kw for each soil map unit encountered along the proposed transmission line corridor indicates either low or medium relative susceptibility to erosion. Actual erosion would depend upon weather and soil management practices.

In contrast to water erosion, multiple areas within the Project Area exhibit susceptibility to wind erosion. Soil map units with high wind erosion susceptibility (WEG of 1) are listed in **Table G-1** and shown in **Figures 3-3**

through **3-5**, Soil Wind Erodibility Group, SPPC Northern, Central, and Southern. These areas contain sandy soil (NRCS map units 102, 154, 186, and 7026) and generally have formed sand dunes with no vegetation due to wind erosion and lack of fine-grained material or organic matter.

The depth of the surface horizon along the proposed transmission line route ranges from 3 to 14 inches, with most areas having surface horizon thicknesses from 5 to 10 inches. Although in many areas this material is not considered topsoil, the surface horizon represents the available growth medium present in the Project Area. Most of the surface horizon material in the Project Area is a poor growth medium for most plants, and supports sparse vegetation. Approximately six inches, or 655,480 cubic yards, (see **Appendix G**, **Table G-2**, Volume of Growth Medium - SPPC Project Area - Proposed Action) of surface horizon material could be salvaged and used in reclamation of disturbed areas.

Alternative 1

Alternative 1 crosses a similar landscape in close proximity to the Proposed Action and encounters similar soil types. The volume of growth medium for Alternative 1 is shown in **Appendix G**, **Table G-3**, Volume of Growth Medium - SPPC Project Area – Alternatives.

Alternative 2

Two and one half miles of the proposed transmission line route are different between Alternative 2 and the Proposed Action. Alternative 2 crosses a similar landscape in close proximity to the Proposed Action, and encounters similar soil types as the Proposed Action. The volume of growth medium for Alternative 2 is shown in Table G-3.

Ormat Project Area

Soil and other surface materials in the Project Area include Badlands and silty, saline-sodic soil on the toeslopes northeast of the Bunejug Mountains (NRCS map units 240 and 7220). North of the Badlands areas, surface material of the proposed north-south production pipeline route consists of two general categories: 1) dune sand formed in lacustrine deposits (NRCS map units 163 and 7026); and 2) saline, clayey soil with shallow groundwater in floodplain alluvium (NRCS map units 129, 144, 145, and 208). The dune sand areas lie east of the clayey floodplain areas. The floodplain alluvium extends north and northwest through the proposed power plant site and along the route of the proposed injection pipeline.

Clayey, saline soil occurs east of the clayey floodplain areas, east of the Newlands Project canal. These soil types are similar to other soil in the floodplain areas, but are formed in lacustrine deposits (NRCS map unit 121). These lacustrine deposits extend through the loop in the proposed production pipeline northeast of the proposed power plant.

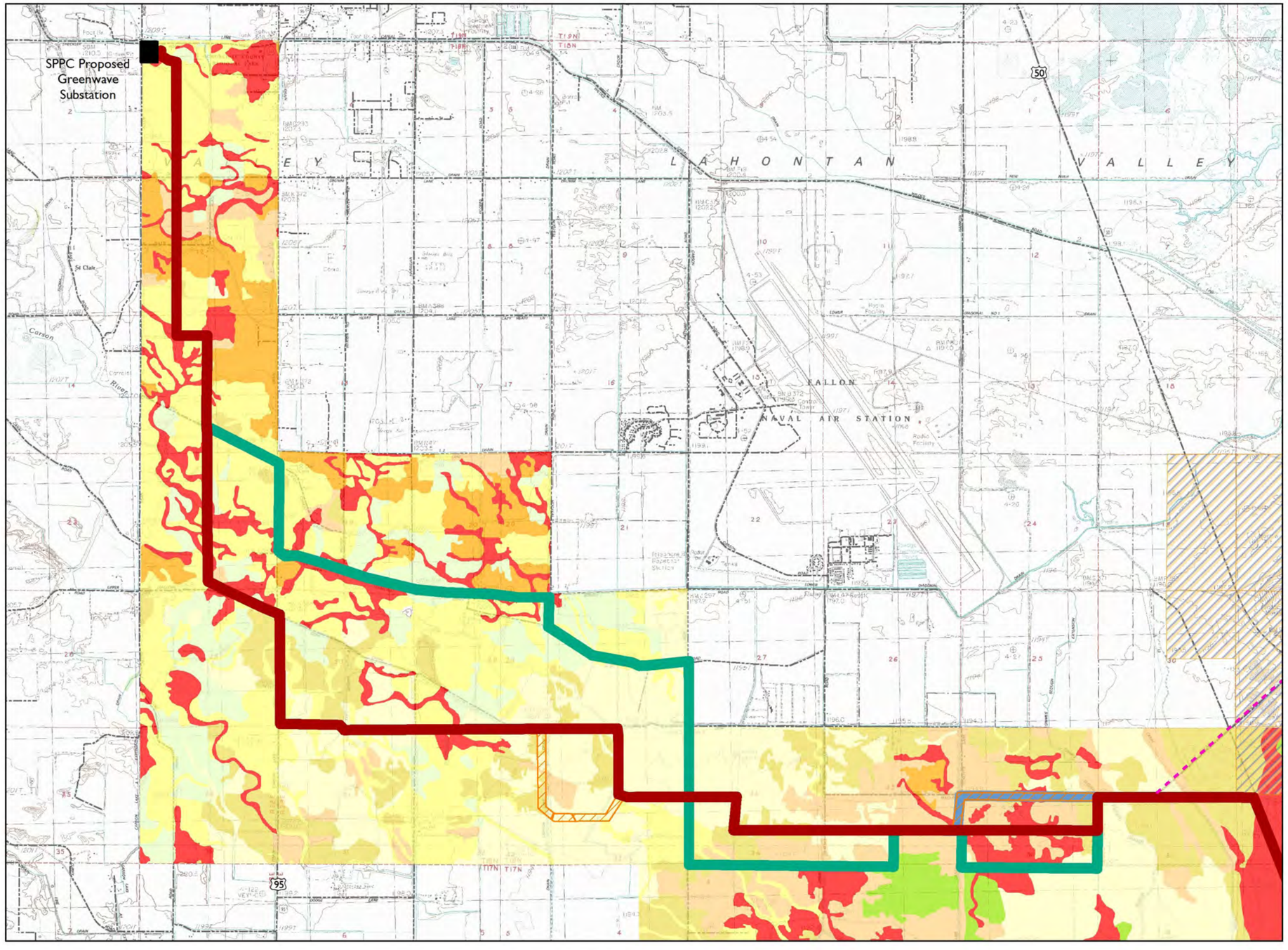
The proposed pipeline route briefly crosses sandy, very saline soil along the Newlands Project canal (NRCS map unit 119) northeast of the proposed power plant, near the northern end of the proposed injection pipeline.

Soil features relevant to reclamation and erosion are listed in **Appendix G**, **Table G-4**, Soil Map Units in Proposed Areas of Disturbance – Ormat Project Area. Features are listed for each of the soil map units encountered in areas of disturbance within the Ormat Survey Area. The Kw and WEG are listed for each map unit, along with average surface horizon thickness in the map unit. The listed values for Kw and WEG are general values assigned by NRCS to the complete soil map unit. Major map unit components are also described in Table G-4, including characteristics of surface horizon thickness, texture, salinity or sodicity, and depth to shallow groundwater or shallow bedrock, if present. All values were obtained from the NRCS database (NRCS 2010). Nearly all soil types in the Project Area are salt-affected and described by NRCS as saline or sodic. Depth to groundwater is 60 inches or less for the majority of the map units.

The relative potential for water erosion is indicated by the Kw of each soil map unit (see Table G-4). The Kw values for soil map units in the Project Area indicate either low or medium relative susceptibility to erosion. Actual erosion would depend upon climate and soil management practices.

Soil map units with high wind erosion susceptibility (WEG of 1) are listed in Table G-4 and are shown on **Figure 3-6**, Soil Wind Erodibility Group, Ormat. These areas contain sandy soil (NRCS map units 147, 163 and 7026) and generally include dune land with no vegetation due to wind erosion and lack of fine-grained material or organic matter.

The depth of the surface horizon in the Ormat Survey Area ranges from 2 to 18 inches, with most areas having surface horizon thicknesses from 5 to 10 inches. Although in many areas this material is not considered topsoil, the surface horizon represents the growth medium present. Most of the surface horizon material in the Ormat Survey Area is a poor growth medium for plants, and supports sparse vegetation. Saline and/or sodic conditions exist in much of the area. Approximately six inches, or 258,908 cubic yards, (see **Appendix G**, **Table G-5**, Volume of Growth Medium - Ormat Project Area - Proposed Action) of surface horizon material could be salvaged and used in reclamation of disturbed areas. Road surfaces, well pads, pipelines, and a power plant, would occupy most disturbed areas following construction, and therefore would not be reclaimed. Staging areas and construction roads would be reclaimed using surface material stockpiled adjacent to the area of disturbance, or by eliminating traffic from areas where the surface soil was left in-place during construction.



Soil Wind Erodibility Group, SPPC Northern

Churchill County, Nevada

Rating, Properties, Index
- 1, Sand, 310 to 134
- 2, Loamy very fine sand, etc., 134
- 3, Sandy loam, etc., 86
- 4, Clay, clay loam, etc., 86
- 4L, Calcareous loam, etc., 86
- 5, Noncalcareous loam that has less than 20 percent clay, etc., 56
- 6, Noncalcareous loam and silt loam that have greater than or equal to 20 percent clay, etc., 48
- 8, Soils not susceptible to wind erosion due to rock and pararock fragments at the surface and/or wetness, etc., 0

SPPC Project Area
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor
- Alternative Macari Fiber Optic Line
- Proposed Substation

Other Features
- No Surface Occupancy

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, USDA 2010, W.M. Keck Earth Sciences and Mining Research Information Center 2010

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Miles

July 2011
NAD 1983 HARN StatePlane Nevada West
Disclaimer: 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.

Figure 3-3

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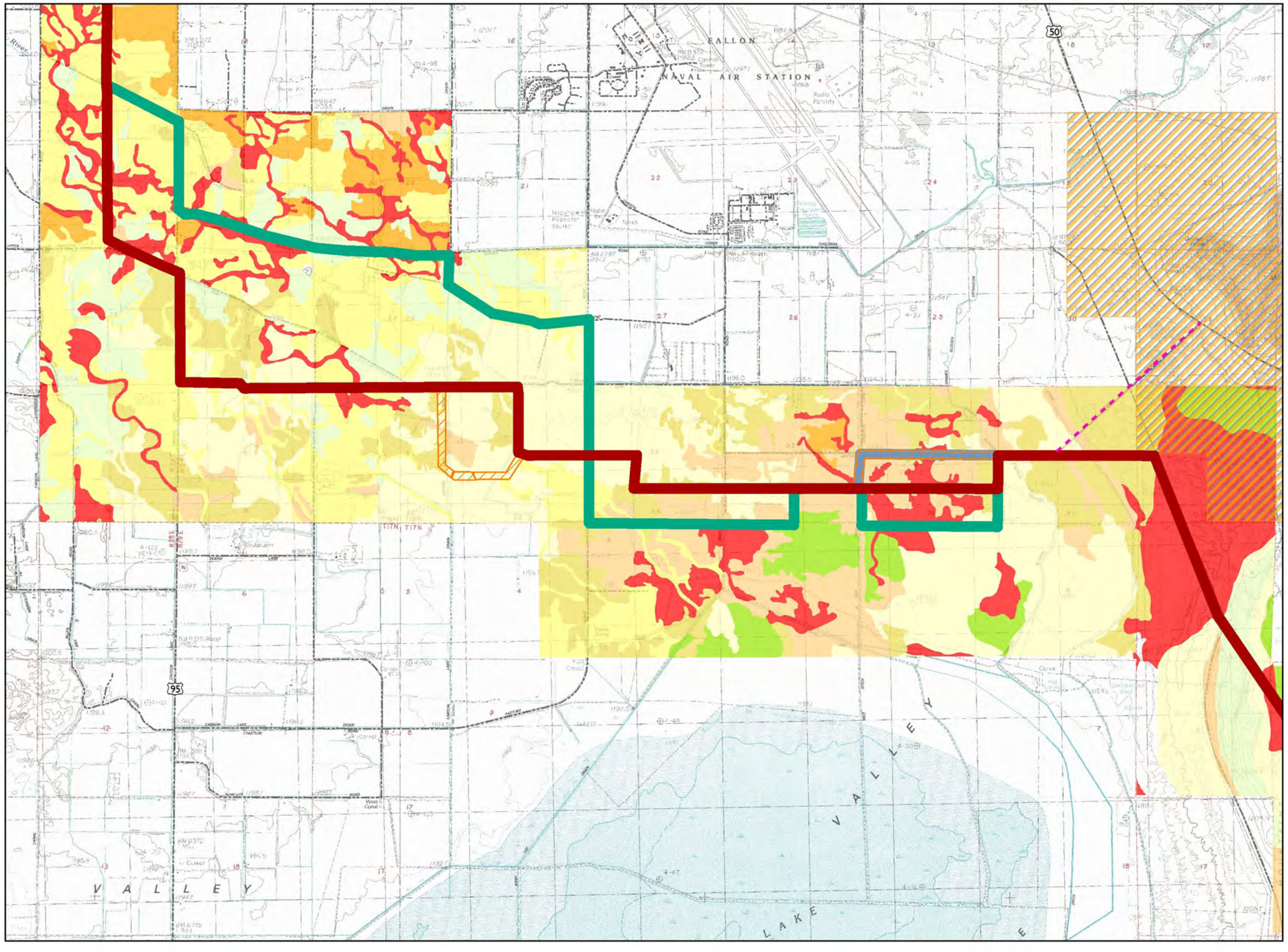

Soil Wind Erodibility Group, SPPC Central

Churchill County, Nevada

Rating, Properties, Index
- 1, Sand, 310 to 134
- 2, Loamy very fine sand, etc., 134
- 3, Sandy loam, etc., 86
- 4, Clay, clay loam, etc., 86
- 4L, Calcareous loam, etc., 86
- 5, Noncalcareous loam that has less than 20 percent clay, etc., 56
- 6, Noncalcareous loam and silt loam that have greater than or equal to 20 percent clay, etc., 48
- 8, Soils not susceptible to wind erosion due to rock and pararock fragments at the surface and/or wetness, etc., 0

SPPC Project Area
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor
- Macari Fiber Optic Alternative

Other Features
- No Surface Occupancy

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, USDA 2010, W.M. Keck Earth Sciences and Mining Research Information Center 2010

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Figure 3-4

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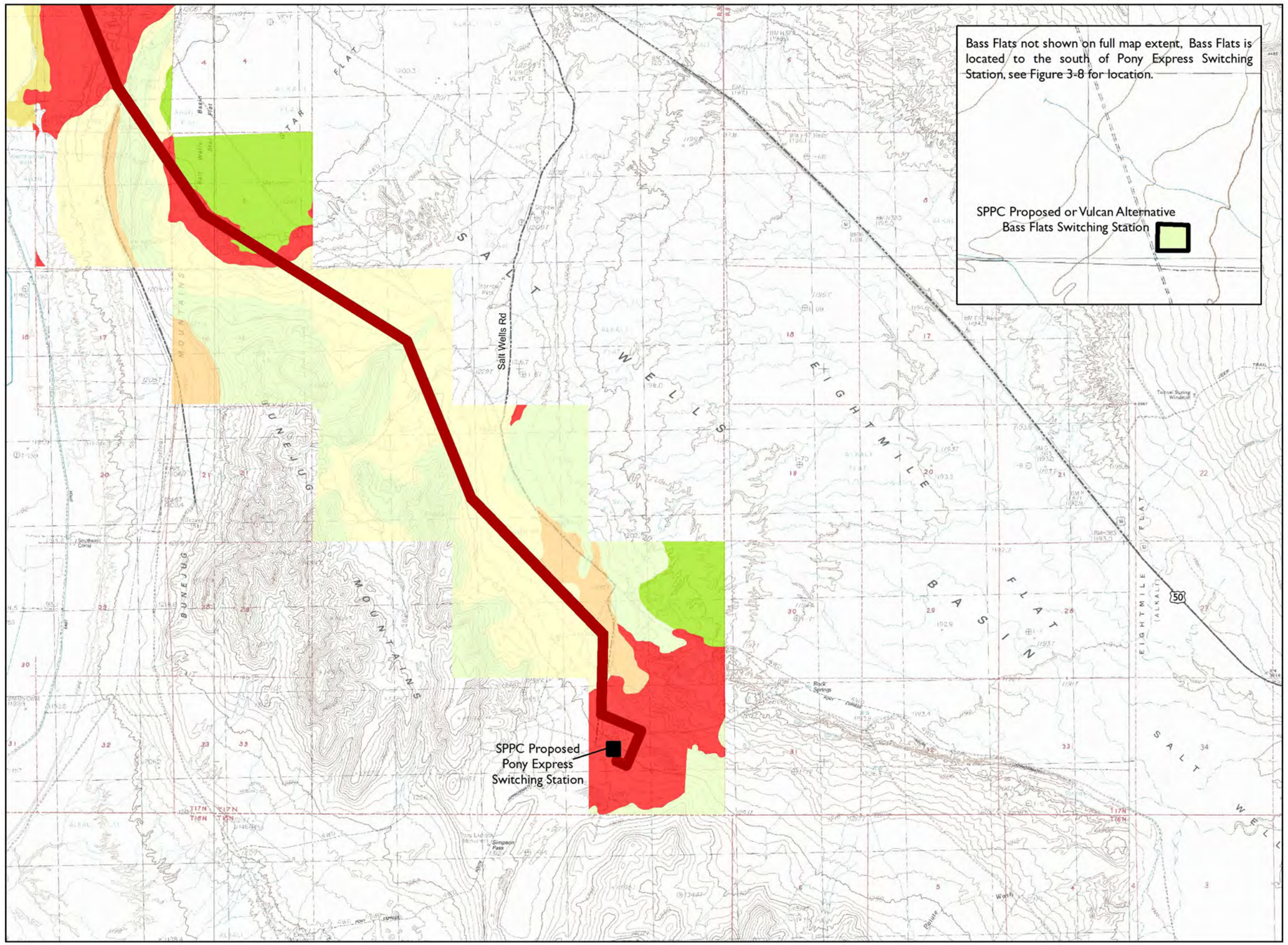

Soil Wind Erodibility Group, SPPC Southern

Churchill County, Nevada

Rating, Properties, Index
- 1, Sand, 310 to 134
- 2, Loamy very fine sand, etc., 134
- 3, Sandy loam, etc., 86
- 4, Clay, clay loam, etc., 86
- 4L, Calcareous loam, etc., 86
- 5, Noncalcareous loam that has less than 20 percent clay, etc., 56
- 6, Noncalcareous loam and silt loam that have greater than or equal to 20 percent clay, etc., 48
- 8, Soils not susceptible to wind erosion due to rock and pararock fragments at the surface and/or wetness, etc., 0

SPPC Project Area
- Proposed 230 kV Transmission Line Corridor

Other Features
- Proposed Switching Station

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, USDA 2010, W.M. Keck Earth Sciences and Mining Research Information Center 2010

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Figure 3-5

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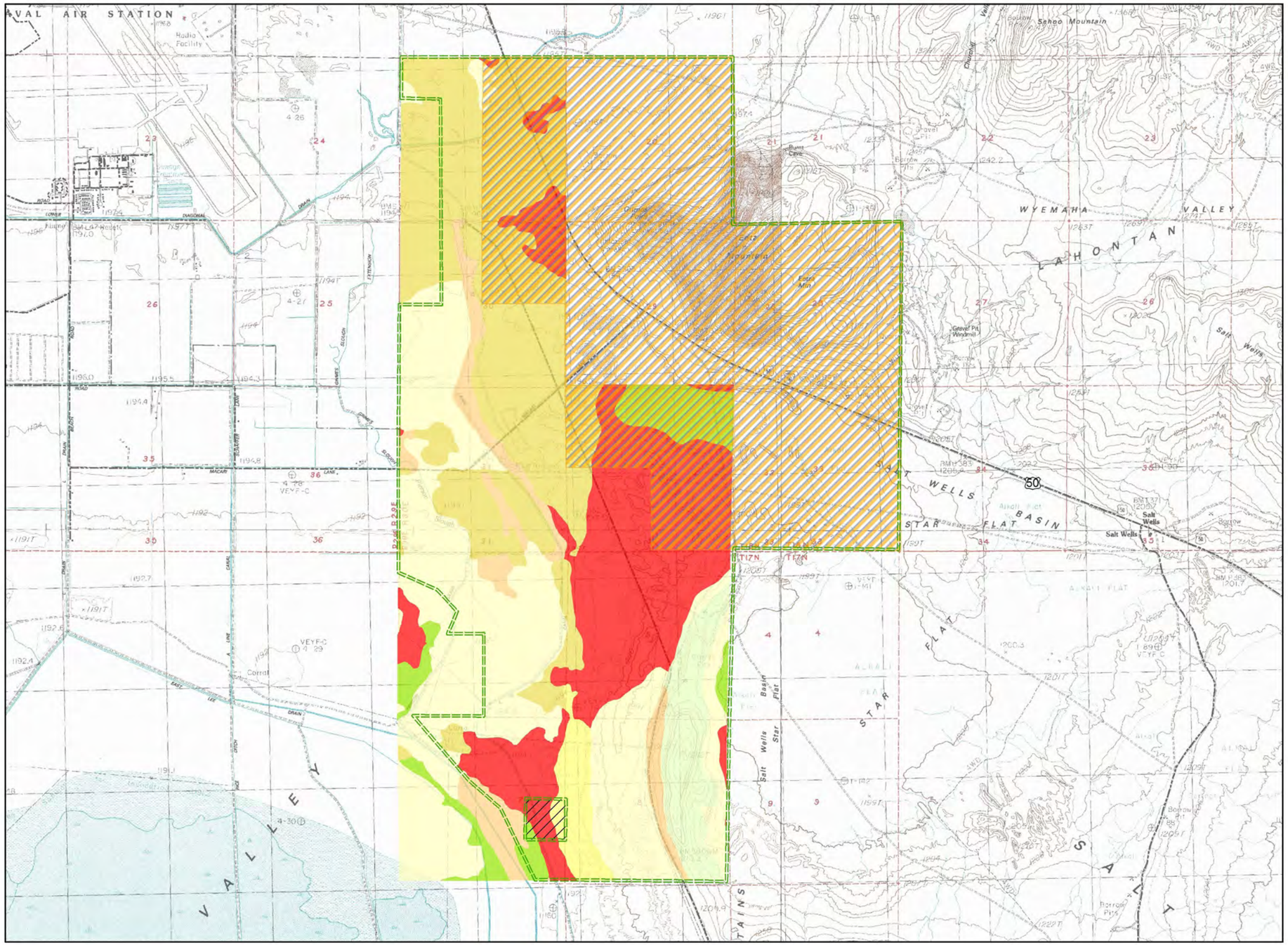

Soil Wind Erodibility Group, Ormat

Churchill County, Nevada

Rating, Properties, Index
- 1, Sand, 310 to 134
- 3, Sandy loam, etc., 86
- 4, Clay, clay loam, etc., 86
- 4L, Calcareous loam, etc., 86
- 5, Noncalcareous loam that has less than 20 percent clay, etc., 56
- 6, Noncalcareous loam and silt loam that have greater than or equal to 20 percent clay, etc., 48
- 8, Soils not susceptible to wind erosion due to rock and pararock fragments at the surface and/or wetness, etc., 0

Ormat Project Area
- Ormat Project Area Boundary

Other Features
- No Surface Occupancy
- Excluded from Lease Area

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, USDA 2010, W.M. Keck Earth Sciences and Mining Research Information Center 2010

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NAD 1983 HARN StatePlane Nevada West

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Figure 3-6

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Alternative 1

Alternative 1 crosses a similar landscape in close proximity to the Proposed Action and with similar soil types. The volume of growth medium for Alternative 1 is shown in **Appendix G**, **Table G-6**, Volume of Growth Medium - Ormat Project Area – Alternatives.

Vulcan Project Area

The soil and other surface materials in the Project Area are within map units that have at least 50 percent Biddleman and Mazuma components. These soil types are saline-sodic sandy loams on the footslopes west and north of the Bunejug Mountains (NRCS map units 7017 and 7023).

Soil types in most of the proposed disturbance area in the vicinity of Salt Wells are fine-grained, saline or saline-sodic, and have shallow groundwater or ponding. Major map units in the area south of Salt Wells are the Tarupah-Parran association (NRCS map unit 7024) and Playas (NRCS map unit 192).

The remaining Vulcan Survey Area falls into two general soil categories. The first category consists of sandy material on the northern and southern ends of the Project Area. These sandy areas contain associations of dune sand with either sand sheets or finer-grained, saline-sodic components. The sandy areas include the Isolde-Parran-Appian association (NRCS map unit 7026), which is present at both the northern and southern ends of the Project Area, and the Hawsley-Isolde association (NRCS map unit 7022) present at the southeastern terminus of the area to be disturbed. The second category is the toeslope east of the Bunejug Mountains, which consists of Badlands and silty saline-sodic soil (NRCS map units 240 and 7220).

Soil features relevant to reclamation and erosion are listed in **Appendix G**, **Table G-7**, Soil Map Units in Proposed Areas of Disturbance – Vulcan Project Area. Features are listed for each of the soil map units encountered in the Project Area. The Kw and WEG are listed for each map unit, along with average surface horizon thickness in the map unit. The listed values for Kw and WEG are general values assigned by NRCS to the complete soil map unit. The major map unit components are also described in Table G-7, including characteristics of surface horizon thickness, texture, salinity or sodicity, and depth to groundwater or bedrock, if present. All values were obtained from the NRCS database (NRCS 2010). Nearly all soil of the Vulcan Survey Area is salt-affected, and described by NRCS as saline or sodic. Depth to groundwater is 60 inches or less for the many areas, including frequent ponding in playas. Shallow bedrock is present in three individual map unit components.

The relative potential for water erosion is indicated by the Kw of each soil map unit encountered along the proposed disturbance area. Either low or medium Kw values are present in the Project Area, indicating low or moderate relative susceptibility to erosion. Actual erosion would depend on climate and soil management practices.

Soil map units with high wind erosion susceptibility (WEG of 1) are listed in Table G-7 and are shown on **Figure 3-7,** Soil Wind Erodibility Group, Vulcan. These areas contain sandy soil (NRCS map units 7022 and 7026), and generally include some dune land with no vegetation due to wind erosion and lack of fine-grained material or organic matter.

The depth of the surface horizon in the Project Area ranges from 0 to 20 inches, with most areas having surface horizon thicknesses from 3 to 8 inches. Although in many areas this material is not considered topsoil, the surface horizon represents the growth medium present. Most of the surface horizon material in the Project Area is a poor growth medium for plants, and supports sparse vegetation. Saline and/or sodic conditions exist in much of the area. Approximately five inches, or 842,799 cubic yards, (see **Appendix G**, **Table G-8**, Volume of Growth Medium - Vulcan Project Area - Proposed Action) of surface horizon material would be available for salvage and use in reclamation of disturbed areas. Road surfaces, well pads, pipelines, and a power plant, would occupy most disturbed areas following construction, and therefore would not be reclaimed. Staging areas and construction roads would be reclaimed using surface material stockpiled adjacent to the area of disturbance, or by eliminating traffic from areas where the surface soil was left in-place during construction.

Alternative 1

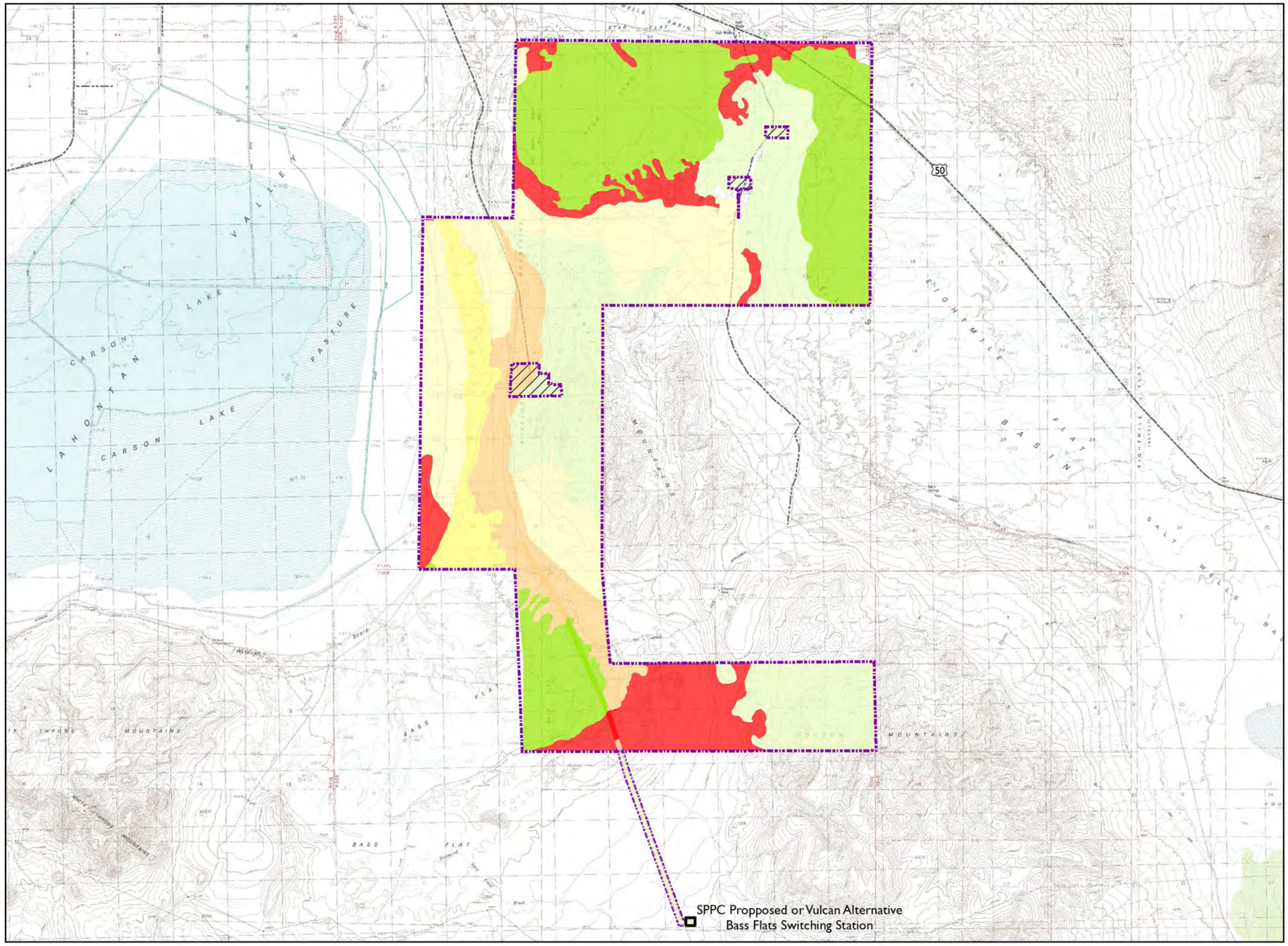
Alternative 1 would extend into additional acreage to the south of the Proposed Action. This additional acreage is highly susceptible to wind erosion (see Figure 3-7). The volume of growth medium for Alternative 1 is shown in **Appendix G**, **Table G-9**, Volume of Growth Medium - Vulcan Project Area – Alternatives.

3.6 FARM LANDS (PRIME OR UNIQUE)

The following data and information is presented to assist agency compliance with the Farmlands Protection Policy Act (FPPA). The locations and acreages of Prime and Unique Farmlands in the Salt Wells Energy Projects Area are identified based on information in the NRCS online soils database (NRCS 2010).

Regional Overview

No land is classified as Unique Farmland in the Salt Wells Energy Projects Area. All potential Prime Farmland in the Projects Area requires irrigation, abatement of salts, or depends upon climatic and wind erosion variables to qualify as Prime or Unique Farmland. The majority of potential Prime Farmland is located south of the city of Fallon and north of Carson Lake and Pasture, where the land is currently supporting agricultural fields (**Figure 3-8**, Farmlands). The majority of the potential Prime Farmland in the vicinity of the Projects Area is located on private land, with the exception of potential Prime Farmland on Reclamation land immediately north and northwest of Carson Lake and Pasture. Minor areas of potential Prime Farmland are located immediately northeast of Carson Lake and Pasture. No potential Prime Farmland is present eastward into the badlands,



Soil Wind Erodibility Group, Vulcan

Churchill County, Nevada

Rating, Properties, Index
- 1, Sand, 310 to 134
- 3, Sandy loam, etc., 86
- 4, Clay, clay loam, etc., 86
- 5, Noncalcareous loam that has less than 20 percent clay, etc., 56
- 6, Noncalcareous loam and silt loam that have greater than or equal to 20 percent clay, etc., 48
- 8, Soils not susceptible to wind erosion due to rock and pararock fragments at the surface and/or wetness, etc., 0

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching Station
- Excluded from Lease Area

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, USDA 2010, W.M. Keck Earth Sciences and Mining Research Information Center 2010

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Figure 3-7

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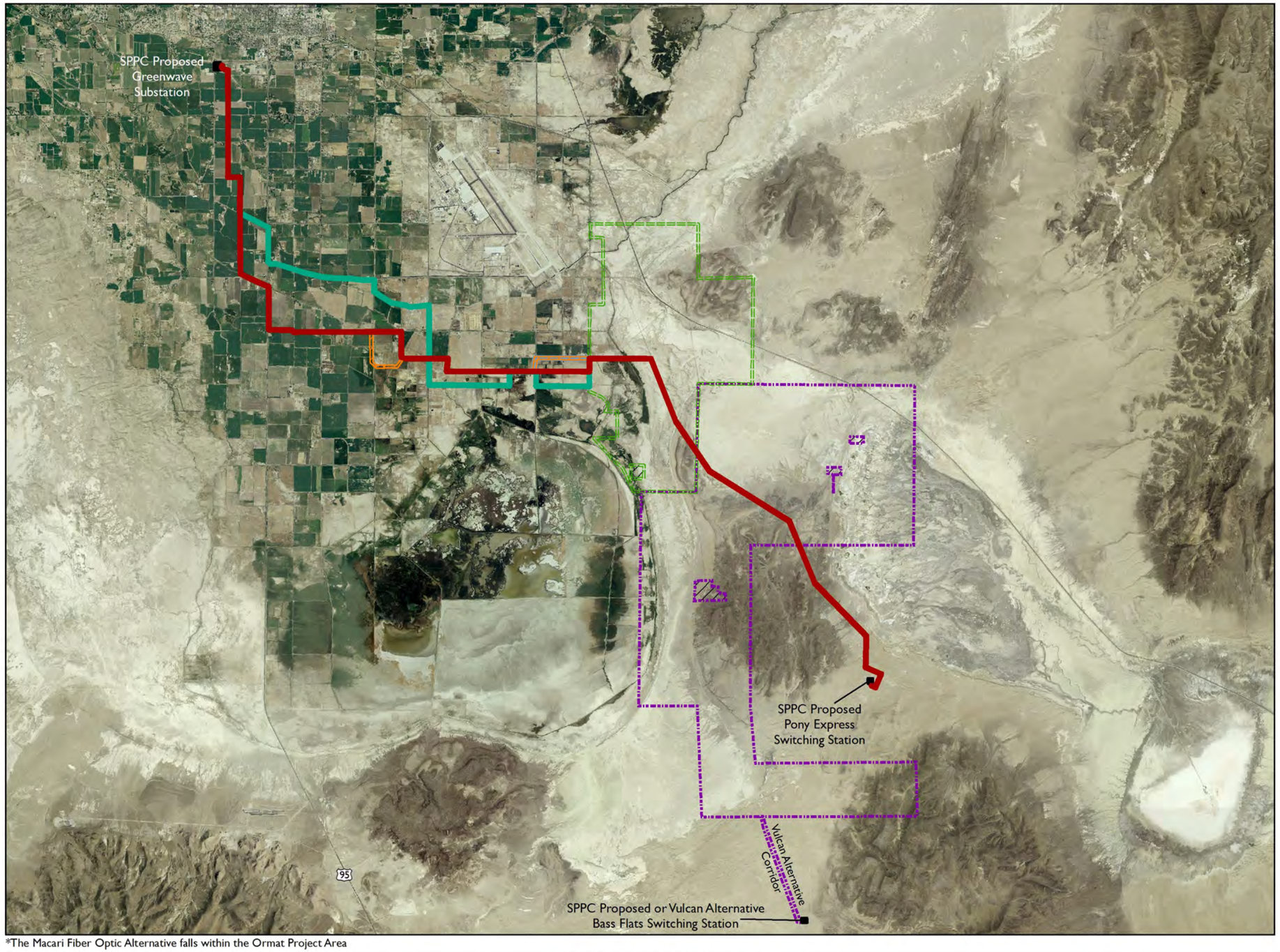

Farmlands

Churchill County, Nevada

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Excluded from Lease Area

Areas on aerial photograph that are green in color and regular in shape (square or rectangular) are agricultural fields.

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, USGS 2010

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*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-8

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playas, rocky areas, and salt flats of the Bunejug Mountains and surrounding areas (**Figure 3-9**, Prime Farmlands).

The entire Salt Wells Energy Projects Area is located on non-urban land. Land use to the south of Fallon and north of Carson Lake and Pasture is generally agricultural, and the remaining portions of the Projects Area are non-agricultural rural land, such as salt flats, mountainous areas, or areas of dune sand.

SPPC Project Area

The SPPC Survey Area includes agricultural land directly south of Fallon and non-agricultural land in the vicinity of the Bunejug Mountains. The quantity of potential Prime Farmland in the SPPC Survey Area is shown for the Proposed Action and Alternatives in **Table 3-8**, Acres of Potential Prime Farmland – SPPC Survey Area. Within the potential Prime Farmland in the SPPC Survey Area, 370.1 acres are proposed for temporary disturbance and 151.8 acres are proposed for permanent disturbance. The majority of this land would require reclamation of salts and/or sodium to qualify as Prime Farmland, as indicated in Table 3-8. Where the proposed transmission line corridor would encounter potential Prime Farmland, the line would be located generally at the margins of existing property boundaries; adjacent to roadways or canals. Action and Alternatives in **Table 3-8**, Acres of Potential Prime Farmland – SPPC Survey Area. Within the potential Prime Farmland in the SPPC Survey Area, 370.1 acres are proposed for temporary disturbance and 151.8 acres are proposed for permanent disturbance. The majority of this land would require reclamation of salts and/or sodium to qualify as Prime Farmland, as indicated in Table 3-8. Where the proposed transmission line corridor would encounter potential Prime Farmland, the line would be located generally at the margins of existing property boundaries; adjacent to roadways or canals.

Table 3-8
Acres of Potential Prime Farmland – SPPC Survey Area

	Prime Farmland If Irrigated (acres)	Prime Farmland If Reclaimed of Salts and/or Sodium (acres)	Climate Dependent Prime Farmland (acres)	Total Potential Prime Farmland (acres)
Temporary Disturbance Area				
Proposed Action	96.3	263.3	10.5	**370.1**
Alternative 1	68.2	317.4	22.6	**408.1**
Alternative 2	95.3	261.1	10.5	**366.9**
Permanent Disturbance Area				
Proposed Action	38.3	109.2	4.3	**151.8**
Alternative 1	26.6	134.3	9.8	**170.7**
Alternative 2	37.7	108.4	4.3	**150.4**

Ormat Project Area

Potential Prime Farmland in the Ormat Survey Area are located mostly in the northern portion of the Survey Area, as shown in Figure 3-9. One of the proposed well pads in the southern portion of the Ormat Survey Area would be located in potential Prime Farmland. As shown in **Table 3-9**, Acres of Potential Prime Farmland – Ormat Survey Area, there are 198.6 acres of potential Prime Farmland in the Ormat Survey Area, 193 acres of which would require abatement of salts and/or sodium to qualify as Prime Farmland. None of the potential Prime Farmland in the Ormat Survey Area is currently supporting agriculture.

Table 3-9
Acres of Potential Prime Farmland – Ormat Proposed Action

Prime Farmland If Irrigated (acres)	Prime Farmland If Reclaimed of Salts and/or Sodium (acres)	Climate Dependent Prime Farmland (acres)	Total Potential Prime Farmland (acres)
Temporary Disturbance Area			
5.6	193.0	0.0	**198.6**

Source: AMEC 2010

Vulcan Project Area

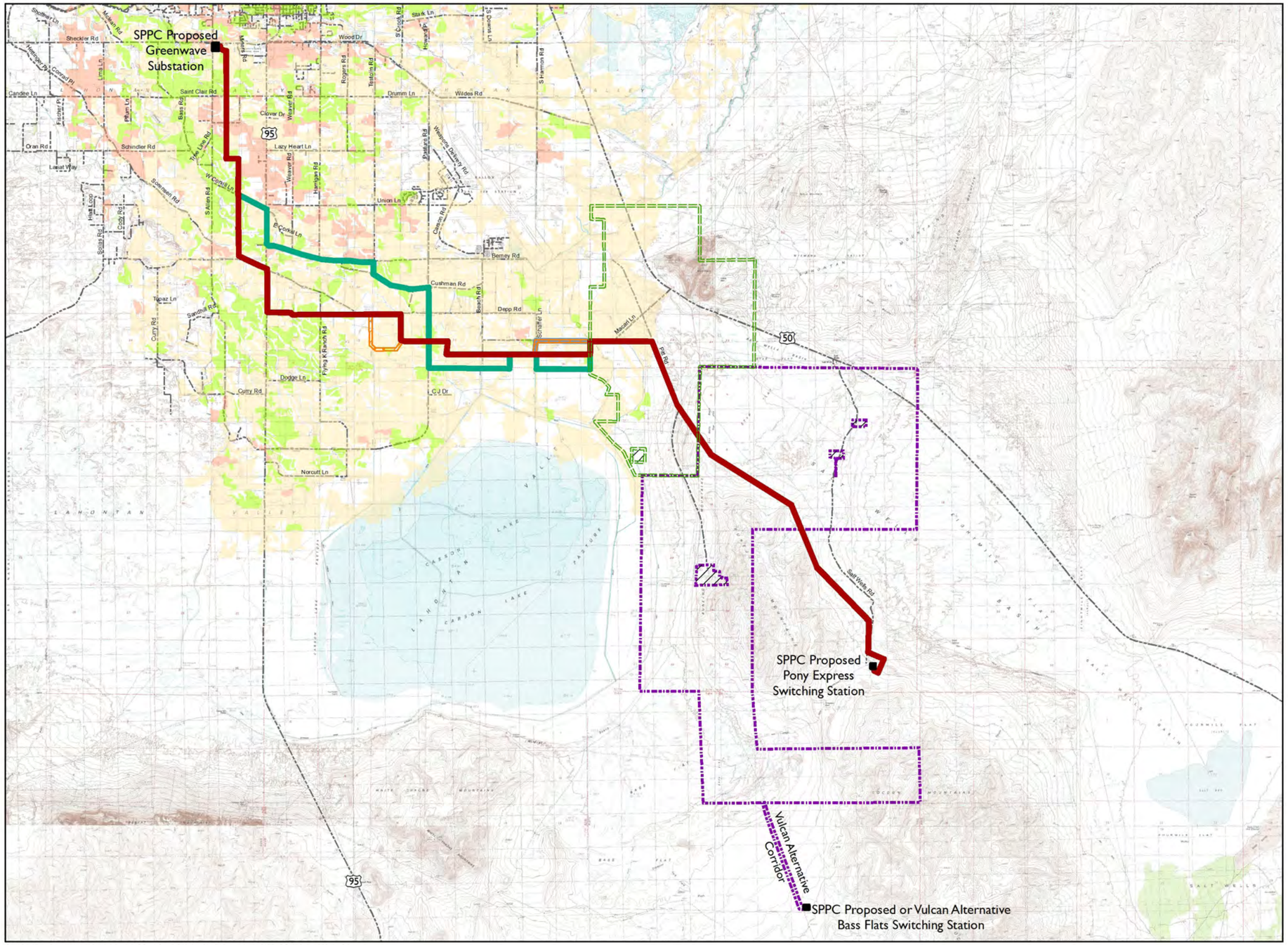
No Prime or Unique Farmlands are located in the Vulcan Project Area.

3.7 WATER QUALITY AND QUANTITY

This section describes water resources in the Salt Wells Energy Projects Area. Information for this section was obtained from available documents and data; however, proprietary subsurface geologic and hydrogeologic information from Ormat and Vulcan for their leases was not available for review.

Regional Overview

The Salt Wells Energy Projects Area is located in the Basin and Range physiographic province of west-central Nevada which is characterized by small north- and northeast-trending mountain ranges separating alluvium-filled valleys that contain terminal lakes or playas (BLM 2005). The proposed geothermal developments lie southeast of Fallon, Nevada, in the western portion of the Basin and Range where topography is characterized by endorheic, or internally drained, closed basins. The Salt Wells Basin is located on the southeast margin of the Carson Desert, a large terminal lake basin that contains the Carson Sink (**Figure 3-10**, Springs, Seeps, and Surface Water Features). The Bunejug and Lahontan mountain ranges rise to elevations above 4,500 feet near the Salt Wells Energy Projects Area. Harrill et al. (1988) delineated two scales of hydrologic systems located in the Projects Area: Carson River (major hydrologic flow system) and Lahontan Valley (hydrographic area).



Prime Farmlands

Churchill County, Nevada

Prime Farmland
- Prime Farmland if Salt/Sodium is Reclaimed
- Prime Farmland if Irrigated
- Climate Dependent Prime Farmland

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Excluded from Lease Area

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, NRCS 2010

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*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-9

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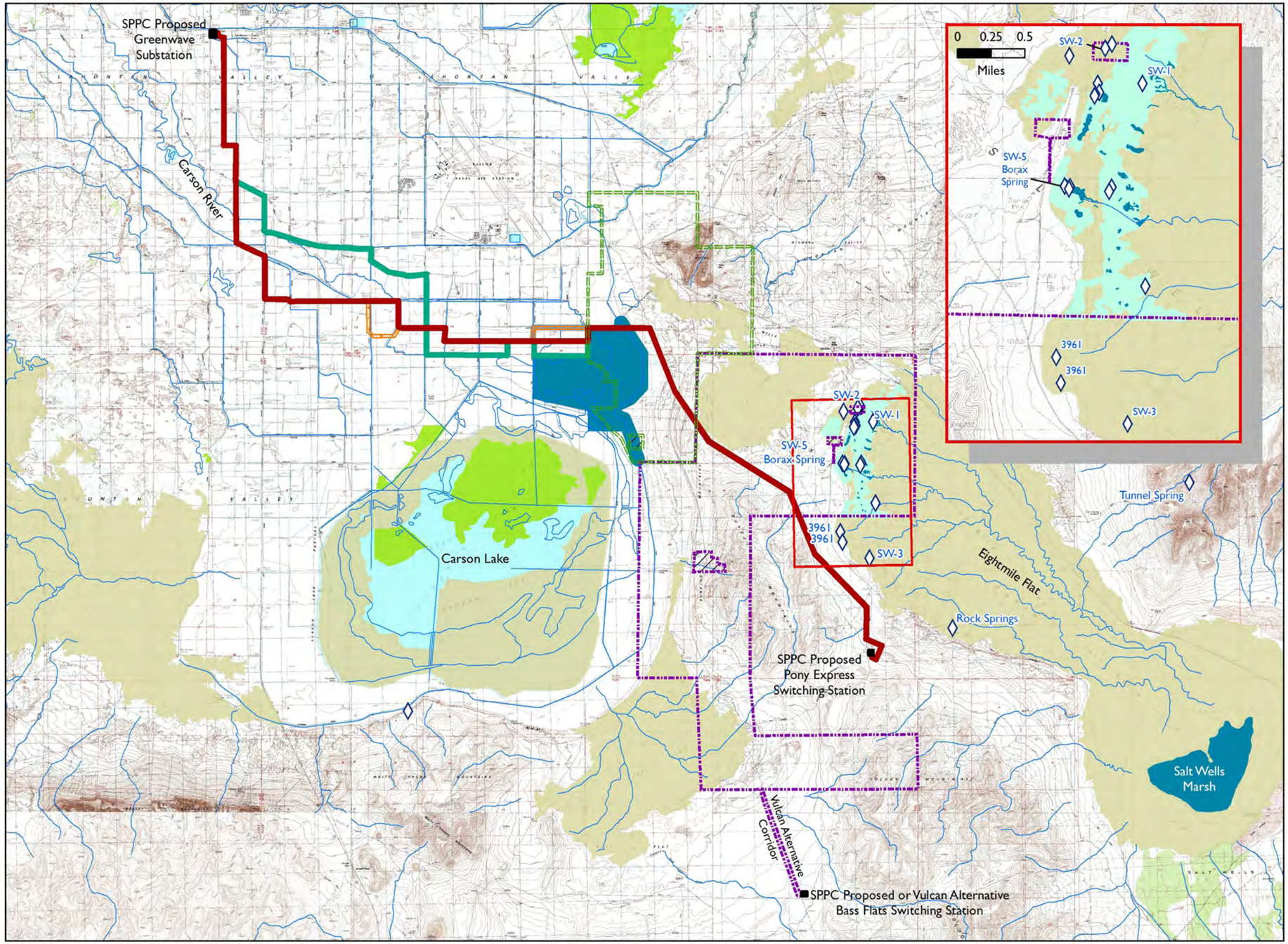

Springs, Seeps, and Surface Water Features

Churchill County, Nevada

Surface Water Feature
- Lake - Reservoir
- Playa
- Major Wetland
- Perennial Wetland
- Seasonal Wetland
- Spring/Seep
- Stream or Canal

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Excluded from Lease Area

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, Coolbaugh 2010, Huffman and Carpenter 2010, NNHP 2010, W.M. Keck Earth Sciences and Mining Research Information Center 2010

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*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-10

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Surface Water

Major surface water features in or near the Salt Wells Energy Projects Area (Figure 3-10) include:

- Carson River;
- Irrigation canals, laterals, and drains;
- Carson Lake and surrounding wetland complex;
- Other perennial and seasonal wetlands;
- Hot and warm springs and seeps;
- Non-geothermal springs; and
- Salt Wells playa

Surface Water Quantity

The Carson River lies northwest of the Salt Wells Energy Projects Area and is a major source of recharge in the Carson Desert (Lico and Seiler 1993). After exiting Lahontan Reservoir, the river flows from southwest to northeast toward the Carson Sink. A portion of the flow is diverted for irrigation downstream of the reservoir, and the river also supports wetlands within the Lahontan Valley. The ultimate discharge point for the river is the Carson Sink. Mean annual discharge of the Carson River below Lahontan Reservoir was 375,000 ac-ft based on the period 1967 to 1992 (Seiler and Allander 1993). Of that volume, approximately 50,000 ac-ft per year discharge to Carson Sink (Maurer et al. 1996). The Carson River is hydraulically connected to local basin-fill aquifers.

The USGS monitors the Carson River at two locations near the Salt Wells Energy Project Area: Station No. 10312150 below Lahontan Reservoir near Fallon and Station No. 10312275 at Tarzyn Road near Fallon. At the first upstream station below the reservoir, mean annual flow ranges from 181 to 1,066 cubic feet per second (cfs) during the period of record (1967 to 2010) (USGS 2011). Over the last 10 years (2001 to 2010), the average of the mean annual flows was 386 cfs. At the second downstream station, mean annual flow ranges from 2.4 to 170 cfs during the period of record (1986 to 2010) (USGS 2011). Over the last 10 years, the average of the mean annual flows was 18 cfs. These flow ranges show that a significant amount of water is removed for irrigation between the upper and lower stations. Mean monthly flows at the upper station, which is not significantly affected by irrigation withdrawals, but is affected by storage in the reservoir, show that the high flow period is May through July (905 to 973 cfs), with lowest flows in December (41 cfs), followed by November, January, and February (110 to 141 cfs) (USGS 2011).

The USGS also monitors one of the diversion canals near Fallon – Station No. 10312210, Stillwater Point Res. Diversion Canal near Fallon. Mean annual flow at this canal ranges from 5 to 68 cfs during the period of record (1991 to 2010) (USGS 2011). Over the last 10 years (2001-2010), the average of the mean

annual flows was 29 cfs. Mean monthly flows at this canal station are highest in May and June (46 and 43 cfs) and lowest in December and January (4 and 13 cfs) (USGS 2011).

Irrigation water is delivered to large areas of agricultural land in the Fallon, Nevada area by a complex array of irrigation works including canals, laterals, and drains (Figure 3-10). This irrigation system is part of the Newlands Project, one of the first irrigation projects built by Reclamation in Nevada. The Newlands Project is operated by the TCID and has approximately 60,000 irrigated acres and two divisions: Truckee Division with water diverted at Derby Dam from the Truckee River into the Truckee Canal and then to the Lahontan Reservoir; and Carson Division with water released from the Carson River near the Lahontan Reservoir (Reclamation 2010). The Carson Division Dam is located 5 miles below the Lahontan Dam and diverts water into two main canals ("V" and "T" canals) to irrigate project land areas.

According to Seiler and Allander (1993), the Carson Division irrigation system in the Fallon area consists of 69 miles of canals, 312 miles of laterals, and 345 miles of return drains. Total diversion capacity of this system is 2,000 cubic feet per second (Reclamation 2010).Maurer et al. (1996) estimated that, between 1975 and 1992, an average of 170,000 ac-ft of water diverted from the Carson River below Lahontan Reservoir reached farm head gates. Approximately 200,000 ac-ft of annual flow diverted from the river is lost to leakage, as most of the irrigation canal system is unlined, and evaporation occurs within the irrigation distribution system (Maurer et al. 1996).

Carson Lake is located west of the Ormat, Vulcan, and SPPC Project Areas. The lake and surrounding wetland complex are approximately 39 square miles in area. In the early 19th century, the Carson River discharged to Carson Lake (Seiler and Allander 1993). Prior to that time, discharge of the river likely alternated between Carson Sink and Carson Lake in response to channel alterations caused by flooding. The acreage of Carson Lake was reduced when irrigation of crops began in the early 1900's (Maurer et al. 1996; Seiler and Allander 1993). Maurer et al. (1996) estimated surface water flow to Carson Lake from the irrigation system at approximately 60,000 ac-ft per year. Water evaporates from the lake area, and, during periods of low water, there is not a single contiguous water body within the footprint of the historic lake boundary.

Within the basin, perennial wetlands are found in topographically low areas where groundwater discharges to the surface (Huffman and Carpenter 2009a). Larger seasonal wetland areas adjacent to perennial wetlands may be supported by precipitation, although the average annual precipitation in the Salt Wells Basin is less than 5 inches per year (Maurer et al. 2009). Some wetlands appear to be recharged by near-surface groundwater, while others are associated with structural controls (i.e., fault systems). Although the amount of water discharging to or evaporating from these wetlands is unknown, volumes are

expected to be low in relation to the overall water budget for the basin. Refer to **Section 3.8**, Floodplains, Wetlands, and Riparian Zones, for more information about wetlands in the Salt Wells Energy Projects Area.

Salt Wells Basin

The USGS and others have mapped several geothermal springs in the Salt Wells Energy Projects Area (Seiler and Allander 1993; Coolbaugh et al. 2006). Most of the springs and seeps are located in or near the Salt Wells Basin along the west side of Eightmile Flat (Figure 3-10). Temperatures measured at 11 of the springs/seeps show that about half are in the range of 21 to 28°C, and the other half are from 54 to 82°C (Coolbaugh et al. 2006). Flow rates are generally low (less than 1 gallon per minute). According to Coolbaugh et al. (2006), springs and seeps at Salt Wells are ephemeral and are only present during cool and wet periods in the winter. During the summer, these springs typically disappear when the water table drops in response to increased evapotranspiration. The hot springs are indicators of subsurface geothermal activity, and often are coincident with active hydrothermal conduits such as faults (Kratt et al. 2004; Coolbaugh et al. 2006). **Figure 3-11**, Groundwater Flow in Basin Fill Aquifer shows several faults mapped along the west side of Eightmile Flat in the Salt Wells Basin.

For the non-thermal springs, recharge is derived from precipitation and runoff in the watersheds in the adjacent ranges (BLM 2005). Therefore, flow path lengths for these springs are likely short, and water temperatures are assumed to reflect non-geothermal conditions. For the hot and warm springs, at least some of the source water is from deeper groundwater zones that is likely moving up along fault zones.

Shallow groundwater flow on the east side of the Salt Wells Energy Projects Area discharges to the playa within the Salt Wells Basin (Figure 3-11). Although topographic maps indicate several ephemeral channels draining into the Fourmile and Eightmile Flat areas, surface water discharge occurs only during intense rain events and snow melt. Shallow groundwater discharges to the playa or is just below ground surface (bgs), where it evaporates. According to Coolbaugh et al. (2006), some playas are also fed by geothermal groundwater associated with upwelling zones.

Maurer et al. (1996) estimates the rate of groundwater discharge from playas in the range of 0.1 to 0.3 feet per year. Mean annual evapotranspiration determined by the USGS for an area in Nevada is 1.3 feet per year for a dry playa, 2.6 feet per year for a wet playa, and 3.9 feet per year for an area dominated by dense wetland vegetation (Laczniak et al. 1999). Another study by the USGS indicates that average annual evapotranspiration is 0.4 to 1.1 feet per year for a dry playa, 1.7 to 2.3 feet per year for a moist playa, and 3.6 to 4.6 feet per year for a marshland (Welch et al. 2007).

Surface Water Quality and Temperature

Water quality of the Carson River is monitored by the USGS at the two locations described previously in the Water Quantity section: below Lahontan Reservoir near Fallon and at Tarzyn Road near Fallon. At the first upstream station below the reservoir, multiple samples have been collected and analyzed annually from 1980 to present. At the downstream station, surface water samples were collected and analyzed from 1992 to 1998. Lico and Seiler (1993) include geochemical data for surface water samples collected from the Carson River between 1978 and 1989. **Table 3-10**, Summary of Water Quality Data for the Carson River, summarizes data for selected samples collected from the river. This table also includes results of a representative sample of water collected by the USGS from the Stillwater Point Diversion Canal near Fallon.

Table 3-10
Summary of Water Quality Data for the Carson River

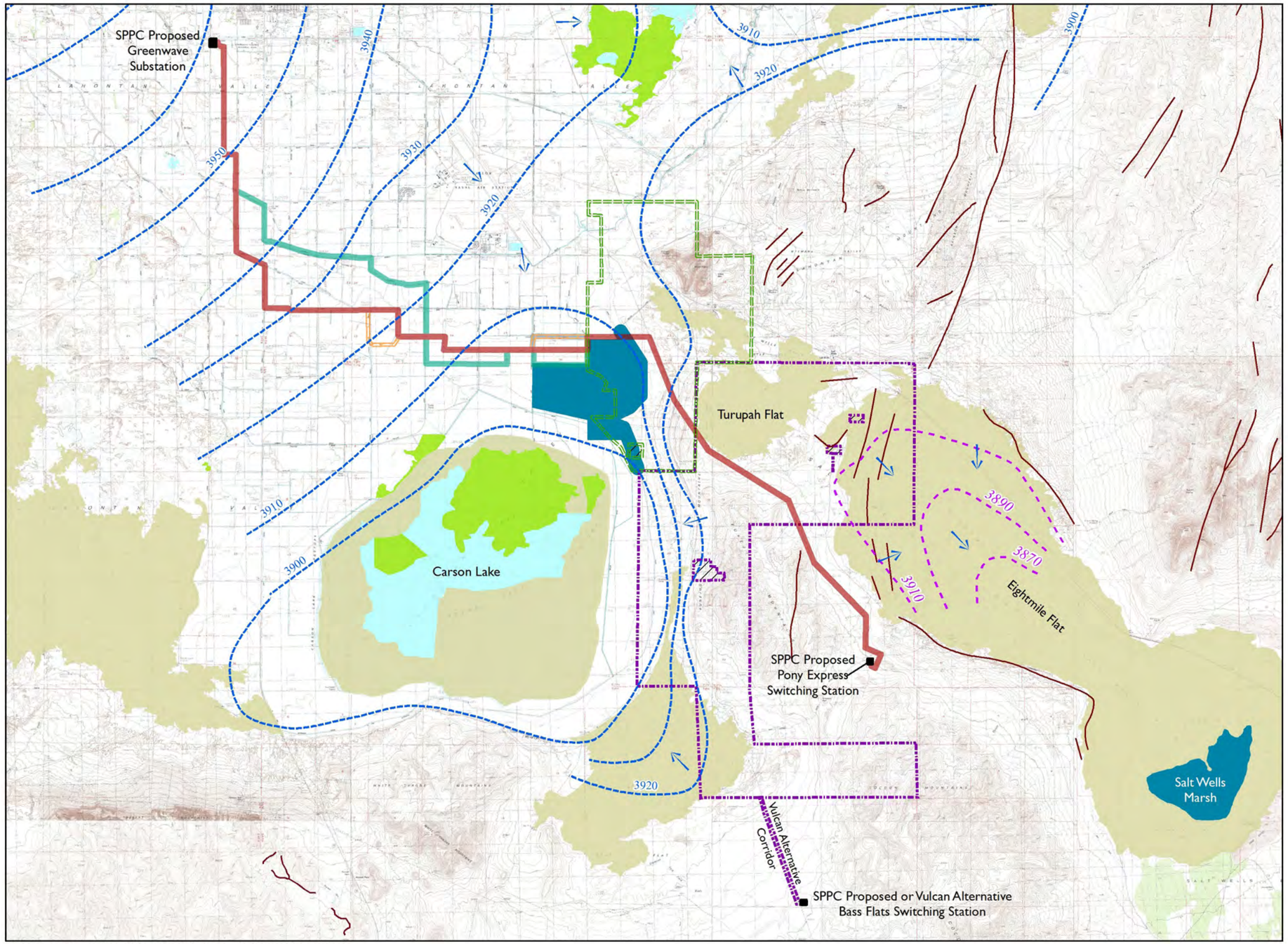
Sampled	TDS	SC	pH	Cl	SO_4	K	Na	Mg	Ca	HCO_3	Temp.
6-17-08[1]	211	314	8.1	17	43	4.2	32	6.6	24	---	18.0
3-22-95[2]	730	1,160	8.3	81	180	11	170	16	53	322	8.0
1988[3]	256	406	8.9	21	50	4.3	55	7.1	25	122	---
8-16-95[4]	498	830	8.0	61	100	8.8	120	11	42	253	20.5

Note: Concentrations are in milligrams per liter (mg/L) except for pH (standard units) and specific conductance (SC) (microSiemens per centimeter). TDS = total dissolved solids; Cl = chloride; SO_4 = sulfate; K = potassium; Na = sodium; Mg = magnesium; Ca = calcium; HCO_3 = bicarbonate; SiO_2 = silica.

Source: [1] USGS 2011 (below Lahontan Reservoir); [2] USGS 2001 (at Tarzyn Road near Fallon); [3] Lico and Seiler 1993; [4] USGS 2011 (Stillwater Point Res. Diversion Canal near Fallon).

Several irrigation ditches and drains are present near Carson Lake. Samples collected by the USGS (2010) from the Rice Ditch on the north side of Carson Lake from 1987-1996 show the following general water quality characteristics: total dissolved solids (TDS) = less than 500 milligrams per liter (mg/L); pH = 7.3 – 8.5; chloride = 20 to 60 mg/L; sulfate = 60 to 160 mg/L; potassium = 5 to 11 mg/L; sodium = 50 to 170 mg/L; bicarbonate = 100 to 370 mg/L; and silica = 5 to 30 mg/L. Sources of water in the drains include shallow groundwater recharge and irrigation return flows. Quality of water in the drains is generally poor near Carson Lake with TDS concentrations up to 3,000 mg/L (Maurer et al. 1996). TDS concentrations vary seasonally in relation to irrigation practices.

Coolbaugh et al. (2006) provides water chemistry data and geothermometer estimates of reservoir temperatures obtained from springs and seeps in the Salt Wells area (Figure 3-10 and **Tables 3-11**, Thermal Seep and Spring Water Quality Data, and **3-12**, Attributes and Locations of Springs and Seeps). Water temperatures range from 21°C to 82°C. Samples collected from four of the hot springs (54 to 82°C) show elevated concentrations of chloride (1,090 to 1,400 mg/L), sulfate (243 to 286 mg/L), sodium (841 to 1,030 mg/L), potassium (68 to 86 mg/L), and silica (165 to 236 mg/L) (Table 3-11). These temperatures and



Groundwater Flow in Basin Fill Aquifer

Churchill County, Nevada

Groundwater Flow Feature
- Water-level elevation contour in basin-fill deposits (feet)
- Groundwater Flow Direction
- Faults
- Potentiometric lines

Approximate water-level contour in basin-fill deposits (feet) Potentiometric lines are based on ground surface elevations & an assumed depth to water of 50 feet.

Surface Water Feature
- Lake - Reservoir
- Playa
- Major Wetland
- Perennial Wetland

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Excluded from Lease Area

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, NBMG 1996 and Greene et al 1991, NNHP 2010, USGS 2010, W.M. Keck Earth Sciences and Mining Research Information Center 2010

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*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-11

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concentrations of geothermal springs are higher than those of the Carson River and shallow basin-fill aquifers (less than 20°C). Water quality data and geothermometer estimates obtained from springs and seeps are similar to those of samples collected from nearby geothermal wells (Coolbaugh et al. 2006), indicating that high-temperature springs in the Salt Wells Energy Projects Area are likely surface expressions, at least in part, of subsurface conduits that connect to geothermal reservoirs at depth.

Table 3-11
Thermal Seep and Spring Water Quality Data

Sample ID	SW-1	SW-2	SW-3	SW-5
Description	seep	seep	spring	Borax Spring
UTM-NAD27-East	364,134	364,220	364,489	363,738
UTM-NAD27-North	4,357,128	4,357,548	4,353,068	4,355,906
Temperature (˚C)	54.2	66.4	54.4	81.6
Bicarbonate (mg/L)	222	201	204	178
Boron (mg/L)	9.8	10.4	13.5	9.0
Fluoride (mg/L)	6.0	5.3	5.9	5.9
Chloride (mg/L)	1210	1090	1400	1170
Sulfate (mg/L)	249	243	286	243
Calcium (mg/L)	47.3	41.3	34.7	33.6
Iron (mg/L)	0.2	0.107	0.204	0.117
Potassium (mg/L)	75	68.7	85.3	78.9
Lithium (mg/L)	1.79	1.8	2.0	1.84
Magnesium (mg/L)	3.9	2.3	2.6	1.3
Manganese (mg/L)	0.081	0.157	0.147	0.098
Sodium (mg/L)	914	841	1030	866
Silica (mg/L)	165	236	209	201

Note: See Figure 3-10 for locations of springs/seeps. ˚C = degrees Celsius; mg/L = milligrams per liter.
Source: Coolbaugh et al. 2006

Groundwater

Groundwater Quantity

In the Fallon area, several key aquifers have been identified, including three unconsolidated basin-fill aquifers: shallow aquifer (up to 50 feet bgs); intermediate aquifer (from 50 feet to 1000 feet bgs); and deep aquifer (from 1,000 to several thousand feet bgs) (Maurer et al. 1996). The shallow aquifer is recharged by the Carson River, irrigation canals, and irrigation return flows (Seiler and Allander 1993). This aquifer discharges to irrigation drains and additional water is consumed by evapotranspiration. According to Harrill et al. (1988), some groundwater enters the Lahontan Valley from the west, but the general direction of regional groundwater flow in valley-fill sediments is to the

Table 3-12
Attributes and Locations of Springs and Seeps

Description	Date	Temperature (°C)	UTM-East	UTM-North
Small 0.3-meter diameter pool in grass	2/25/05	27.6	364,302.4	4,357,595.1
Reeds on side of mound	2/16/04	66.4	364,220.1	4,357,547.5
Seep near grass	2/19/05	54.2	364,133.9	4,357,127.9
Spring in grass	2/24/05	55.3	364,148.9	4,357,022.0
Spring in grass	2/19/05	57.3	364,102.7	4,356,999.1
Spring in reeds	2/19/05	21.0	364,096.0	4,356,978.7
Massive grey opolized mud (Borax Hot Springs)	2/12/05	81.6	363,738.2	4,355,905.8
Seep in middle of reeds	2/22/05	27.9	363,804.5	4,355,894.5
Spring in reeds	2/12/05	21.1	364,300.2	4,355,893.3
Spring in grass	2/12/05	26.8	363,788.3	4,355,870.9
Spring in reeds	2/12/05	22.5	364,270.1	4,355,842.9

Note: See Figure 3-10 for locations of springs/seeps. °C = degrees Celsius.
Source: Coolbaugh et al. 2006

northeast. Beneath and surrounding the unconsolidated basin-fill deposits are bedrock units, including volcanic, igneous, metamorphic, and sedimentary rocks. A Pleistocene-age basalt aquifer is the sole-source of domestic and industrial supply for the City of Fallon, NAS Fallon, and the Paiute-Shoshone Tribe. The basalt aquifer, which underlies Fallon and areas to the north-northeast of the city, is largely surrounded by the sedimentary aquifers (Maurer and Welch 2001). The bedrock units are recharged by and discharge to the basin-fill aquifers.

Maurer et al. (1996) estimated recharge to, discharge from, and flows within the shallow and intermediate basin-fill aquifers and the basalt aquifer. For the shallow aquifer, discharge slightly exceeds recharge (129,000 vs. 126,000 ac-ft per year). The annual volume of lateral flow within the shallow aquifer was estimated to be 2,800 ac-ft. Recharge to the intermediate aquifer exceeds discharge (33,000 vs. 25,000 ac-ft), and the annual lateral flow estimate is 27,000 ac-ft. Recharge to and discharge from the basalt aquifer is 4,000 ac-ft per year, and flow within the aquifer is 180 ac-ft per year. Approximately 3,000 ac-ft of groundwater was pumped from the basalt aquifer in 1992.

Historic Data for Salt Wells Basin

In the Fallon and Salt Wells areas, some shallow groundwater discharges via evapotranspiration (Harrill et al. 1988). Several areas of phreatophytic vegetation are present in or near the Salt Wells Energy Projects Area. Evapotranspiration accounts for much of the shallow groundwater discharge in

the Fallon area (Herrera et al. 2000). Direct evaporation of groundwater occurs at the Salt Wells Basin playa in the Eightmile and Fourmile Flat areas.

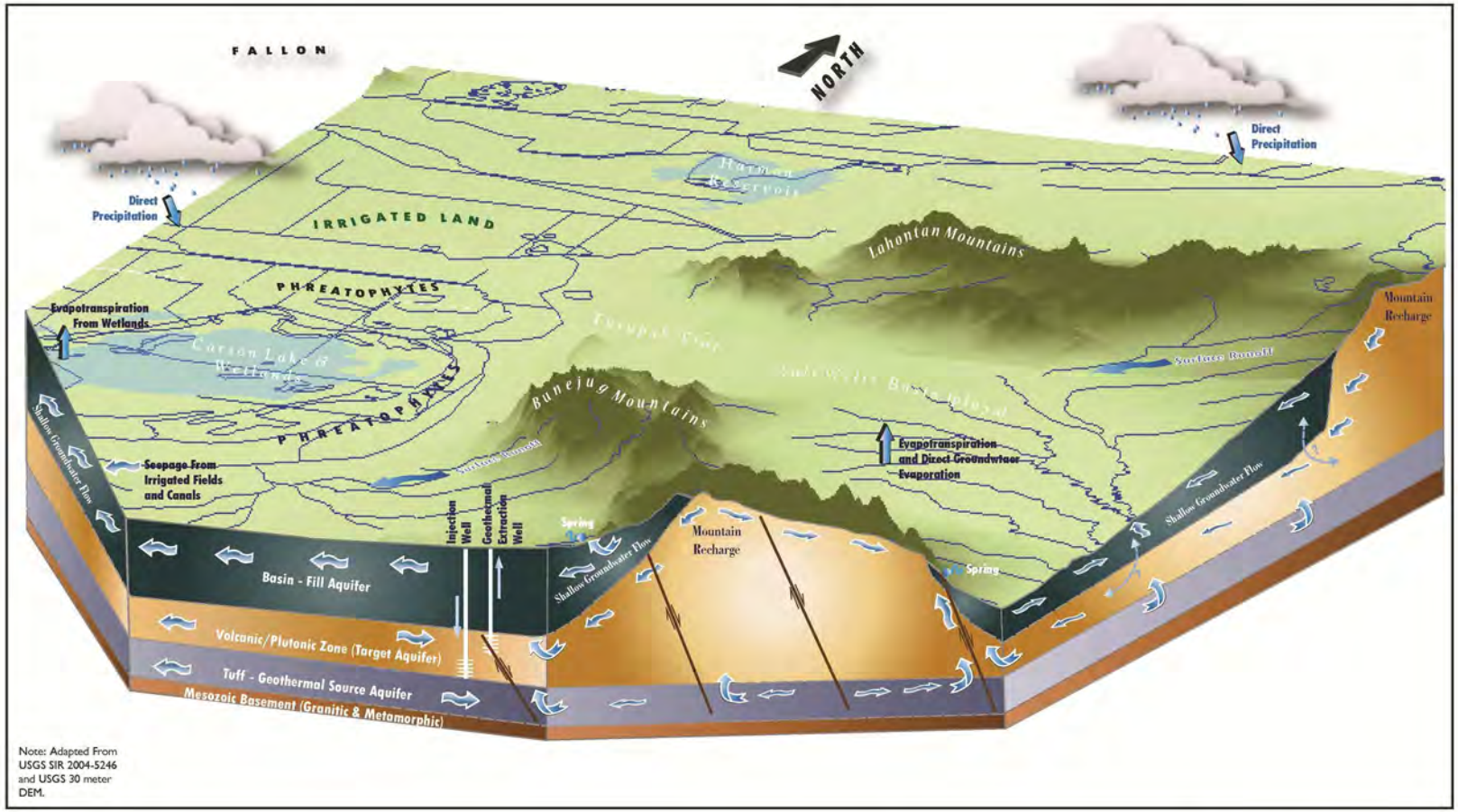
According to Seiler and Allander (1993), the direction of shallow groundwater flow in the Salt Wells Energy Projects Area is from east in the Bunejug Mountains to the west toward Carson Lake (Figure 3-11). To the north and east of the Bunejug Mountains, groundwater flow is likely toward the Salt Wells playa. The elevation of shallow groundwater in the local basin fill system is approximately 3900 feet amsl. Depth to groundwater is less than 50 feet bgs in areas surrounding the Bunejug Mountains (Lopes et al. 2004).

Geothermal Flow System. The unconsolidated basin-fill aquifers overlie a basalt-rich volcanic/plutonic zone (**Figure 3-12**, Conceptual Hydrologic Block Model Diagram). The geothermal source aquifer is an ash-flow tuff unit which underlies the basin-fill aquifers. The tuff is underlain by granitic and metamorphic basement rocks. Both the basalt and the tuff units are targets for geothermal exploration. The degree of hydraulic connection between the volcanic/plutonic aquifer and the Fallon sole-source basalt aquifer is unknown. Further information about the geology within the region of influence (ROI) is provided in **Section 3.4**, Minerals/Geology.

Geothermal water rises from depths of greater than 8,000 feet bgs along fault planes that lie 1,000 to 1,500 feet below the surface where basin-fill deposits overlie bedrock in the Salt Wells Energy Projects Area (Maurer et al. 1996). Geothermal exploration wells in the Carson Lake area have been completed from 8,000 to 10,000 feet bgs (US Navy and BLM 2008). The deep geothermal systems have strong upward gradients due to groundwater heat absorption and buoyancy (Lico and Seiler 1993; Maurer et al. 1996). Geothermal water discharges locally along fault zones as evidenced by geothermal springs and seeps at the ground surface. For example, high temperature-high TDS groundwater has been documented at several springs within the Vulcan Project Area (see Figure 3-10) (Coolbaugh et al. 2006).

According to a 2005 EA within the Salt Wells Basin (BLM 2005), geothermal injection wells were to be completed in fractured basalts at approximately 2,000 feet bgs. For the proposed Salt Wells Energy Projects, geothermal production wells would be constructed to depths of 1,500 to 10,000 feet, and injection wells would be completed to depths of 1,500 to 9,500 feet. Hydraulic testing of the production zone would be used to determine if the proposed rates of extraction could be sustained for the projects, and that good hydraulic communication existed over large distances within the target basalt aquifer.

Groundwater volumes and flow rates within the geothermal aquifer system have not been estimated for the Salt Wells area. Total flow of geothermal water upwelling within the Carson Desert basin could be as much as 4,000 ac-ft per year (Maurer et al. 1996). A flow test was conducted in a well drilled



SOURCE: USGS SIR 20045-246

Normal Fault Thought To Control The Vertical Flow Of Geothermal Groundwater

Groundwater Flow Path

Suspected Groundwater Flow Path

Conceptual Hydrogeologic Block Model Diagram

Not to scale

Figure 3-12

approximately 2 miles east of the current Vulcan Project Area (Anadarko Petroleum Corporation 1995b). During this test, a packer was set at 401 feet bgs and the borehole made between 35 and 62 gallons per minute (gpm). Other data suggest that geothermal boreholes have produced flow rates as high as 100 gpm. Several thermal gradient borings installed by Anadarko Production Company (1984) were flowing at the ground surface at rates of up to 1 gpm.

Hydrogeologic Cross Sections. In addition to the general information presented previously about groundwater in the Salt Wells Energy Projects Area, specific wells have been identified in the Projects Area from which data have been obtained. These wells are shown on **Figure 3-13**, Cross Section and Well Locations. Well depths range from 24 to 1,400 feet bgs with completions in unconsolidated deposits (clay, sand, gravel) or bedrock (basalt, volcanics, tuff, and sandstone). Depth to groundwater is less than 50 feet in shallow wells, and in the range of about 280 to 550 feet in deeper wells. **Figures 3-14**, Hydrogeologic Cross Section A-A', and **3-15**, Hydrogeologic Cross Section B-B', are hydrogeologic cross sections through the Salt Wells Energy Projects

Area using information from some of the wells shown on Figure 3-13. The cross sections represent the hydrostratigraphy discussed previously and indicate that unconsolidated deposits (basin-fill aquifers) overlie basalt-rich rocks within the ROI. Due to a lack of lithologic and completion logs for deep wells that are well distributed geographically, the cross sections do not indicate the contact between the basalts and the tuff-rich geothermal source aquifer (see Figure 3-12).

Groundwater Quality and Temperature

The following sections summarize geochemical characteristics of each of the aquifer systems described previously. Groundwater quality data are presented in Tables 3-13 through 3-16.

Basin-Fill and Basalt Aquifers. Maurer et al. (2004) provide geochemical and temperature data for a shallow well (USGS Well 64) west of the Salt Wells Energy Projects Area and north of Carson Lake (Figure 3-13). Selected data are presented in **Table 3-13**, Groundwater Quality Data for Shallow Basin-Fill Aquifer. Water quality at this depth (13 feet bgs) is likely influenced by irrigation practices in the Fallon area. Specific conductance values were moderate [1,360 to 1,880 microSiemens/centimeter (µS/cm)] relative to surface water and geothermal values. Values of pH were slightly alkaline, similar to Carson River water. The dominant ions dissolved in groundwater of the basin-fill aquifer at this location are sodium and chloride. Groundwater from the shallow aquifer in the groundwater discharge area surrounding Carson Lake is saline, and TDS concentrations greater than 40,000 mg/L have been measured (Maurer et al. 1996). Calcium concentrations in shallow groundwater (up to 3.4 mg/L) were lower than in the Carson River (25 mg/L), possibly indicating that ion exchange reactions have removed dissolved calcium which was then replaced with

sodium. Sulfate and silica concentrations were elevated relative to the Carson River, but were lower than in the geothermal reservoirs (Maurer et al. 2004).

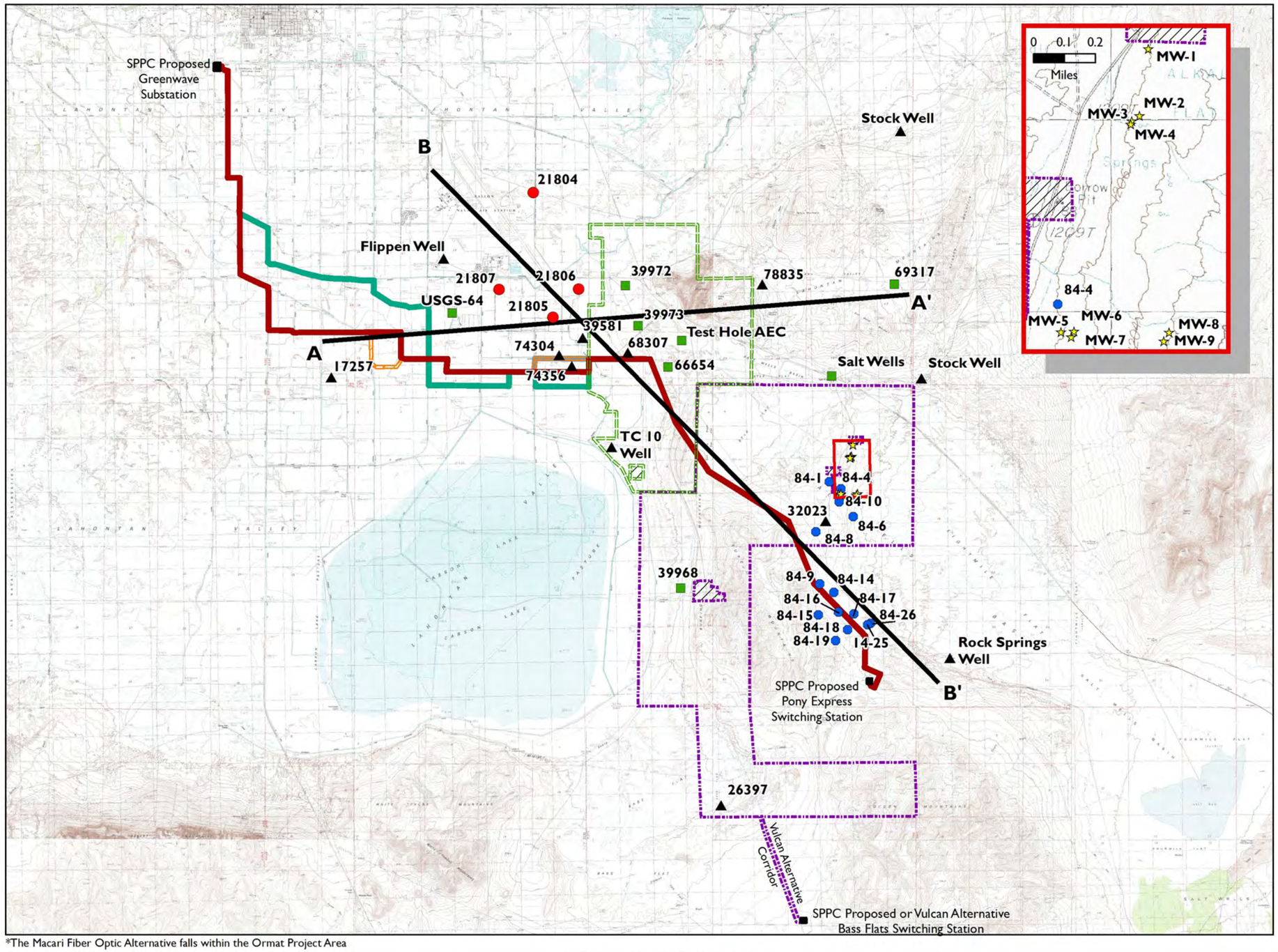
Table 3-13
Groundwater Quality Data for Shallow Basin-Fill Aquifer

Location	**USGS Well 64**				
Latitude / Longitude	**39.390752 / -118.7159817**				
Sample Date	**12/10/98**	**8/7/00**	**3/1/01**	**6/17/02**	**9/17/03**
Temperature (˚C)	14	18.5	13.5	15.6	19.5
SC (µS/cm)	1,360	1,540	1,570	1,880	1,780
pH (std. units)	8.1	7.8	7.8	7.8	7.7
Fluoride (mg/L)	1.5	1.2	1.3	1.1	0.6
Chloride (mg/L)	191	171	159	237	251
Sulfate (mg/L)	99.5	73.3	60.4	114	70.1
Calcium (mg/L)	1.6	2.1	2.5	3.4	2.9
Iron (mg/L)	0.054	NR	NR	0.031	0.025
Potassium (mg/L)	7.7	NR	NR	10.3	11.8
Magnesium (mg/L)	2.4	3.5	3.6	4.7	4.6
Manganese (mg/L)	0.023	NR	NR	0.042	0.028
Sodium (mg/L)	291	NR	NR	398	391
Silica (mg/L)	26.6	NR	NR	24.9	29.4

Note: See Figure 3-13 for location of USGS Well 64. ˚C = degrees Celsius; SC = specific conductance; µS/cm = microSiemens per centimeter; mg/L = milligrams per liter; NR = not reported. Well depth is 13 feet below ground surface (bgs); screen extends from 11 to 13 feet bgs.
Source: Maurer et al. 2004

Groundwater temperatures in water from USGS Well 64 ranged from 14 to 20°C. Water temperature measured in nine shallow piezometers in the vicinity of some wetlands along the western side of Eightmile Flat range from 8 to 50°C (**Table 3-14**, Groundwater Quality Data for Shallow Piezometers Near Wetland Areas). The temperature data shown in both tables indicate that water temperature often varies seasonally, with warmer temperatures in the summer/fall, and cooler temperatures in the winter/spring. This shows that warm or hot shallow groundwater is influenced by precipitation and shallow non-thermal groundwater.

The shallow basin-fill aquifer generally stores hard water (greater than 70 mg/L as $CaCO_3$), while hardness of the intermediate aquifer is generally less than 25 mg/L (Maurer et al. 1996). In the vicinity of Carson Lake, the TDS concentration in the intermediate aquifer is approximately 1,000 mg/L, and the groundwater is generally of better quality than the shallow aquifer (Maurer et al. 1996). Groundwater stored in the deep part of the basin fill aquifer is typically saline, although its quality is not well documented.



Cross Section and Well Locations

Churchill County, Nevada

Feature
- Geothermal Boring
- Domestic/Stock Well
- Monitoring and Test Hole
- Temperature Gradient Hole
- Piezometer
- Cross Section

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Excluded from Lease Area

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, NNHP 2010, W.M. Keck Earth Sciences and Mining Research Information Center 2010

0 1 2
Miles

July 2011
NAD 1983 HARN State Plane Nevada West
Disclaimer: 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.

*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-13

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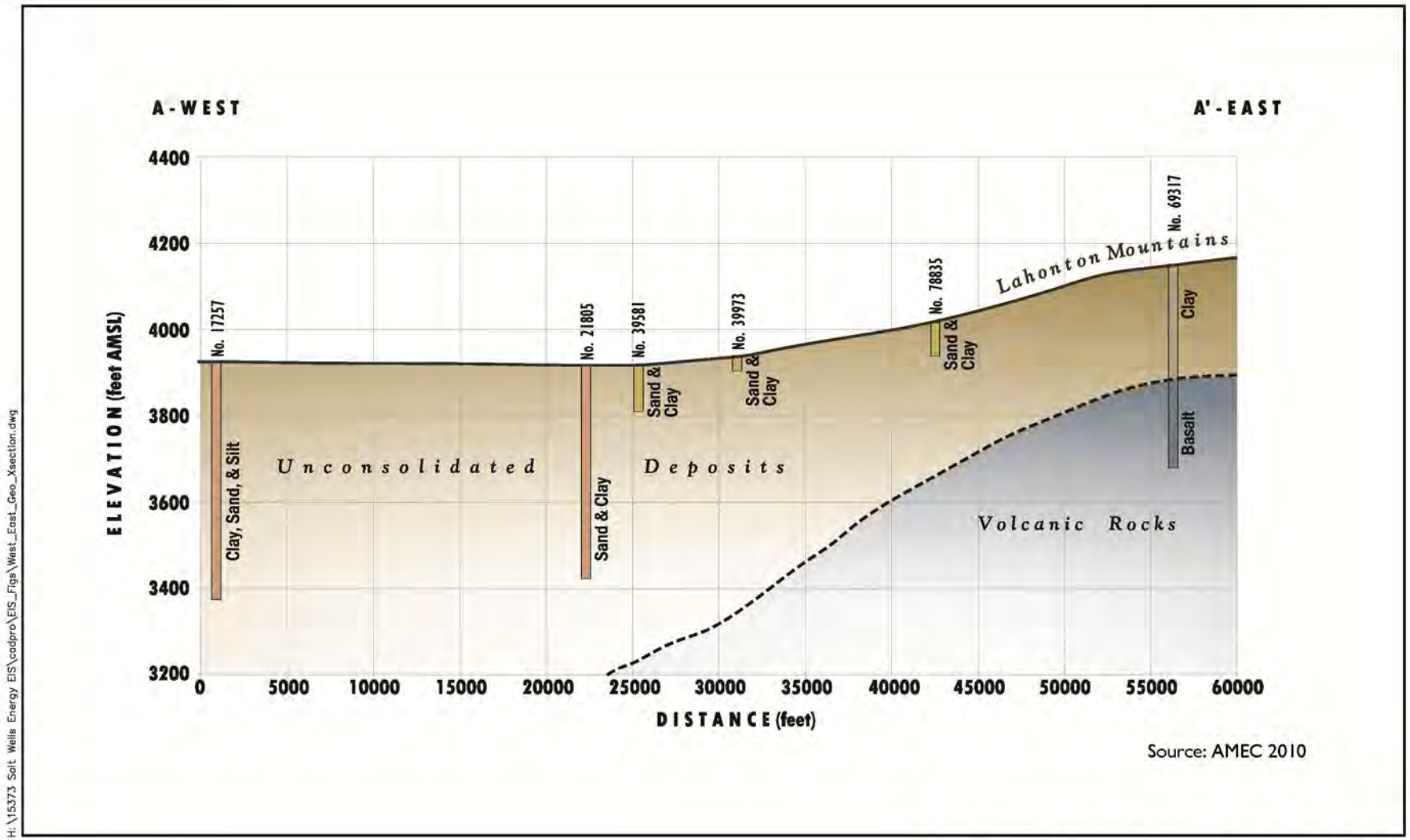

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Hydrogeologic Cross-Section A-A'

0 Feet 320
Vertical

0 Feet 8000
Horizontal

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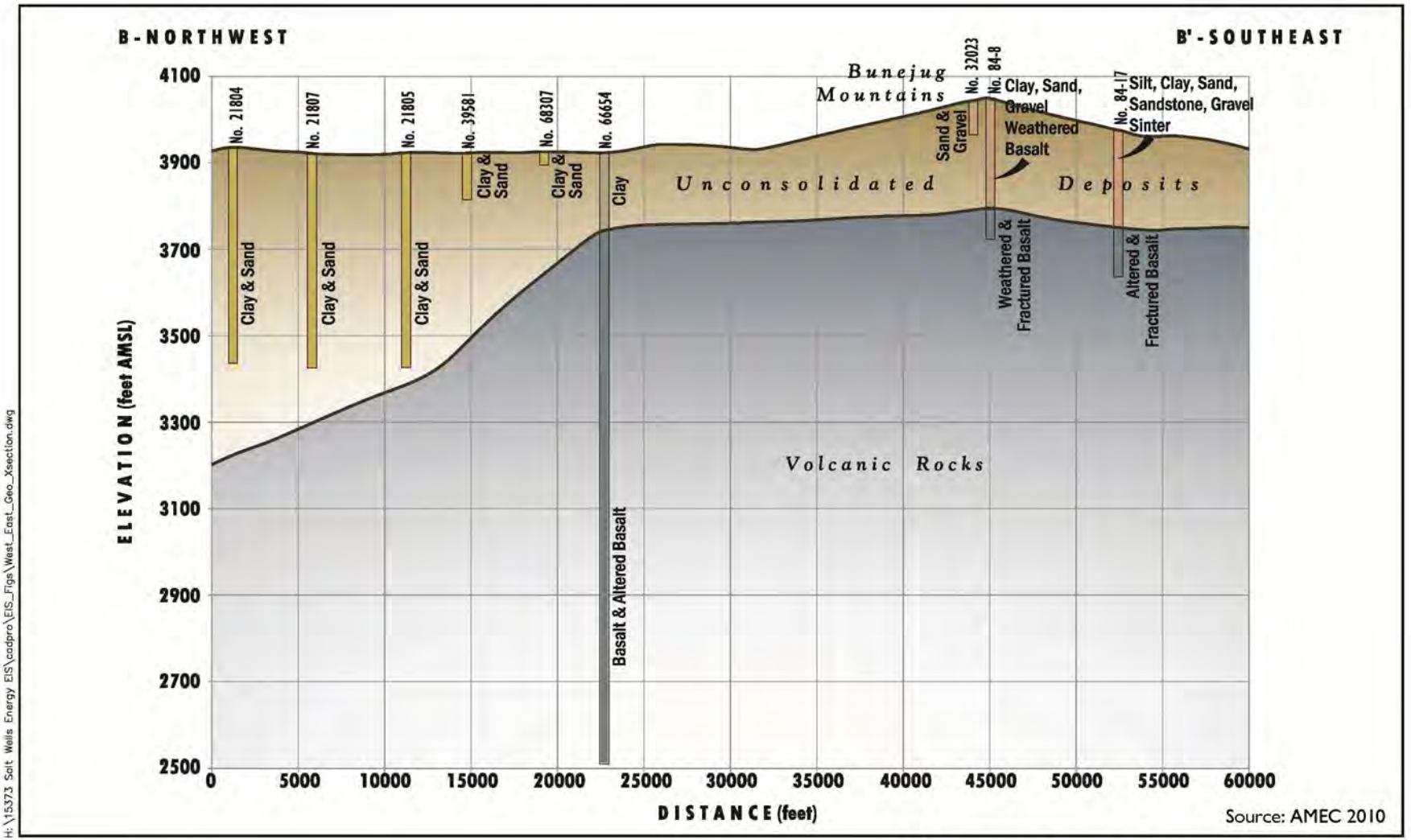
Figure 3-14



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Hydrogeologic Cross-Section B-B'

0 Feet 320 Vertical

0 Feet 8000 Horizontal

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Figure 3-15

Table 3-14
Groundwater Quality Data for Shallow Piezometers Near Wetland Areas

Piezometer Number	Date	Total Depth (ft)	Water Level (ft bgs)	Temp. (°C)	SC (µS/cm)	pH (std. units)	Silica (mg/L)	Chloride (mg/L)
MW-1	6/10/09	4.5	>4.5	NR	NR	NR	NR	NR
	9/23/09		1.23	36.7	2550	7.39	170	1200
	2/11/10		0.46	23.4	4610	7.5	130	1100
MW-2	6/10/09	1.6	1.71	35.5	4630	7.42	NR	NR
	9/23/09		>2.1	NR	NR	NR	NR	NR
	2/11/10		1.21	14.2	6570	7.75	120	1800
MW-3	6/10/09	4.6	0.92	49.6	4570	7.16	NR	NR
	9/23/09		1.49	48.2	4390	7.06	210	1100
	2/11/10		0.13	48.2	4890	7.26	200	1100
MW-4	6/10/09	4.5	0.73	33.5	4980	7.56	NR	NR
	9/23/09		1.9	37.3	4430	7.19	200	1100
	2/11/10		0.15	25.3	7270	7.43	120	2100
MW-5	6/10/09	4.7	1.54	25.5	6310	7.42	NR	NR
	9/23/09		2.11	33.7	4490	7.26	230	1200
	2/11/10		0.63	19.4	7130	7.31	120	2100
MW-6	6/10/09	3.5	-0.14	21.8	5060	7.42	NR	NR
	9/23/09		0.08	24.1	4650	7.54	160	1100
	2/11/10		-0.15	15.3	8700	7.64	94	3400
MW-7	6/10/09	4.9	0.81	20.1	7420	7.28	NR	NR
	9/23/09		2.25	26.0	5640	7.42	140	1500
	2/11/10		-0.05	12.5	10,870	7.57	80	3100
MW-8	6/10/09	4.4	-0.29	15.6	5100	6.84	NR	NR
	9/23/09		0.01	18.7	5980	7.39	120	1500
	2/11/10		-0.27	7.8	4470	7.67	94	1200
MW-9	6/10/09	4.7	-0.1	17.5	5530	6.98	NR	NR
	9/23/09		0	19.4	7520	6.94	110	2000
	2/11/10		-0.03	11.0	5000	7.6	89	1200

Note: See Figure 3-13 for location of piezometers. ft = feet; bgs = below ground surface; Temp. = temperature; °C = degrees Celsius; SC = specific conductance; µS/cm = microSiemens per centimeter; mg/L = milligrams per liter; NR = not reported. Negative water levels indicate height above ground surface.
Source: 7Q10 2010

Groundwater quality in the basalt aquifer is distinct from the basin-fill aquifers. The water is a sodium-bicarbonate chloride type, with TDS concentrations ranging from 300 to 700 mg/L (Maurer et al. 1996). Water hardness ranges from 3 to 11 mg/L.

Geothermal Aquifers. Water quality data (**Tables 3-15**, Groundwater Quality Data for Geothermal Sources, and **3-16**, Groundwater Quality Data for

Selected Wells Within and Near the Salt Wells Energy Projects Area) indicate that the geothermal reservoirs are typically of the sodium-bicarbonate type.

Although these ions are also predominant in the shallow basin-fill aquifer, concentrations are higher in the geothermal reservoirs. For example, while the sodium concentration in USGS Well 64 ranged from about 290 to 400 mg/L, concentrations in geothermal groundwater ranged from 930 to 1,080 mg/L. Sodium, potassium, chloride, sulfate, and silica concentrations in the geothermal reservoirs are also high relative to surface water (e.g., Carson River and irrigation ditch water) and groundwater within the shallow basin-fill aquifer.

Geochemical data provided by GeothermEx (1977) are summarized in Table 3-16 for several temperature gradient, exploration, and test holes in the Salt Wells Energy Projects Area (Figure 3-13). With the exception of one well at 71°C, water temperatures range from 12 to 20°C. Groundwater at these locations is characterized by relatively high concentrations of sodium, potassium, chloride, fluoride, bicarbonate, and sulfate, which is consistent with geothermal

Table 3-15
Groundwater Quality Data for Geothermal Sources

Sample ID Description	SW-4 shallow groundwater	SW-6 playa groundwater	Well 14-25 geothermal well
UTM-NAD27-East	363,891	363,667	364,448
UTM-NAD27-North	4,354,070	4,357,234	4,351,951
Hole Depth (feet)	1.3	5	700
Temperature (˚C)	46	75.6	50-131
Bicarbonate (mg/L)	221	183	205
Boron (mg/L)	14.2	13.2	8.1
Fluoride (mg/L)	6.0	5.8	8.5
Chloride (mg/L)	1,460	1,250	1,300
Nitrate (mg/L)	NR	NR	0.2
Sulfate (mg/L)	329	250	300
Calcium (mg/L)	46.9	36.8	18.0
Iron (mg/L)	0.026	0.003	0.8
Potassium (mg/L)	102	83	67
Lithium (mg/L)	2.29	2.0	2.0
Magnesium (mg/L)	2.7	1.7	2.1
Manganese (mg/L)	0.529	0.127	<0.1
Sodium (mg/L)	1,080	931	1,000
Silica (mg/L)	200	293	260

Note: See Figure 3-10 for locations of groundwater sources. ˚C = degrees Celsius; mg/L = milligrams per liter; NR = not reported.
Source: Coolbaugh et al. 2006

Table 3-16
Groundwater Quality Data for Selected Wells Within and Near the Salt Wells Energy Projects Area

Well Name	Location	Temp. (°C)	Flow (L/min)	pH (std. units)	SC (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	NH_3 (mg/L)	B (mg/L)	F (mg/L)	TDS (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)
Stock Well (26397)	16-30-9cad	NR	NR	8.5	NR	5	5	2,622	70	2,365	NR	NR	NR	5,660	1,002	9.01	587	NR
TCID Well	17-30-7ba	71	20	6.9	6,900	68	12	1,210	41	2,034	4	9.2	2	3,898	182	NR	106	54/110
Rock Spr. Stock Well	17-31-31abb	20	4	8.1	NR	9.8	3.6	1,130	100	1,347	NR	NR	NR	3,098	358	10.2	244	NR
Rock Spr. Stock Well	17-31-31abb	15	5	8.2	5,700	14	1.3	1,050	85	1,289	4.2	4.7	5.2	3,180	395	NR	259	60/81
Flippen Well	18-29-22c	NR	NR	8.0	NR	3	7	340	16	50	NR	NR	NR	934	1,002	15	18.3	NR
Well (39581)	18-29-36adc	15.5	3	8.1	6,800	6	3	1,350	42	1,562	14	9.8	2.6	3,863	1,379	NR	10	49/48
Stock Well	18-30-12aca	15.5	NR	8.5	17,500	6.8	0.5	4,180	154	5,420	NR	36	5.2	11,200	784	47	876	35
Well (68307)	18-30-31bc	16.5	3	7.9	8,800	8	9	1,840	70	2,254	20	11.9	2.3	5,230	1,507	NR	10	52
Test Hole A.E.C.	18-30-32aaa	NR	NR	8.6	NR	9	16	2,147	29	3,168	NR	NR	NR	5,468	386	1.2	91	NR
Well, Salt Wells	18-30-35cdd	NR	NR	NR	NR	39.7	13.6	1,198	112	1,617	NR	NR	NR	NR	334	27.7	366	NR
Well, Salt Wells	18-30-35cdd	12	NR	7.6	5,500	32	7	990	93	1,271	<1	4.7	7.5	3,205	371	NR	269	82
Stock Well	18-31-31ccc	15.5	NR	8.8	NR	2.6	1.6	1,737	120	2,078	NR	NR	NR	4,371	457	41.4	430	NR
Stock Well	18-31-31ccc	15	NR	8.7	9,800	3	0	1,660	110	1,917	<1	6.8	4.8	4,745	532	NR	542	42

Note: See Figure 3-13 for locations of wells. °C = degrees Celsius; L/min = liters per minute; SC = specific conductance; µS/cm = microSiemens per centimeter; Ca = calcium; mg/L = milligrams per liter; Mg = magnesium; Na = sodium; K = potassium; Cl = chloride; NH_3 = ammonia; B = boron; F = fluoride; TDS = total dissolved solids; HCO_3 = bicarbonate; CO_3 = carbonate; SO_4 = sulfate; SiO_2 = silica; NR = not reported.
Source: GeothermEx 1977.

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groundwater. Sodium and chloride were the dominant ions. Specific conductance and TDS were also elevated. Because information about drill-hole depths and well completions was not available for most of the wells, it is difficult to determine the specific hydrostratigraphic units (HSUs) that were intersected at these locations.A report by 7Q10 (2010) provides detailed information about near-surface groundwater geochemical and temperature conditions in a portion of the Salt Wells Energy Projects Study Area. Nine piezometers (MW-1 through MW-9) were installed near springs and seeps within the Vulcan Project Area in the northwest side of Salt Wells Basin and Eightmile Flat (Figure 3-13 and Table 3-14). The springs and seeps are located within areas of seasonal and perennial wetlands identified within the Vulcan Project Area (Huffman and Carpenter 2009a). Total piezometer depths ranged from 1.6 to 4.9 feet bgs. Water level, temperature, pH, specific conductance, chloride, and silica concentrations were reported for June 2009, September 2009 (dry season) and February 2010 (wet season) (Table 3-14). Shallow groundwater temperatures ranged from 8 to 50°C, and pH values were near-neutral to slightly alkaline (6.8 to 7.8). Specific conductance values ranged from 2,550 to 10,870 µS/cm, and were lower in the dry season for some locations. Elevated chloride concentrations (1,100 to 3,400 mg/L) indicate that groundwater discharging to some of the springs, seeps, and perennial wetlands may originate at depth. Silica concentrations ranged from 80 to 230 mg/L, consistent with long groundwater flow paths and high groundwater temperatures. These data indicate zones of groundwater discharge that are influenced by water from a deep geothermal source.

Within the Salt Wells geothermal field, approximately half of the tested wells at depths of less than 330 feet yielded groundwater temperatures greater than 100°C (BLM 2005). Some of the highest groundwater temperatures occur within 500 feet of ground surface.

In the early 1980s, Anadarko Petroleum Corporation drilled a test well located approximately 2 miles east of the existing Vulcan Project Area (Westec 1987). Total depth of the well is 7,948 feet bgs. Chloride concentrations in groundwater from depths below 5,000 feet ranged from 2,400 to 4,000 mg/L, and sodium and silica concentrations were also elevated. Temperature of one deep groundwater sample was 122°C.

Two thermal gradient observation boreholes were completed approximately 2 miles east of the current Vulcan Project Area (Anadarko Petroleum Corporation 1995a). One of the boreholes was drilled to a depth of 1,165 feet bgs, and the maximum recorded groundwater temperature was 118°C at 660 feet bgs. A second borehole was drilled to 1,080 feet bgs. Maximum temperature reported was 104°C at 660 feet bgs. A third observation borehole located in the same general area was described by Anadarko Petroleum Corporation (1995b). Total depth of the hole was 530 feet bgs, and lithologies encountered included silt and sand, sandstone, red clay, siliceous sinter, and basalt. The borehole intersected fractures in basalt several times below a depth

of 370 feet. Maximum groundwater temperature was 132°C from 200 to 350 feet bgs.

Additional information on geothermal resources at Salt Wells, including well drilling and logging histories for 11 temperature gradient holes, was provided by Anadarko Production Company (1984). All of the borings, having the ID number "84-#", were drilled within or near the current Vulcan Project Area (Figure 3-13). Temperature-depth data are graphed in **Figure 3-16**, Geothermal Gradients for Selected Boreholes. The data indicate that temperatures and geothermal gradients were generally higher in basalt (up to 130°C) than in unconsolidated sediments (up to 90°C). In borehole 84-17, the temperature and flow rate increased dramatically when fractured basalt was encountered at 333 feet bgs (70°C increasing to 125°C). In borehole 84-9, the temperature gradient was unchanged (approximately 115°C) after basalt was encountered at approximately 100 feet bgs.

Water Rights

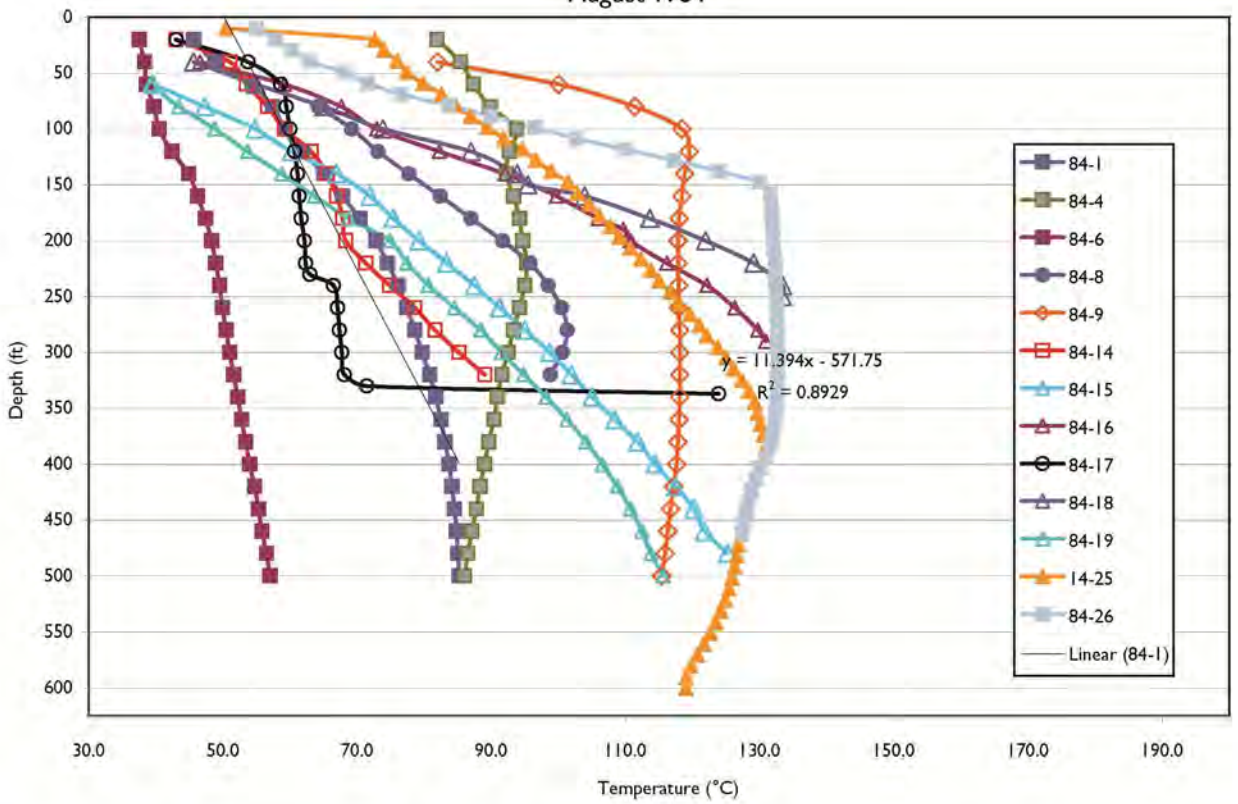
A listing of water rights was obtained from the NDWR (NDWR 2010) for an area that includes the Ormat and Vulcan Project Areas and a 5-mile buffer. In general, numerous groundwater rights are held for commercial, stock, and irrigation purposes. Most of the commercial rights are for ENEL Salt Wells LLC and Bar Bell Farms. One commercial water right is held by Churchill County. The TCID holds three of the irrigation rights for surface water. Other groundwater rights in the study area are for industrial, recreation, environmental, storage, and mining/milling purposes. The industrial water right is held by Anadarko Petroleum Corporation, and the recreational water right is held by the USFWS.

For the Carson Desert hydrographic area (no. 101) and Carson River hydrographic region (no. 08), the NDWR (2010) reports that total groundwater use is about 19,700 ac-ft per year. Of this amount, geothermal use is about 1,566 ac-ft per year. Perennial yield for the Carson River Basin is 2,500 ac-ft per year (NDWR 2010).

Hydrogeologic Conceptual Model

AMEC reviewed regional and site-specific subsurface data to develop a conceptualization of the hydrogeologic system (Figure 3-12). Components of the model are documented in the following sections:

- Potentially affected water resources;
- Surface water flow;
- Groundwater flow;
- Hydrostratigraphy;
- Aquifer hydraulic properties;



Source: AMEC 2010

Notes:
-> Open symbols represent boreholes outside the existing Vulcan lease area.
-> Symbols represent general lithologies:
- squares (clay, sandstone, and siliceous sinter)
- triangles (basalt)
- circles (fill overlying fractured/weathered basalt)
- diamond (altered volcanics, clay, tuff, and basalt)

Geothermal Gradients for Selected Boreholes

Figure 3-16

- Hydrologic boundary conditions;
- Hydrologic interactions;
- Recharge and discharge relationships; and
- Structural controls on geothermal reservoirs

Surface Water Flow

Principal surface water features in or near the Salt Wells Energy Projects Area include the Carson River, irrigation systems, Carson Lake and associated wetlands, other perennial and seasonal wetlands, springs, and Salt Wells playa. The Carson River is located to the northwest of the Projects Area and is not expected to substantially influence the hydrology of the Projects Area, except for water that is diverted to irrigation canals located closer to the Projects Area. Surface-subsurface hydraulic interconnections among the irrigation system, Carson Lake, and the Carson Lake wetlands are likely restricted to the shallow basin-fill aquifer. Surface water flows at wetlands, springs, and the playa are likely limited components of the water budget in the Projects Area; however, water quality and temperature data indicate that the warm and hot springs present in the area are likely hydraulically connected to the deep geothermal reservoir.

Groundwater Flow

Within and near the site of the proposed geothermal developments, groundwater in the shallow unconsolidated aquifer flows to the west (Figure 3-11). Water level contours west of the Bunejug Mountains and Turupah Flat are from Seiler and Allander (1993). A water table map of the Salt Wells Basin and Turupah Flat areas has not been identified, and limited groundwater elevation data for that area exist. Water level contours for the shallow unconsolidated aquifer in the Salt Wells Basin/Turupah Flat region (Figure 3-11) were developed based on topography. Groundwater in the western portion of the Salt Wells Basin likely flows toward the middle of Eightmile Flat. Groundwater movement in the deep system is along fault planes that lie 1,000 to 1,500 feet bgs. Upward vertical hydraulic gradients are characteristic of the tuff-rich geothermal source aquifer. Water quality and temperature data presented previously indicate that the deep geothermal aquifer is likely hydraulically connected to some areas of shallow groundwater and springs present within a portion of the Salt Wells Energy Projects Area (Figure 3-10).

Hydrostratigraphic Units

Hydrostratigraphy of the Salt Wells Energy Projects Area was delineated based on a review of 1) information presented previously; 2) lithologic logs and borehole and well completion reports obtained from NDWR; and 3) geologic, geochemical, and temperature data collected during previous geothermal exploration in and near the Projects Area. The compilation was used to develop a conceptual model of the hydrologic system (Figure 3-12), create hydrogeologic

cross sections (Figures 3-14 and 3-15), and define Hydrostratigraphic Units (HSUs).

As described previously, Maurer et al. (1996) identified three sedimentary valley-fill aquifers (shallow, intermediate, and deep). In this section, unconsolidated deposits overlying basalts are considered to be one HSU. The Pleistocene-age basalt aquifer in the Fallon area is largely surrounded by the sedimentary aquifers and extends to approximately 3,500 feet bgs (Maurer and Welch 2001). The basalt lies in close proximity to the proposed development area and is a sole-source aquifer for the City of Fallon, NAS Fallon, and Paiute-Shoshone Tribe; consequently, the basalt aquifer is considered to be a HSU. The deep ash-flow tuff sequence is the likely reservoir for geothermal groundwater, and this unit is the deepest principle HSU in the Salt Wells area. Mesozoic-age granitic and metamorphic basement rocks are present at depths greater than 5,000 feet bgs. Because they are not likely permeable enough to store or transmit significant quantities of groundwater, these rocks are not considered a primary HSU for the purpose of this section. Water quality characteristics previously discussed are consistent with division of the local geologic units into the HSUs.

Aquifer Hydraulic Properties

Limited site-specific hydrogeologic data were available for aquifers within the ROI. Transmissivity and hydraulic conductivity of the bedrock units (tuff and volcanic/plutonic aquifers) is likely low in regions lacking substantial fracturing and faulting. Fractures and faults in these lithologic units likely increased the permeability of the aquifers in discrete zones and it is along these fractures that high-temperature groundwater is thought to discharge from the tuff-rich aquifer to the volcanic/plutonic zone and to some areas of shallow groundwater, including hot and warm springs and seeps. Storativity values for these deeper systems are likely consistent with confined conditions.

Glancy (1986) estimated that the transmissivity of the alluvial aquifers is generally less than 2,000 square feet per day, although the permeability may be higher in isolated locations. Maurer et al. (1996) indicate that the porosity and permeability of aquifers varies across the Carson Desert, with hydraulic conductivity varying by two or more orders of magnitude. Storativity and specific yield values of these aquifers are probably variable depending on the degree of confinement.

Hydrologic Boundary Conditions

The following lithologic contact likely form vertical barriers to groundwater flow:

- Granitic/metamorphic basement rocks and deep geothermal source aquifer (tuff);
- Geothermal source aquifer and shallower basalt zone; and

- Basalt and valley fill sediments; this is an irregular boundary and is not always vertical.

Horizontal barriers to groundwater flow include:

- Edge of the Lahontan Valley hydrographic area (groundwater divide); and
- Topographic highs represented by the Bunejug Mountains, Turupah Flat, and Lahontan Mountains; these are local surface water and shallow groundwater divides.

Hydrologic Interactions / Recharge and Discharge Relationships
Interactions between the HSUs identified previously and between groundwater and surface water resources are illustrated within the conceptual block model of the Salt Wells hydrogeologic system (Figure 3-12).

Hydrostratigraphic Units
The degree of hydrologic interconnection between the Mesozoic-age basement rocks and the tuff aquifer is poorly understood. The tuff aquifer, which is the likely reservoir for geothermal groundwater, exhibits strong upward hydraulic gradients due to groundwater heating and buoyancy (Lico and Seiler 1993; Maurer et al. 1996). Heated groundwater within the tuff is interconnected with the shallower basaltic aquifer. Because of the upward vertical gradients, shallower aquifers likely do not recharge the tuff stratigraphic unit. Recharge to the tuff may occur in the mountain regions where precipitation infiltrates to the deeper bedrock zones.

The basalt aquifer is both recharged by, and a source of recharge for, the unconsolidated valley-fill aquifer. The basalt aquifer present in the Salt Wells Energy Projects Area may be hydrologically connected to the well-defined basalt aquifer that serves Fallon and surrounding areas. If there is a connection, it is likely at depth, because the Fallon aquifer is surrounded by unconsolidated deposits to a depth greater than 1,000 feet (Maurer and Welch 2001).

Groundwater - Surface Water Relationships
The Carson River recharges the shallowest basin-fill aquifer and supports wetlands within the Lahontan Valley. Flow diverted from the Carson River is lost via seepage to the shallow aquifer from within the irrigation distribution system (Maurer et al. 1996). The shallow aquifer also receives water from irrigation return flows and direct precipitation and infiltration. Discharge from the shallow aquifer flows into irrigation drains, and additional water is consumed by evaporation and transpiration from phreatophytic vegetation. A component of surface water from the irrigation system recharges Carson Lake.

Shallow groundwater flow on the west side of the Salt Wells Energy Projects Area flows toward and recharges Carson Lake. On the east side of the Projects

Area, shallow groundwater discharges to the playa within the Salt Wells Basin. Although topographic maps indicate several ephemeral channels draining into the Fourmile and Eightmile Flat areas, surface water discharge likely occurs only during snow melt and major rain events. According to Coolbaugh et al. (2006), the playas are also influenced by geothermal groundwater associated with upwelling zones.

Several springs are present along the western margin of Eightmile Flat. Recharge to the non-thermal springs is derived from precipitation and runoff in the watersheds in the adjacent ranges (BLM 2005). Additional recharge may occur from shallow aquifers. Flow paths for these springs are likely short, and water temperatures and chemistry are expected to reflect non-geothermal conditions.

Within the basin, perennial wetlands are found in zones of groundwater upwelling. Larger seasonal wetland areas adjacent to perennial wetlands may be supported by precipitation inputs and/or shallow aquifers. Some wetlands appear to be recharged by near-surface groundwater, while others are associated with structural controls (i.e., fault systems).

Geothermal water discharges locally in association with structural zones as evidenced by hot and warm springs/seeps. Temperature and chemistry data collected at these surface water features are consistent with a deep geothermal source (Coolbaugh et al. 2006; 7Q10 2010) ; however, season changes in water temperature and quality indicate that these features are also affected by non-thermal shallow groundwater.

Structural Controls on Geothermal Reservoirs

North- to northeast-striking normal faults are the dominant structural features in the Salt Wells area (Figure 3-12). Conduits for hydrothermal fluids are typically associated with near-vertical systems of highly fractured bedrock associated with such fault zones. Multiple intersecting faults create increased fracture densities that likely result in higher bedrock permeability. The Salt Wells geothermal field appears to be controlled by these faults, some of which have been mapped near the Salt Wells Energy Projects Area (Figure 3-12). Fault zones may provide local pathways for geothermal discharge to shallow groundwater and at the ground surface (e.g., hot springs and seeps).

SPPC Project Area

The proposed SPPC Project Area would be located primarily on basin-fill deposits extending from the east side of the Bunejug Mountains to the north side of the Carson Lake area and into the Lahontan Valley. A portion of the proposed transmission line would cross a wetland area north of Carson Lake (Figure 3-10). In addition, the SPPC Project Area is adjacent to over seven miles of canals and crosses 11 canals and drains (Figure 1-2). Specific hydrologic conditions for this area are included in **Section 3.7.1**, Regional Overview.

Ormat Project Area

The proposed Ormat facilities, including wells and pads, pipelines, roads, and power station would be located between Carson Lake and Pasture, and the Lahontan Mountains, near the west side of Alkali Flat. The Ormat Project Area is located on basin fill deposits northeast of Carson Lake and Pasture. Along the southeast side of the Project Area is a bedrock ridge that extends north from the Bunejug Mountains. Surface runoff and shallow groundwater in this area flow from east and northeast to the south and southwest, away from the Bunejug and Lahontan Mountains and toward Carson Lake (Figures 3-10 and 3-11).

In the northern portion of the Project Area, the direction of shallow groundwater flow is variable. A portion of the groundwater in the northern Project Area likely flows to the south toward Carson Lake. A second groundwater component is directed to the northeast, toward the Stillwater National Wildlife Refuge (Seiler and Allander 1993). Specific hydrologic conditions for this area are included in **Section 3.7.1**, Regional Overview.

Vulcan Project Area

The proposed Vulcan facilities, including wells and pads, pipelines, roads, and power stations would be located in the following general areas: between Carson Lake and Pasture, and the Bunejug Mountains; the north side of Bunejug Mountains; and between the Bunejug and Lahontan mountains (in Star Flat and Eightmile Flat). The Vulcan Project Area is located on the foothills of the Bunejug Mountains and basin fill deposits. The Wildcat Fault Scarp extends through a portion of the Project Area between Carson Lake and Pasture, and the Bunejug Mountains. The flow of runoff and shallow groundwater varies within the Project Area. In the northeast portion of the Project Area, flow is to the southeast along the Salt Wells Basin (Figures 3-10 and 3-11).

Turupah Flat is located in the northwestern portion of the Project Area, and is an endorheic basin. Any runoff and shallow groundwater that flows toward the center of this basin is likely discharged by evapotranspiration. The south-central and southwest portions of the Project Area drain to the west, toward Carson Lake and Pasture. Shallow groundwater also flows toward the lake (Figure 3-11) (Seiler and Allander 1993). Surface runoff in the southeastern portion of the Project Area likely flows to the west, away from the Cocoon Mountains and toward Bass Flat. Groundwater flow direction in this area is unknown, but may mimic topography. Specific hydrologic conditions for this area are included in **Section 3.7.1**, Regional Overview.

3.8 FLOODPLAINS, WETLANDS AND RIPARIAN ZONES

Regulatory Background

Clean Water Act

CWA established the basic structure for regulating discharges of pollutants into Waters of the US, which are also defined by the Act. Also included are requirements to set water quality standards for all contaminants in surface waters. Under Section 401, the CWA made it unlawful for any person to discharge any pollutant from a point source into navigable Waters of the US unless a water quality certification permit was obtained from the NPDES. Permits under Section 401 are generally issued by the state in which the activity is proposed. For discharge of dredged or fill material into navigable waters, including wetlands, a Section 404 permit from the USACE is required.

Regional Overview

The main hydrologic features in the Salt Wells Energy Projects Area include Carson Lake, canals associated with the Newlands Reclamation Project, and washes, springs, and wetlands within Eightmile Flat. Carson Lake is an intermittent desert lake and is located approximately five miles south of the Ormat Project Area, and just to the west of the Vulcan Project Area.

One of the first Reclamation projects, the Newlands Project was constructed in the early 1900s to provide irrigation water from the Truckee and Carson Rivers to lands in the Lahontan Valley and near Fernley. The portion of the Newlands Project in the Salt Wells Energy Projects Area is part of the Lahontan Area Office Division of Reclamation and consists of several canals. These canals originate at the Carson Diversion Dam, approximately 3 miles south of the Lahontan Dam.

Wetlands

Wetlands are rare in the arid west region; however, several do exist associated with the Newlands canals, Eightmile Flat, and Carson Lake. Emergent wetlands occur along the banks of the Newlands canals and around springs and the lower depressions of Eightmile Flat. Within Eightmile Flat, perennial wetlands are associated with springs that flow year round, and seasonal wetlands are associated with a combination of this spring water flow and surface runoff that pools from precipitation events. This seasonal wetland is called a playa. Playas are important because they store water in a part of the country that does not receive much rainfall and where there are few permanent rivers and streams. Consequently, playas support a large array of wildlife, including waterfowl, amphibians, and mammals (EPA 2011).

The Carson Lake and Pasture area is a 30,000-acre wetland that is a component of the Western Hemisphere Shorebird Reserve Network. The importance of

the Lahontan Valley, including Carson Lake and Pasture as well as other terminus lakes and wetlands, to migratory birds is described in Section 3.12.

As discussed in the following sections, no jurisdictional wetland delineations have been conducted within the Projects Area; rather the BLM applied a more conservative approach by identifying wetlands as a resource (e.g., Cowardin system), not by jurisdiction. As such, it provides the BLM the ability to provide a greater level of protection to the resource.

Wetland assessments were conducted along the canal for the Ormat project by a contractor in 2008 and again by BLM in 2010. The assessments were based on identifying wetland vegetation. This approach ensures that more wetland areas are identified then would be under a formal jurisdictional delineation (under which all three wetland indicators have to be present). Based on this information the BLM developed an alternative in the EIS to avoid the wetlands and provide a 650 foot buffer.

Wetland vegetation mapping was conducted for the Vulcan project by a contractor in 2009 to identify perennial wetlands. The Vulcan Proposed Action was designed to avoid the perennial wetlands in the playa areas. No jurisdictional wetlands were identified.

Riparian Zones

Within the Salt Wells Energy Projects Area, riparian zones are limited to the banks of Newlands canals, within Eightmile Flat in association with springs, and in other areas of high water table surrounding the Carson Lake.

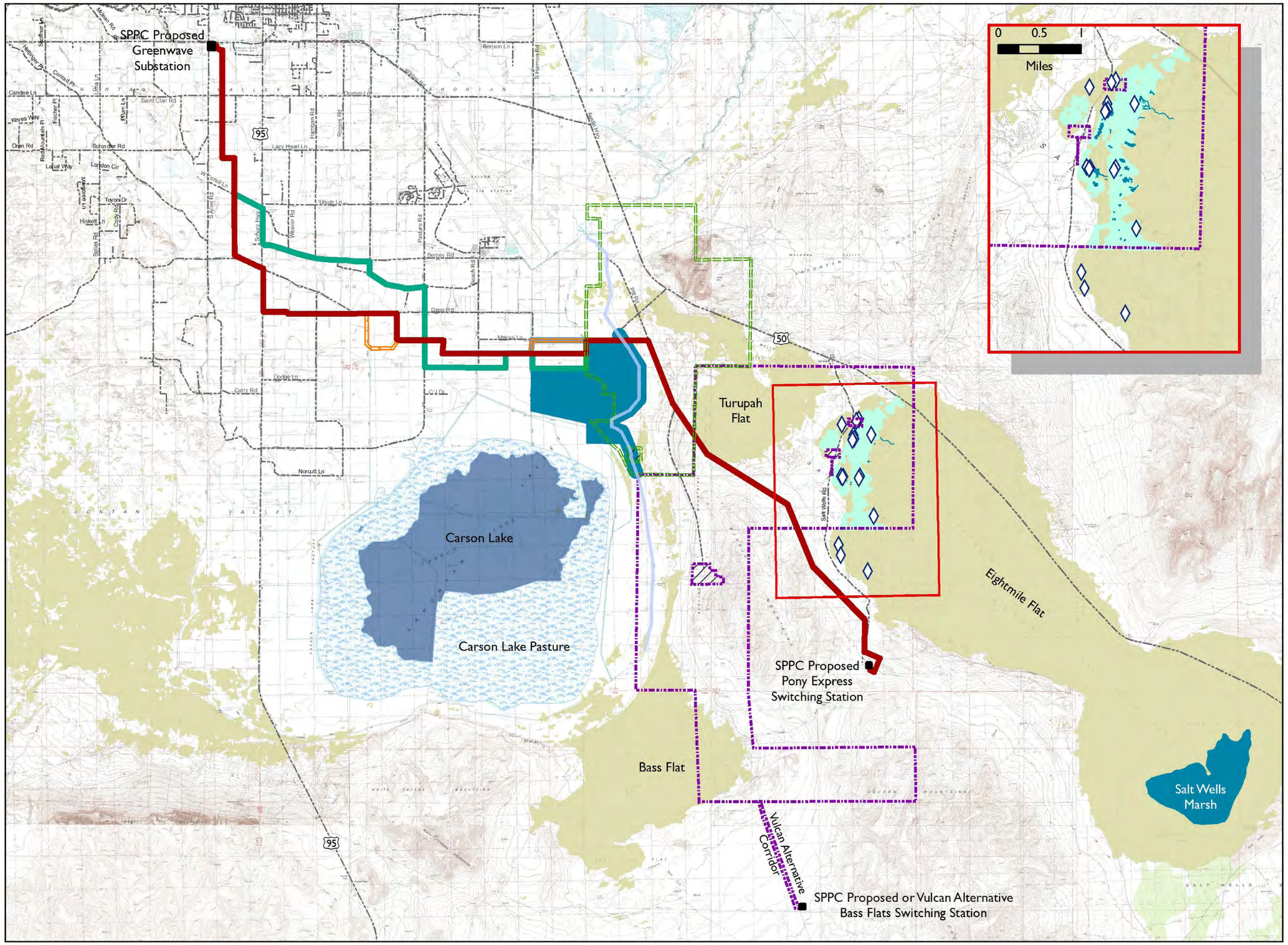
Floodplains

Floodplains in the region are primarily associated with Carson Lake and the east-west aligned portion of the New River Drain in Fallon. Flooding in the region is rare but can occur during wet winters.

SPPC Project Area

Perennial wetlands (wet meadows) located west of the Newlands canal (L-12 canal) are within parts of the east-west aligned section of the SPPC Project Area. Perennial wetlands are also located northeast of the Carson Lake and Pasture, south of Macari Lane. There are no riparian areas or wetland zones within any other area being considered for development by SPPC. As described in **Section 3.9**, Vegetation, 112 acres of perennial wetlands (emergent marsh and wet meadow) are present within the SPPC Survey Area (**Figure 3-17**, Wetlands and Water Bodies). Discharge of dredge or fill material into navigable waters, including wetlands is not anticipated for the proposed action.

The 100-year floodplains just north of Carson Lake are present within the east-west aligned portion of the Survey Area. There are no other 100-year floodplains within other sections of the transmission line or substation Survey Area (Federal Emergency Management Agency [FEMA] 2010).



Wetlands and Water Bodies

Churchill County, Nevada

Wetland Types
- Open Water
- Carson Lake Pasture
- Playa
- Perennial Wetland
- Seasonal Wetland

Water Features
- Spring/Seep
- Newlands Project Canal

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Excluded from Lease Area

Source: AMEC 2010, BLM, Ormat, SPPC, Vulcan 2010, Great Basin Ecology 2010, Huffman and Carpenter 2009, NNHP 2010, SWReGap 2010, USFWS 2010

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Miles

July 2011
NAD 1983 HARN State Plane Nevada West
Disclaimer: 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.

*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-17

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Ormat Project Area

Riparian and wetland communities associated with the Newlands Project canals and perennial wet meadows were observed within the Ormat Project Area. Seasonal playa wetlands are also present (Figure 3-17). The Pierson Slough Extension Canal runs through the southwest quartersections of section 31 and the northwest and southwest quartersections of section 6. The L-12 Canal runs north-south through the length of the western portion of the Project Area, from the northwest corner of the Project Area in Section 19 to the center of the southern edge of the Project Area on the border of sections 7 and 8.

The waterways lack distinguishing attributes; however, the banks of the canals do provide a small strip (25 feet on either side) of vegetation that resembles emergent wetland communities. The wet meadow located on the west side of the L-12 Canal extends from where Macari Lane crosses the canal, south to the Carson Lake (Great Basin Ecology, Inc. 2008). Moving south from Macari Lane along the L-12 canal, from the point where it turns to a north-south alignment, the wet meadow on the east side of the canal extends out increasingly farther to the east to a maximum distance from the canal of approximately 1,000 feet. This extended portion of the wet meadow extends out from the southeast quarter of Section 6 into the southwest quarter of Section 5 (EMPSi and Google Earth 2010). A small amount of riparian vegetation also occurs in this area. Two playa areas in Lease Blocks NVN-079104 and NVN-079106 were also identified in a field survey (Great Basin Ecology, Inc. 2008).

Per a BLM briefing (BLM 2010a), a standard stipulation and a condition of approval for leases limit development within 650 feet of wetlands, riparian areas, and floodplains. Site visits conducted by biologists in 2008 and 2010 delineated these 650-foot buffers around the L-12 canal, as there is wetland and riparian vegetation along the length of the canal. The final boundary for wetland vegetation was delineated during the June 23, 2010 site visit, and this avoidance area was compared with proposed Ormat facilities. During the June 23, 2010, site visit, it was determined that the pipeline crossing along Macari Lane would not be subject to the 650-foot avoidance area due to existing disturbance associated with Macari Lane, the bridge, dirt access roads on either side of the canal, and livestock grazing operations. The pipeline would cross this canal and would protect the canal embankment by avoiding the toe on each side of the canal and incorporating sufficient vertical clearance for Reclamation operations and maintenance. Per Reclamation comment, wetland vegetation near proposed production wells R and S is likely a result of breaches or leaks in the canal (Wilson 2010). These wells are located outside of the avoidance buffer areas. Proposed production wells U and V, as well as the pipeline connecting them, are located within the avoidance area. As a result of the site visit, alternate locations for these two wells and pipeline have been developed and will be considered in the EIS Alternative analysis.

As described in **Section 3.9**, Vegetation, 61 acres of perennial wetlands, and 84 acres of seasonal wetlands are present within the Ormat Project Area. Discharge of dredge or fill material into navigable waters, including wetlands, is not anticipated for the proposed action.

The western and southwestern regions of the Ormat Project Area are within the 100-year flood zone associated with Carson Lake. These areas are within FEMA Flood Insurance Rate Maps (FIRMs) Nos. 32001C2100F and 32001C1775F. The 100-year floodplain extends from Macari Road where it meets the L-12 Canal, southward toward Carson Lake. The eastern extent of the 100-year floodplain is the L-12 Canal for the majority of the western area and the East Ditch Canal for the southwestern region. There are no other 100-year flood zones areas within the remainder of the Ormat Project Area (FEMA 2010).

Vulcan Project Area

Perennial wetlands, seasonal wetlands, including areas dominated by salt grass (*Distichlis spicata*) as well as playa wetlands, and ephemeral washes were observed within the Eightmile Flat and Turupah Flat portions of the Vulcan Project Area. Twenty-five acres of perennial wetlands, 18 acres of seasonal salt grass wetlands, and 281 acres of playa occur within the Vulcan Project Area (Figure 3-17). No riparian areas, 100-year floodplains, or any other forms of wetlands have been identified anywhere else in the Project Area. Discharge of dredge or fill material into navigable waters, including wetlands, is not anticipated for the proposed action.

Perennial wetland vegetation occurs in the Eightmile Flat portion of the Project Area where springs are located. Seasonal wetlands occur adjacent to the perennial wetlands and are distinguished by less dense wetland vegetation. These seasonal wetland areas appear to be supported by surface water and are characterized by a shorter growing season.

Playas are a type of seasonal wetlands, characterized by a defined basin, hard, cracked, clayey soils, and salt on the soil surface. Approximately 281 acres of seasonal wetlands were identified within the Vulcan Project Area (Southwest Regional GAP Analysis Project [SWReGAP] 2010). The USACE is not expected to take jurisdiction over these sites since they do not abut or have surface connection to Waters of the US. However, seasonal wetlands are considered Waters of the State, and are thus subject to requirements under Section 401 of the CWA. The edges of playas are usually marked by a distinct break in vegetation from extremely low-lying species within the playas to more shrubby plant types outside of the playas, as well as a distinct topographical change from very flat inside the playas to more varied terrain outside of the playas.

Similar to seasonal wetlands as described previously, ephemeral washes are not expected to be protected as Waters of the US, but are subject to requirements under Section 401 of the CWA. Several features may indicate the presence of

ephemeral washes, including a defined bed and bank, sorted gravel and sand deposits, scour lines, and matted vegetation on the upstream sides of vegetation. A number of ephemeral washes were found in the Vulcan Project Area.

The Vulcan Project Area is outside the 100-year flood zone associated with Carson Lake and Pasture and is subject to minimal flooding (FEMA 2010).

3.9 VEGETATION

Methods

Information regarding vegetation resources within the Salt Wells Energy Projects Area is based on the results of biological studies conducted in support of the projects between 2005 and 2009, as well as targeted and baseline field studies conducted in April, May, June, and July 2010.

Biological resource surveys were conducted within the defined project footprint of each project facility, which include a minimum 300-foot buffer, in some cases, expanded to 500 feet if a facility was not well defined. Additional blanket environmental surveys of the Vulcan Project Area began in late July, outside of the prime period for plant identification. Meandering transects were utilized for maximum coverage, and unvegetated playas were not intensively surveyed (Pondera 2010).

Existing information reviewed prior to field studies includes documents that discuss biological resources in the region, including:

SPPC Project Area: ENEL Salt Wells Geothermal Plant Development Final Environmental Assessment (BLM 2005a) and Salt Wells to Fallon 230-kV Project Constraint Identification, Substation Siting and Routing Study (Natural Resource Group 2008).

Vulcan Project Area: Salt Wells Geothermal Plant Development Environmental Assessment FONSI Nevada Geothermal Specialists, LLC (EA-NV-030-05-08) (BLM 2005b); Salt Wells Geothermal Drilling Environmental Assessment (BLM 2007a) and subsequent Carson Lake Basin Project Geothermal Drilling Permits FONSI (BLM 2007b); Vegetation Survey, Vulcan Power Geothermal Site, Salt Wells, NV (Western Botanical Services 2008); Salt Wells Geothermal Exploratory Drilling Environmental Assessment (BLM 2009a) and subsequent Carson Lake Basin Project LLC Salt Wells Geothermal Exploratory Drilling Program FONSI (BLM 2009b); and Baseline Hydrologic Data Collection Program Salt Wells, Nevada: Wetland Vegetation Mapping (Huffman and Carpenter 2009b).

Ormat Project Area: Carson Lake Geothermal Exploration Project Environmental Assessment (BLM 2008) and Fallon Geothermal Project Wetland Survey (Great Basin Ecology 2008).

In addition to the 2010 surveys conducted for the proposed project, the USFWS, Nevada Natural Heritage Program (NNHP), and NDOW provided comments to the proposed project components. These are provided in **Appendix H**, Supplemental Biological Resources.

Regional Overview

Vegetation communities were broadly classified using the SWReGAP and field documentation (**Figures 3-18** through **3-20**, Habitat Types, Overall, Northern, and Southern Views). SWReGAP was developed by using geospatial data and is used to create the land cover map and to model vertebrate habitat. This section describes the SWReGAP vegetation communities within the Salt Wells Energy Projects Area and their respective species assemblages (Pondera 2010).

The Salt Wells Energy Projects Area is located within the Great Basin ecoregion in the Lahontan Valley. Average elevation is 3,930 feet (1,198 meters) amsl. The majority of the project lies within two plant communities: greasewood flat and mixed salt desert scrub. However, these two communities do not contain the same composition or proportion of species across the landscape. The dominant plant is Bailey's greasewood (*Sarcobatus vermiculatus* var. *baileyi*), which occurs on dry, upland slopes, while the less dominant big greasewood (*S. vermiculatus*) occupies the lower slopes and bottomland portions of the landscape where seasonal flooding or groundwater occurs. Bailey's greasewood is generally found within the mixed salt desert scrub community (Pondera 2010).

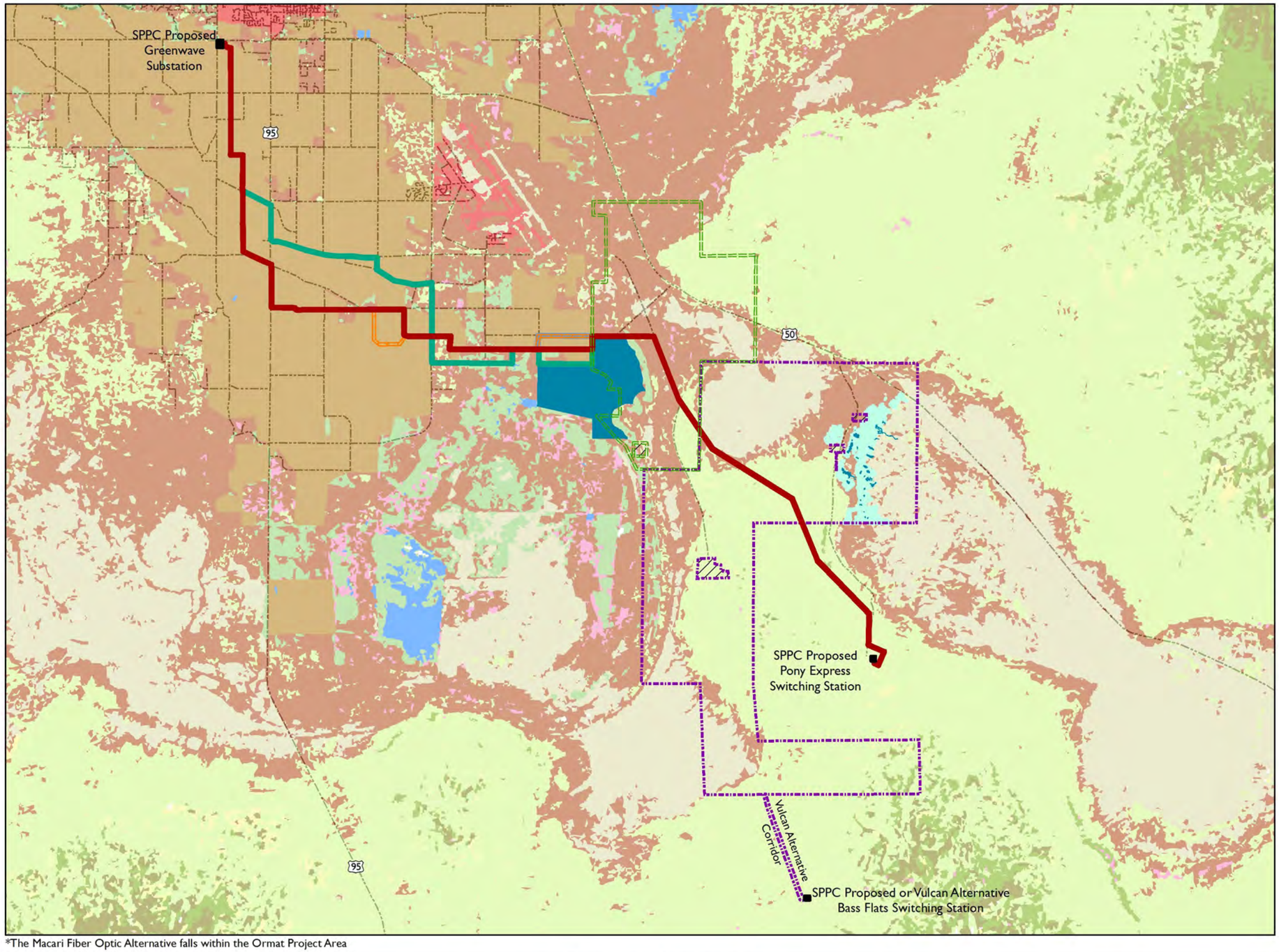
Nearly all native vegetation communities in the Salt Wells Energy Projects Area support some type of biotic crusts and other non-vascular plants–indicators of little soil disturbance. Alternatively, invasive species do occur, as described in **Section 3.10**, Invasive, Nonnative Species.

Greasewood Flat

As described previously, the greasewood flat community primarily occupies lower slopes of fans and basin bottoms adjacent to playas where water is available for big greasewood, which is a phreatophyte (a plant whose roots extend into the water table). A mixture of shadscale (*Atriplex confertifolia*), four-winged saltbush (*Atriplex canescens*), rubber rabbitbrush (*Chrysothamnus nauseosis*), annual lamb's quarters (*Chenopodium album*), low goosefoot (*Chenopodium chenopodioides*), and inland salt grass are common. Soils within this community are generally quite alkaline (Pondera 2010).

Mixed Salt Desert Scrub

Within this community, both shadscale and Bailey's greasewood are co-dominants. Associated species within this community vary by aspect and soils. Observed species include budsage (*Artemisia spinescens*), Nevada dalea (*Psorothamnus poydenius*), horsebrush (*Tetradymia* spp.), and spiny hopsage (*Grayia spinosa*). The forb component of this community varies with soils and aspect as well; noted species include globemallow (*Sphaeralcea ambigua*), Nevada



Habitat Types, Overall View

Churchill County, Nevada

Vegetation
- Agriculture
- Developed
- Great Basin Xeric Mixed Sagebrush Shrubland
- Inter-Mountain Basins Big Sagebrush Shrubland
- Inter-Mountain Basins Greasewood Flat
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Inter-Mountain Basins Playa
- Inter-Mountain Basins Semi-Desert Shrub Steppe
- Invasive Shrubland, Forbland or Grassland
- North American Arid West Emergent Marsh
- Open Water
- Seasonal Wetland
- Perennial Wetland

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Excluded from Lease Area

Source: BLM, Ormat, SPPC, Vulcan 2010, Huffman and Carpenter 2009, SWReGAP 2010

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*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-18

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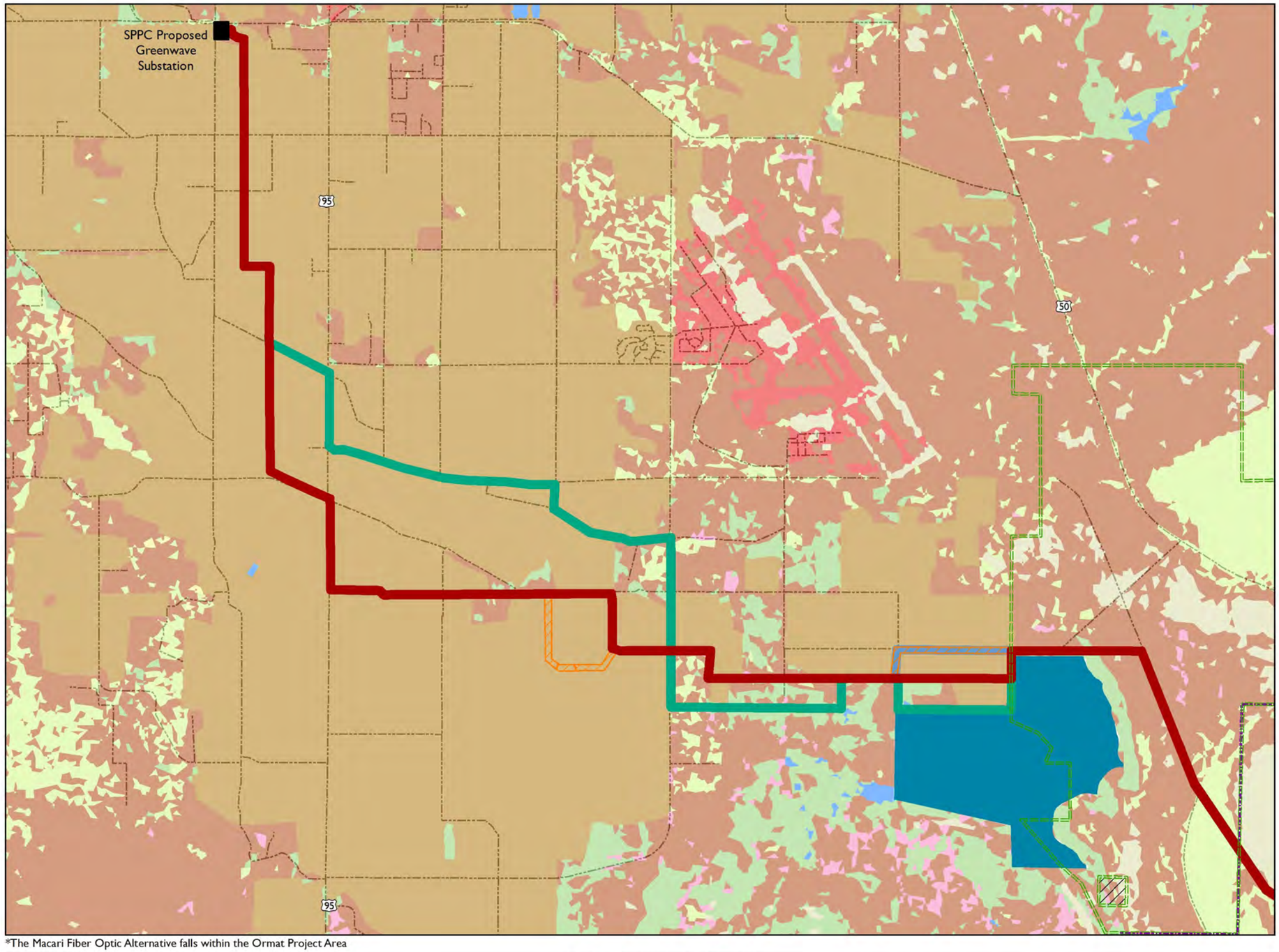

Habitat Types, Northern View

Churchill County, Nevada

Vegetation
- Agriculture
- Developed
- Great Basin Xeric Mixed Sagebrush Shrubland
- Inter-Mountain Basins Big Sagebrush Shrubland
- Inter-Mountain Basins Greasewood Flat
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Inter-Mountain Basins Playa
- Inter-Mountain Basins Semi-Desert Shrub Steppe
- Invasive Shrubland, Forbland or Grassland
- North American Arid West Emergent Marsh
- Open Water
- Perennial Wetland

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
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- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Other Features
- Proposed Substation
- Excluded from Lease Area

Source: BLM, Ormat, SPPC, Vulcan 2010, SWReGAP 2010

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*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-19

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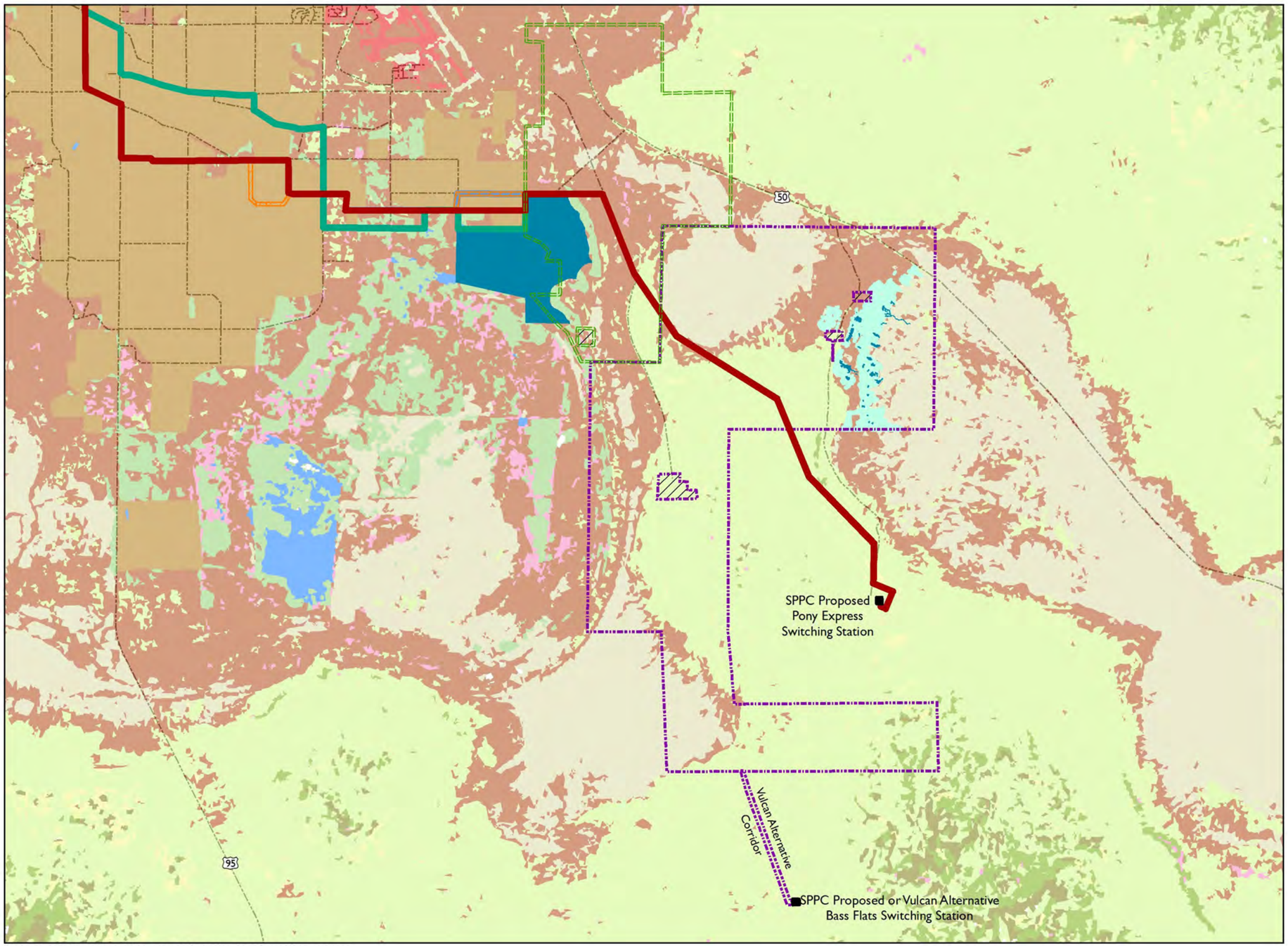

Habitat Types, Southern View

Churchill County, Nevada

Vegetation
- Agriculture
- Developed
- Great Basin Xeric Mixed Sagebrush Shrubland
- Inter-Mountain Basins Big Sagebrush Shrubland
- Inter-Mountain Basins Greasewood Flat
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Inter-Mountain Basins Playa
- Inter-Mountain Basins Semi-Desert Shrub Steppe
- Invasive Shrubland, Forbland or Grassland
- North American Arid West Emergent Marsh
- Open Water
- Seasonal Wetland
- Perennial Wetland

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching Station
- Excluded from Lease Area

Source: BLM, Ormat, SPPC, Vulcan 2010, Huffman and Carpenter 2009, SWReGAP 2010

0 0.5 1 2
Miles

July 2011
NAD 1983 HARN State Plane Nevada West
Disclaimer: 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.

*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-20

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gilia (*Gilia brecciarum*), winged four o'clock (*Mirabilis alipes*), and yellow peppergrass (*Lepidium flavum* var. *flavum*). Grass species occur with very low frequency; species such as invasive cheatgrass (*Bromus tectorum*) occur, and, in sandier soils, Indian ricegrass (*Achnatherum hymenoides*) can be found. Disturbed soils within this community are dominated by ruderal species including cheatgrass, Russian thistle (*Salsola tragus*), flixweed (*Descurainia sophia*), and fiddleneck (*Amsinckia* spp.), with well pads generally being colonized by these species and halogeton (*Halogeton glomeratus*) (Pondera 2010).

Playa

Playas are collection points of water which evaporate during the warmer months. Evaporates left behind are clay minerals, carbonates, salines, analcite, and silicates, but the chemistry and structure vary from one playa to another. Because of the highly concentrated minerals, salts, and soil physiology, playas commonly have unvegetated expanses of salt flats. However, playa systems can support both perennial and seasonal wetlands. Seasonal wetlands are wetlands supported by ephemeral water sources, such as precipitation. These areas are dominated by halophytes (salt-tolerant plants) such as inland salt grass with co-dominants of alkali weed (*Cressa truxillensis*), boraxweed (*Nitrophila occidentalis*), clustered goldenweed (*Pyrrocoma racemosa* var. *paniculata*), red swampfire (*Salicornia rubra*), low goosefoot, and fiddleleaf hawksbeard (*Crepis runcinata* var. *runcinata*) (Pondera 2010). Description of perennial wetlands, such as emergent marsh and wet meadow, follows.

Emergent Marsh and Wet Meadow

Within the Salt Wells Energy Projects Area, these community types are primarily comprised of obligate wetland species such as hardstem bulrush (*Scirpus acutus*) and Baltic rush (*Juncus balticus*), which were found at springs or areas with obvious shallow groundwater, such as Eightmile Flat, and surface water saturated soils, such as those within the Carson Lake and Pasture area. Eightmile Flat has pockets of nonnative common reed grass (*Phragmites australis*), which are associated with springs within the flat (Pondera 2010).

Riparian

This community was not mapped within the SWReGAP, and is not shown on Figures 3-18 through 3-20; however, it occurs along drainage and irrigation ditches as well as edges of flood-irrigated agricultural fields near Fallon. Dominant species include Fremont's cottonwood (*Populus fremontii*), coyote willow (*Salix exigua*), and nonnative invasive tamarisk or salt cedar (*Tamarix ramosissima*) (Pondera 2010).

Active and Stabilized Dune

This community type was also not mapped within the SWReGAP and is not shown on Figures 3-18 through 3-20. It occurs within the Salt Wells Energy Projects Area in eolian bands towards the southern end of the Projects Area. The Blow Sand Mountains are the likely sand source. Dominant plants within

this vegetation community include those found within the mixed salt desert scrub community as well as species commonly found in sandy soils, such as birdcage evening primrose (*Oenothera deltoides*), verbena species (*Abronia* spp.), and Indian ricegrass (Pondera 2010).

Agriculture and Developed

This community varies by proximity to the City of Fallon, but the majority of the agriculture includes hay meadows, alfalfa, corn fields, grazing pastures, dairy operations, and fallow fields bisected by drainage ditches and irrigation canals (Pondera 2010).

Invasive

Areas classified as Invasive are dominated by annual, perennial, and biennial invasive, nonnative grasses, forbs, and shrubs.

Seasonal Wetland

Seasonal wetlands were found associated with perennial springs and seeps in the Vulcan Project Area. These areas exhibited low species diversity and were dominated by an herb layer of salt grass (Huffman and Carpenter 2009a).

SPPC Project Area

The majority of the alternative corridors for the SPPC transmission line are within agricultural and developed areas (**Table 3-17**, Vegetation Communities in the SPPC Survey Area). These include hay meadows, alfalfa, and corn fields as well as drainage and irrigation ditches with desert riparian elements and residential and industrial buildings. The final segment of the transmission line south of the Fallon area (the segment all of the Alternatives have in common) is primarily within the mixed salt desert scrub community, though it crosses over some greasewood flats. This portion of the transmission line (east side of Bunejug Mountains, above Eightmile Flat) had one species of cactus, grizzly bear prickly pear (*Opuntia polycantha* var. *erinacea*), but no other (live) cactus were noted within the rest of this community (Pondera 2010).

Ormat Project Area

The Ormat Project Area is within the boundary of the Carson Lake and Pasture but primarily crosses the greasewood flat community. **Table 3-18**, Vegetation Communities in the Ormat Project Area, presents the acres of each vegetation community within the Ormat Project Area. A portion of Ormat's alternative production well and pipeline encroaches upon a wet meadow dominated by Baltic rush and bird's-foot trefoil (*Lotus tenuis*). The wet meadow community is a result of breaches in the banks of the Extension Canal, which conveys water to the Carson Lake and Pasture (Pondera 2010).

Table 3-17
Vegetation Communities in the SPPC Survey Area

Vegetation Community[1]	Acreage[2]
Greasewood flat	226
Mixed salt desert scrub	225
Playa	6
Emergent marsh and wet meadow	112
Agriculture and developed	622
Invasive	5

[1] Note that riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.
[2] Assumes 300 foot buffer around proposed and alternate project features.
Sources: SWReGAP 2010, BLM 2010b

Table 3-18
Vegetation Communities in the Ormat Project Area

Vegetation Community[1]	Acreage[2]
Greasewood flat	327
Mixed salt desert scrub	24
Playa	84
Emergent marsh and wet meadow	64
Invasive	6

[1] Note that riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.
[2] Assumes 300 foot buffer around proposed and alternate project features.
Sources: SWReGAP 2010, BLM 2010c

Vulcan Project Area

The Vulcan Project Area covers more diverse vegetation communities than the other project components (**Table 3-19**, Vegetation Communities in the Vulcan Project Area). The majority of the Vulcan Project Area occupies greasewood or mixed salt desert scrub; however, five wells associated with Power Plant Site 4 are located within the playa of Eightmile Flat. The flat does not classify as a wetland under Section 404 of the CWA, but any activities would have to comply with Section 401 of the CWA (Huffman and Carpenter 2009a).

Emergent Marsh and Perennial Wetlands

Several perennial wetland areas within the Vulcan Project Area are dominated by hardstem bulrush, which are only found at springs or areas with obvious

shallow groundwater such as low-lying areas within Eightmile Flat. While inland salt grass and Baltic rush are the dominant vegetation within the low-lying areas, obligate wetland species arrowgrass (*Triglochin* spp.) and red swampfire are abundant (Huffman and Carpenter 2009a).

Table 3-19
Vegetation Communities in the Vulcan Project Area

Vegetation Community[1]	Acreage[2]
Greasewood flat	577
Mixed salt desert scrub	1,094
Intermountain basins playa	281
Emergent marsh and wet meadow	0
Seasonal wetland	18

[1] Note that desert riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.
[2] Assumes 300 foot buffer around proposed and alternate project features.
Sources: SWReGAP 2010, Huffman and Carpenter 2009

Seasonal Wetlands

Seasonal wetlands within the Vulcan Project Area are wetlands dominated by the facultative species inland salt grass. The following species, all rated as facultative to facultative wetland in the *National List of Plant Species that Occur in Wetlands* (Reed 1988), often appear as co-dominants within seasonal wetland areas: Baltic rush, alkali weed, boraxweed, and clustered goldenweed. Other species, such as red swampfire, common reed grass, low goosefoot, Mexican fireweed (*Kochia scoparia*), and fiddleleaf hawksbeard, were also present in the seasonal wetland areas (Huffman and Carpenter 2009a).

Vulcan's alternative transmission line crosses stabilized dune hummocks along with greasewood flat and mixed salt desert scrub communities. Eolian features of the stabilized dunes have similar species as those found within a greasewood community, but floristically have a greater diversity of species. These habitats are also unique in that they generally proceed the bloom period of the other community types, primarily blooming in late June to July (Pondera 2010).

3.10 INVASIVE, NONNATIVE SPECIES

Regulatory Background

Federal Noxious Weed Act of 1974

This law provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The Federal Noxious Weed Act

prohibits importing or moving any noxious weeds identified by the regulation, and allows for inspection and quarantine to prevent the spread of noxious weeds.

Executive Order 13112, Invasive Species
Signed in 1999, this Executive Order directs federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. To do this, the Executive Order established the National Invasive Species Council; currently there are 13 Departments and Agencies on the Council.

Nevada Revised Statutes 555, Control of Insects, Pests, and Noxious Weeds
This law advises that the control of noxious weeds is the responsibility of every landowner or occupant. The statute includes the laws by which noxious weeds and other pests are designated and regulated by the Nevada Department of Agriculture. It gives the current noxious weed list for the State of Nevada and creates weed control districts to help control and eradicate noxious weeds.

Methods

Information regarding invasive and nonnative species within the Salt Wells Energy Projects Area is based on the results of biological studies conducted in support of the projects between 2005 and 2009 as well as targeted and baseline field studies conducted in April, May, June, and July 2010 (Pondera 2010).

Biological resource surveys were conducted, and existing information was reviewed, as described in **Section 3.9**, Vegetation. During surveys, invasive nonnative species were documented and noted on survey forms, although a thorough survey for invasive, nonnative species was not conducted

Regional Overview

As described in **Section 3.9**, Vegetation, the project components cross agricultural areas with a suburban feel as well as stretches of greasewood, mixed salt desert scrub, low elevation sinks or playas, low hills, rocky outcrops, stabilized sand hummocks, and wetlands associated with the Carson Lake and Pasture and springs of Eightmile Flat.

Nearly all native vegetation communities supported some type of biotic crusts and other non-vascular plants, indicators of little soil disturbance. Despite this, invasive, nonnative species do occur and are primarily located near areas of previous disturbance, such as roadways, ditch banks, and well pads. Tamarisk was within riparian areas, Russian knapweed (*Acroptilon repens*) was noted adjacent to fallow fields; and cheatgrass and halogeton were common throughout (Pondera 2010). Russian knapweed is a Nevada Category B weed, which is a weed established in scattered populations in some counties of the state, and where control is required where populations are not well established or previously known to occur. Tamarisk is a Nevada Category C weed, which is a weed currently established and generally widespread; control is required at

the discretion of the state quarantine officer. No federal noxious weeds occur in the Salt Wells Energy Projects Area.

SPPC Project Area

The SPPC Project Area would cross a large expanse of agricultural areas where invasive, nonnative species and noxious weeds could grow. Examples of likely species include Russian knapweed, perennial pepperweed (*Lepidium latifolium*), and tamarisk. Other weeds common to agricultural areas are likely to occur along the transmission line (Pondera 2010). Perennial pepperweed is a Nevada Category C weed.

Ormat Project Area

The Ormat Project Area has the most known invasive, nonnative, and noxious weeds including Russian knapweed, halogeton, tamarisk, Russian olive (*Elaeagnus angustifolia*), and perennial pepperweed. Most of the tamarisk was along the ditches and perennial wetlands of the Carson Pasture area. In the Ormat Project Area, tamarisk provided nesting habitat for a Swainson's hawk (*Buteo swainsoni*) during 2010 surveys (See **Section 3.12**, Migratory Birds). The Carson Lake Binary Power Plant and Substation would be located on disturbed land, dominated by invasive species (Pondera 2010).

Vulcan Project Area

Weeds within the Vulcan Project Area are similar to those described for the Ormat Project Area. There are fewer species of weeds in the Vulcan Project Area, as this area is generally less disturbed–it has less agricultural habitat and more unvegetated playa habitat. Most of the tamarisk was along the ditches and perennial wetlands of the Carson Lake and Pasture area, though there was one large tamarisk in Eightmile Flat (Pondera 2010).

3.11 WILDLIFE

Methods

Biological resource surveys were conducted for wildlife, and existing information was reviewed, as described in **Section 3.9**, Vegetation.

Regional Overview

As described in **Section 3.9**, Vegetation, the project habitat setting was mapped using the SWReGAP. Presented in **Table 3-20**, Habitat Types in the Project Area, are the habitat types mapped using the SWReGAP along with the common species associated with them within the Salt Wells Energy Projects Area. Species documented during surveys were typical for the habitat types found within the Projects Area. Surveys coincided with migration of some avian species that were passing through the Lahontan Valley.

Table 3-20
Habitat Types in the Project Area

Habitat Type/Ecological Systems	Associated Species in Project Area
Greasewood Flat	Black-tailed jack rabbit (*Lepus californicus*), white-tailed antelope squirrel (*Ammospermophilus leucurus*), black-throated sparrow (*Amphispiza bilineata*), horned lark (*Eremophila alpestris*), western whiptail (*Aspidoscelis tigris*), zebra-tailed lizard (*Callisaurus draconoides*)
Mixed Salt Desert Scrub	Pronghorn antelope (*Antilocapra americana*), coyote (*Canis latrans*), pocket mouse (*Perognathus* sp.), loggerhead shrike (*Lanius ludovicianus*), sage sparrow (*Amphispiza belli*), Great Basin rattlesnake (*Crotalus oreganus lutosus*), side-blotched lizard (*Uta stansburiana*), long-nosed leopard lizard (*Gambelia wislizenii*).
Playa	Pocket gopher (*Thomomys* sp.), voles (*Microtus* sp.), American avocet (*Recurvirostra americana*), snowy plover (*Charadrius alexandrinus*), killdeer (*Charadrius vociferus*), black-necked stilt (*Himantopus mexicanus*), spadefoot toad (*Spea intermontana*)
Emergent Marsh and Wet Meadow	Yellow-headed blackbird (*Xanthocephalus xanthocephalus*), marsh wren (*Cistothorus palustris*), spotted sandpiper (*Actitis macularius*), cinnamon teal (*Anas cyanoptera*), long-billed curlew (*Numenius americanus*), bullfrog (*Rana catesbeiana*)
Riparian	Swainson's hawk, snowy egret (*Egretta thula*), great blue heron (*Ardea herodias*), bat species, voles and shrews (*Sorex* sp.), cliff swallow (*Petrochelidon pyrrhonota*), garter snake (*Thamnophis sirtalis*)
Active and Stabilized Dune	Kit fox (*Vulpes macrotis*), kangaroo rats (*Dipodomys* sp.), pallid kangaroo mouse (*Microdipodops pallidus*), desert horned lizard (*Phrynosoma platyrhinos*)
Agriculture/Developed	Swainson's hawk, great-horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), coyote, pocket mice, pocket gophers, voles, barn swallow (*Hirundo rustica*), western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis catenifer*)

Sources: SWReGAP 2010 and Pondera 2010

Game Species

Habitat for game species is managed by BLM. Game species observed within the Salt Wells Energy Projects Area include pronghorn antelope, mule deer, mourning dove, and waterfowl. Both mule deer and pronghorn were noted within mixed salt desert scrub on the Carson Lake and Pasture side of the Bunejug Mountains. Pronghorn or their sign were also seen on the Eightmile Flat side of the Bunejug Mountains. Pronghorn are more abundant within sagebrush

communities but occur in lower, drier elevation habitat, such as that of mixed salt desert scrub. Pronghorn browse on a variety of vegetation found in the Projects Area, such as saltbush, rabbitbrush, cheatgrass, Indian ricegrass, lamb's quarters, shadscale, globemallow, and penstemon. Pronghorn seemed to move through the Bunejug Mountains via drainages and valleys (e.g., the valley behind Vulcan's Power Plant Site 5 to Power Plant Site 2) (Pondera 2010).

Mule deer sign was also noted in the agricultural fields and Carson Lake and Pasture where mourning doves also occurred. Mule deer utilization of the Projects Area is likely low, but stable. The Projects Area habitats are mapped by NDOW as a "Mule Deer Distribution" area (Pondera 2010).

Migratory Birds

A description of migratory birds within the Salt Wells Energy Projects Area is presented in **Section 3.12**, Migratory Birds.

SPPC Project Area

Habitats traversed by the Alternatives for the SPPC transmission line include developed and agricultural, riparian, emergent marsh (associated with canals), mixed salt desert scrub, and greasewood flat. Common species listed in Table 3-20 for these habitats are likely to occur.

Ormat Project Area

The Ormat Project Area covers greasewood flat, perennial wetlands (wet meadow associated with Carson Pasture and canal), and a limited amount of mixed salt desert scrub. Common species listed in Table 3-20 for these habitats are likely to occur.

Vulcan Project Area

The Vulcan Project Area covers all habitat types except for developed and agricultural. Additionally, various rock outcrops and other formations (e.g., tufa) were within or adjacent to their sites. The bulk of the species noted within **Table 3-20** were within the Vulcan Project Area.

3.12 MIGRATORY BIRDS

Regulatory Background

Migratory Bird Treaty Act of 1918

The Migratory Bird Treaty Act implements a series of international treaties that provide for migratory bird protection. The Act authorizes the Secretary of the Interior to regulate the taking of migratory birds; the act provides that it shall be unlawful, except as permitted by regulations, "to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird" (16 USC 703) but does not regulate habitat. The list of species protected by the Act was revised in March 2010, and includes almost all bird species (1,007 species) that are native to the US.

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Signed on January 11, 2001, this Executive Order directs each federal agency taking actions that are likely to have a measureable effect on migratory bird populations to develop and implement a Memorandum of Understanding with the USFWS that promotes the conservation of migratory bird populations.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (1940 as amended 1959, 1962, 1972, 1978) prohibits the take or possession of bald and golden eagles with limited exceptions. Take, as defined in the Act, includes "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "Disturb" means "to agitate or bother a bald or golden eagle to a degree that causes or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding or sheltering behavior."

An important eagle-use area is defined in the Act as an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles.

BLM requires consideration and NEPA analysis of golden eagles and their habitat for all renewable energy projects (BLM IM No. 2010-156). The BLM Instruction Memorandum (IM) on Golden Eagles provides direction for complying with the Act, including its implementing regulations (i.e., Eagle Rule, 50 CFR parts 13 and 22) for golden eagles, and to identify steps that may be necessary within the habitat of golden eagles to ensure environmentally responsible authorization and development of renewable energy resources(BLM 2010d). The IM primarily addresses golden eagles, because a process to acquire take permits for bald eagles already exists. The IM is applicable until the USFWS establishes criteria for programmatic golden eagle permits.

Instruction Memorandum 2008-050, Migratory Bird Treaty Act–Interim Management Guidance

This IM establishes a consistent approach for addressing migratory bird populations and habitats when adopting, revising, or amending land use plans and when making project level implementation decisions until a national Memorandum of Understanding with the USFWS is established. It provides guidance for conservation planning, land use planning, and management of habitat for USFWS Bird Species of Conservation Concern and Game Birds Below Desired Condition.

Methods

Biological resource surveys were conducted for migratory birds, and existing information was reviewed, as described in **Section 3.9**, Vegetation. For migratory birds, surveys were conducted April through June using modified point counts. Golden eagle and other raptors were surveyed specifically for the presence of nests. For raptor nests outside of the Fallon agricultural area (Ormat and Vulcan Project Areas) all rocky outcrops were surveyed for suitability (e.g., enough vertical exposure), and for whitewash and stick nests. Outcrops within direct sight of project facilities were examined with binoculars and spotting scope, following the USFWS protocols for golden eagle inventory and monitoring (Pagel et al. 2010). Potential nesting outcrops beyond sight of the facilities were found using satellite imagery (e.g., Google Earth) and were assessed for suitability (Pondera 2010).

Regional Overview

Lahontan Valley

The Lahontan Valley was historically covered by a large Pleistocene lake, Lake Lahontan. As evidence of this, the valley is distinguished by terminus lakes and wetlands associated with the formerly free-flowing Carson River and waters diverted from the Truckee River via the Newlands Project. In an area of the Great Basin that receives just over 5 inches of precipitation annually, the diverse and extensive wetlands of the Lahontan Valley are a crucial stop along the Pacific Flyway for hundreds of thousands of migrating shorebirds and waterfowl. Estimates of annual shorebird use range between 250,000 and 500,000 individuals, including long-billed dowitcher (*Limnodromus scolopaceus*), western and least sandpipers (*Calidris mauri* and *C. minutilla*), American avocet, and long-billed curlew (PWNet 2010, Audubon 2010). The Lahontan Valley is also regionally important for dozens of bird species that rely on the diverse wetlands for reproduction. It has been designated as an Important Bird Area (IBA) by the Audubon Society, is designated as an area of Hemispheric Importance by Western Hemisphere Shorebird Reserve Network (McIvor 2005), and is listed as a Global IBA by the American Bird Conservancy (Wildlife Action Plan Team 2006). Eleven species of shorebirds breed, and another 23 migrate regularly within the Intermountain West region of the Pacific Flyway (PWNet 2010). Up to 90 percent of the world's Wilson's phalaropes (*Phalaropus tricolor*) molt or stage in Intermountain West hypersaline lakes (PWNet 2010), and Stillwater National Wildlife Refuge is the home of the largest colony of white-faced ibis (*Plegadis chihi*), comprised of approximately 10,000 birds (Audubon 2010).

The Carson Lake and Pasture is located to the southwest of the Salt Wells Energy Projects Area, and encompasses a substantial portion of the Lahontan Valley wetlands at the terminus of the Carson River. This area of shallow ponds and extensive marshes is one of the Pacific Flyway's major stopovers for migrating shorebirds and waterfowl. Tens of thousands of shorebirds can be found at the Carson Lake and Pasture from late April to mid-May and again

from July through September. Waterfowl arrive in fall, sometimes numbering in the hundreds of thousands. Shorebirds present in large numbers include long-billed dowitcher, western sandpiper, American avocet, and black-necked stilt (Audubon 2011).

Salt Wells Energy Projects Area

Numerous migratory birds have the potential to use the Salt Wells Energy Projects Area, as 56 species of birds were recorded during the 2010 field effort. Species such as black-throated sparrow, horned lark, northern mocking bird (*Mimus polyglottos*), and rock wren (*Salpinctes obsoletus*) are species associated with intermountain basins mixed salt desert scrub, and were noted during the 2010 surveys. Within marsh and playa habitats white-faced ibis, killdeer, yellow-headed blackbirds, and great blue heron were commonly seen during the surveys (Pondera 2010). The importance of playa habitats is described in Section 3.8. **Table 3-21**, BLM-Designated Sensitive Bird Species, USFWS Bird Species of Conservation Concern and Game Birds Below Desired Condition (as per IM 2008-050) Potentially Occurring in the Projects Area, presents BLM-Designated Sensitive Bird Species, USFWS Bird Species of Conservation Concern, and Game Birds Below Desired Condition (as per IM 2008-050) that could potentially occur in the Projects Area. BLM-designated sensitive bird species are also addressed in this section.

Raptors were seen throughout the Projects Area primarily within the developed and agricultural habitats. Red-tailed hawks were seen nesting in many of the trees of the agricultural areas and were seen foraging within most habitats, including greasewood flats. Great-horned owls were seen nesting in similar habitats as those of red-tailed hawks. A pair of American kestrels (*Falco sparverius*) was seen in April, and again with a fledged young near outcrops along the Carson Lake and Pasture area. Since they are cavity nesters, it is unclear where they may nest, but the riparian habitats within the agricultural areas are the likely setting. Only one northern harrier was noted during the surveys; these ground nesters likely nest along many of the agricultural and pasture habitats as well as the playa habitats with wetlands (Pondera 2010).

BLM-Designated Sensitive Bird Species

Golden Eagle. Golden eagles were noted within the Salt Wells Energy Projects Area, as were nest outcrops and roosts. No occupied nest was located within any Projects Area during the survey period. An occupied nest was observed during 2010 surveys (nest GoEa 3), though it was possibly a failed nest, as an egg was noted at the edge of the nest and minimal down was seen. This nest was located within 1.25 miles (2.3 kilometers) from Ormat's proposed pipelines, within 0.25 miles (0.40 kilometers) from Highway 50. Two nest outcrops featuring numerous alternative nests (GoEa 1 and GoEa 2) are adjacent to the Vulcan Project Area. The entire Salt Wells Energy Projects Area provides

Table 3-21
BLM-Designated Sensitive Bird Species, USFWS Bird Species of Conservation Concern and Game Birds Below Desired Condition (per IM 2008-050) Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
Bald eagle *Haliaeetus leucocephalus*	-/BSCC	Tall trees near open water.	Could occur; potential foraging habitat.
Black tern *Chlidonias niger*	S/--	Nests colonially within freshwater marshes with emergent vegetation.	Unlikely to occur; known to occur in the freshwater marshes with emergent vegetation of Carson Lake and Pasture. This habitat is not present in the Projects Area.
Burrowing owl *Athene cunicularia*	S/--	Burrow sites in open, dry annual or perennial grasslands, deserts, and scrublands with low-growing vegetation and burrowing mammal populations.	Could occur; all sites provide limited burrow opportunities. Most suitable habitat occurs within the SPPC alignment along pastures. Known to occur near Fallon (NDOW) and Carson Lake and Pasture (Floyd et al. 2007).
Ferruginous hawk *Buteo regalis*	S/BSCC	Associated with a variety of open habitats with single juniper or pine trees for perch or nest.	Unlikely to occur; suitable nesting habitat does not occur in Projects Area. NDOW designates a distribution line along the southern edge of the Projects Area.
Golden eagle *Aquila chrysaetos*	S/BSCC	Nests on rocky scarps with large expanses of hunting territory.	Known to occur; observed during 2010 surveys, nests were located less than one kilometer from Vulcan well locations.
Loggerhead shrike *Lanius ludovicianus*	S/BSCC	Uses a wide range of open habitats including shrublands, pinyon juniper, pastures, and agricultural fields.	Known to occur; Suitable habitat present. Observed during the 2010 surveys and have been documented within Lahontan Valley (Floyd et al. 2007).
Long-billed curlew *Numenius americanus*	S/BSCC	Nests in naturally short grasslands and agricultural fields with flooded fields or near wetlands with mudflats, wet soils along shallow shorelines.	Known to occur; nesting curlew was noted during 2010 surveys. Known to nest at Carson Lake and Pasture, agricultural fields, meadow, and playa wetland habitats provide suitable nesting sites (GBBO 2010; Floyd et al. 2007).

Table 3-21
BLM-Designated Sensitive Bird Species, USFWS Bird Species of Conservation Concern and Game Birds Below Desired Condition (per IM 2008-050) Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
Northern goshawk *Accipiter gentilis*	S/--	Nests in a wide variety of forest types; habitat requirements in winter are poorly understood.	Could occur. Potential foraging or wintering habitat.
Prairie falcon *Falco mexicanus*	S/--	Nests on cliff faces adjacent to foraging habitat of saltbush, sagebrush, creosote bush, greasewood, agricultural crops, and native perennial grasses.	Known to occur; suitable nesting habitat exists on rock outcrops. Seen in 2010 surveys. Known to occur in the Lahontan Valley (Floyd et al. 2007, NDOW 2010).
Short-eared owl *Asio flammeus*	S/--	Nests on ground. Expansive wet meadow or pasture and hay crops, or similar grassland buffered by open shrublands, marsh component beneficial, little or no urban encroachment.	Could occur; suitable habitat occurs within the agricultural and wet meadow areas. Known to occur near Fallon and Carson Lake and Pasture (Floyd et al. 2007).
Snowy plover *Charadrius alexandrinus*	S/BSCC	Associated with barren shorelines of playa lakes that contain water but have little or no emergent or shoreline vegetation.	Likely to occur; known to nest at Carson Lake and Pasture, and other sites in the Lahontan Valley (GBBO 2010; Floyd et al. 2007); wetland playa sites provide suitable nesting habitat.
Swainson's hawk *Buteo swainsoni*	S/--	Nests in single old growth cottonwoods, adjacent to foraging habitat of open riparian woodlands with significant expanses of pasture, agricultural fields, wet meadow, or open shrublands with grass cover in immediate vicinity.	Known to occur; Swainson's hawks were noted during 2010 surveys. Suitable nesting and foraging habitat occurs along the Carson Lake and Pasture area and along the SPPC alignment. Two occupied nests were documented in the Projects Area during 2010 surveys. Known to occur throughout the Fallon area (Floyd et al. 2007).
Brewer's sparrow *Spizella breweri*	--/BSCC	Associated with sagebrush but is also found in salt desert scrub habitats.	Known to occur; documented during the 2010 surveys.

Table 3-21
BLM-Designated Sensitive Bird Species, USFWS Bird Species of Conservation Concern and Game Birds Below Desired Condition (per IM 2008-050) Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
Sage sparrow *Amphispiza belli*	--/BSCC	Associated with sagebrush habitats but is also found salt desert scrub.	Known to occur; documented during the 2010 surveys.
Mourning dove *Zenaida macroura*	--/G	Found in a variety of habitats except playas.	Known to occur; documented during the 2010 surveys.
Canada goose *Branta canadensis minima*	--/G	Various habitats near water.	Known to occur; found in Carson Lake and Pasture and fly through the Projects Area.
Snow goose *Chen caerulescens*	--/G	Winters in both freshwater and coastal wetlands, forages also in pastures, cultivated lands, and flooded fields.	Known to occur; found in Carson Lake and Pasture and fly through the Projects Area.
Northern pintail *Anas acuta*	--/G	Various habitats near water.	Known to occur; found in Carson Lake and Pasture and fly through the Projects Area.
White-fronted goose *Anser albifrons*	--/G	Various habitats near water.	Known to occur; found in Carson Lake and Pasture and fly through the Projects Area.
Mallard *Anas platyrhynchos*	--/G	Found anywhere water sources occur.	Known to occur; documented during the 2010 surveys in agricultural fields and canals.
Canvasback *Aythya valisineria*	--/G	Nests in aquatic habitats with dense emergent wetlands.	Known to occur; Documented during the 2010 surveys, however, suitable nesting habitat does not occur within the Projects Area. Documented nesting at Carson Lake and Pasture (Floyd et al. 2007).

[1] **Legal Status Definitions**
BLM Listing Categories
S BLM-designated sensitive species
USFWS Listing Categories
BSCC Bird Species of Conservation Concern
G Game Birds Below Desired Condition

Table 3-21
BLM-Designated Sensitive Bird Species, USFWS Bird Species of Conservation Concern and Game Birds Below Desired Condition (per IM 2008-050) Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]

[2] **Potential for Occurrence Definitions**

Unlikely to occur: Potentially suitable habitat present but species unlikely to be present in the Salt Wells Projects Area because of current status of the species and very restricted distribution.

Could occur: Suitable habitat is available in the Projects Area; however, there are few or no other indicators that the species might be present.

Likely to occur: Habitat conditions, behavior of the species, known occurrences in the project vicinity, or other factors indicate a relatively high likelihood that the species would occur in the Projects Area.

Known to occur: The species, or evidence of its presence, was observed in the Projects Area during surveys or was reported by others.

Source: NNHP 2010 Bradley et al. 2006, Floyd et al. 2007, and GBBO 2010

suitable foraging, roosting, nesting, and migratory habitat. Two adults were seen in late April above the Bunejug Mountains and were observed on a number of occasions during early May. The pair was seen using one of the unoccupied nest outcrops (GoEa 1), appearing to be unaffiliated with a nest in early May. A juvenile golden eagle was seen north of Highway 50 above Eetza Mountain near the GoEa 3 nest location (Pondera 2010).

There are an estimated seven alternate nest sites located on rock outcrops within four miles of proposed project facilities, each having one to five alternate nests per outcrop. The majority of these nest locations were documented during the 2010 surveys; two nest locations documented by NDOW were not surveyed for as access was unattainable (Pondera 2010).

The landscape of the Salt Wells Energy Projects Area is ideal golden eagle habitat, as it has wide open terrain, including agricultural land and open shrub habitats with suitable nest features (e.g., rock outcrops). Nest sites generally have expansive views of their territory. Golden eagle's common prey sources are rabbits, ground squirrels, other medium or small mammals (e.g., coyote pups), and carrion; the Projects Area also offers afterbirth from calving activities within the Carson Pasture area (Pondera 2010).

Burrowing Owl. Surveys for burrowing owls and potential habitat revealed limited suitable burrow opportunities for this species. Burrowing owls rely on other species to construct burrows for shelter and nesting, and they prefer habitat that has a sparse shrub cover, such as grasslands or barren fields, with suitable perches. These perches may be rocks, shrubs or simply mounds of dirt that offer views for hunting lizards and insects as well as lookouts for potential predators. It is not uncommon to see these owls near roadways or other

somewhat busy locales. Burrow complexes of kit fox, badger, ground squirrel, and coyote were noted and examined during surveys. Few were suitable for owls because of excessive shrub canopy, steep slope locations, and ground squirrel burrows were often easily collapsed. No burrow examined had characteristic whitewash or pellets usually found with burrowing owl visitation or inhabitation. The species is known to occur nearby, and as such, is considered to have the potential to occur within the Salt Wells Energy Projects Area (Pondera 2010).

Prairie Falcon. Suitable prairie falcon foraging habitat and nest features occur throughout the Salt Wells Energy Projects Area, as they commonly utilize the same nest locations as golden eagles. Prairie falcon was not encountered during the surveys, but two were seen during a site visit in August. It is likely that prairie falcon were not nesting within a mile of the Projects Area in 2010. According to NDOW records, they have been documented nesting within the Projects Area. Suitable habitat includes areas of sagebrush, salt desert scrub, and badlands with cliffs, canyons, or rocky ledges for nests. They commonly prey on small mammals and birds (Pondera 2010).

Swainson's Hawk. Swainson's hawks appear to be plentiful in the Lahontan Valley. They were seen during nearly all site visits and were documented nesting adjacent to or within the Salt Wells Energy Projects Area. This migrant arrives in Nevada in April from South America. Swainson's hawk habitat is that of open fields, agricultural areas and grasslands with large mature trees for nesting. Swainson's hawk preys upon lizards, small mammals, and insects, which are their primary prey base during the non-breeding season. Swainson's hawk have been reported to nest in riparian areas, not utilizing large trees, and one occupied nesting locale was observed within a large tamarisk adjacent to a canal, approximately six feet off the ground. Other nests in the valley are primarily located within larger trees, such as cottonwoods and elms, and one such nest was located within the Projects Area (Pondera 2010).

Short-eared Owl. Surveys were not conducted specifically for short-eared owls. Short-eared owls are active during crepuscular hours (dawn and dusk), but field surveys generally did not occur during this time period. Their preferred hunting habitats include grasslands, wetlands, or other habitats supporting healthy vole populations (e.g., Carson Pasture). Nests are generally located within dry grasslands with tall ground cover. The Salt Wells Energy Projects Area likely supports this species, particularly near the Carson Lake and Pasture wetland habitats (Pondera 2010).

Other Avian Species. Three additional BLM-designated sensitive avian species that might or do occur in the Salt Wells Energy Projects Area are the loggerhead shrike, snowy plover, and long-billed curlew. These species are also USFWS Bird Species of Conservation Concern. Loggerhead shrike were seen most abundantly in July and were noted in all habitats where they likely nest in

larger shrubs. Snowy plovers were once more abundant than the now roughly 350 individuals in northern Nevada, all within the Lahontan Valley (Floyd et al. 2007). Snowy plovers nest in the area from late March until July. Nesting snowy plovers have been documented within the Carson Lake and Pasture area and within the playa south east of Eightmile Flat (Four Mile Flat) (NNHP 2010a), and the Projects Area provides suitable habitat for this species. Surveys of Eightmile Flat coinciding with the breeding period for this plover were conducted on only one day in June, which was an extremely windy day.

Long-billed curlews were noted during the surveys, as was a nest. They have been previously documented breeding within the Lahontan Valley (Floyd et al. 2007). Long-billed curlews are a grassland species but have adapted to changing habitats and now utilize irrigated hay meadows and agricultural areas as well as cheatgrass stands (GBBO 2010). One nest was located within the Carson Pasture adjacent to Ormat's proposed components (Pondera 2010).

USFWS Bird Species of Conservation Concern

Sage sparrow and Brewer's sparrow were seen within the Projects Area during the 2010 surveys. Sage sparrow likely nests within the habitats of the Projects Area; they were seen in virtually every habitat transect between April and July except those within the playa or wetland areas. Brewer's sparrows were seen during the early surveys (April and May) but were seen only twice in July. Mixed salt desert scrub habitat provides nesting and foraging habitat for both of these species (Pondera 2010).

Game Birds Below Desired Condition

Mourning dove and mallard were both encountered during surveys–mallard within the ditches and mourning doves throughout the Salt Wells Energy Projects Area. Suitable nesting habitat for mallard occurs within the Carson Lake and Pasture area. Mourning doves nest in a variety of habitats except playas but are primarily found nesting within the riparian and agricultural habitats (Pondera 2010).

SPPC Project Area

Habitats traversed by the Alternatives for the transmission line include developed and agricultural, riparian, emergent marsh (associated with canals), mixed salt desert scrub, and greasewood flat. The agricultural areas provide substantive habitat for a variety of raptors and dozens of species of migratory birds that the other project components do not, such as red-tailed hawks, great-horned owls, and American kestrels. The SPPC proposed transmission line crosses documented nesting habitat for Swainson's hawk, loggerhead shrike, sage sparrow, and mourning dove, potentially suitable habitat for burrowing and short-eared owls, and foraging habitat for golden eagle. One occupied Swainson's hawk nest was located in a cottonwood tree adjacent to the proposed alternative alignment. Because of the density of Swainson's hawks seen in the Fallon agricultural area, it is likely there are more nests nearby.

Other species that were observed include western kingbird (*Tyrannus verticalis*), western meadowlark (*Sturnella neglecta*), lazuli bunting (*Passerina amoena*), and white-faced ibis (Pondera 2010).

Ormat Project Area

The Ormat Project Area is composed of greasewood flat, perennial wetlands (wet meadow associated with Carson Pasture and canal), and a limited amount of mixed salt desert scrub. It includes potential nesting habitat for Swainson's hawk, long-billed curlew, snowy plover, loggerhead shrike, sage sparrow, mallard, and mourning dove. It also provides potentially suitable habitat for short-eared owl as well as foraging habitat for golden eagle and prairie falcon. Long-billed curlew and Swainson's hawks were noted nesting within the Ormat Project Area. The occupied 2010 golden eagle nest, GoEa 3, was located 1.25 miles from the Ormat Project Area. However, Highway 50 bisects the nest site from the proposed facilities (Pondera 2010). Other bird species observed utilizing habitats within the Ormat Project Area include northern mocking bird, white-faced ibis, and yellow-headed blackbirds (Pondera 2010).

Vulcan Project Area

The Vulcan Project Area covers all habitat types except developed and agricultural. Additionally, various rock outcrops and other formations (e.g., tufa) were within or adjacent to their sites. The bulk of the migratory bird species noted were within the Vulcan Project Area (Pondera 2010).

The Vulcan interconnection line primarily covers mixed salt desert scrub and greasewood habitat. Approximately three miles of the interconnection line crosses stabilized dune habitat interlaced with mixed salt desert scrub. Bird species that utilize these habitats, as described previously, are likely to be found in this area (Pondera 2010).

Numerous BLM-designated sensitive, USFWS Bird Species of Conservation Concern, and Game Birds Below Desired Condition were found within the Vulcan Project Area, including golden eagle, loggerheaded shrike, Brewer's sparrow, sage sparrow, and mourning dove. No occupied BLM-designated sensitive species nests were located within the Project Area during the surveys. Additionally, nesting habitat occurs for snowy plover and prairie falcon. Potentially suitable habitat exists for long-billed curlew (Pondera 2010).

Two unoccupied golden eagle nests, GoEa 1 and GoEa 2, are within one-half mile from proposed and existing project facilities, as is a bat and raptor roost outcrop (Pondera 2010). GoEa 1 is located on public land and is a large basalt outcrop adjacent to an intermittently active gravel quarry on private land. It has at least four stick nests of varying size and age; most look as if they have been used for years, although do not appear to have had significant recent use. Golden eagles were observed using the rock in May 2010. Vulcan has an approved well approximately 0.5 mile from the outcrop where GoEa 1 is located. The proposed transmission line is within 0.3 mile from the outcrop.

GoEa 2 is located on a lower basalt outcrop with a tufa mantle. This single stick nest outcrop is shallow and relatively small for golden eagle use; the most recent nesting raptor was likely a prairie falcon due to egg shell fragments and small prey size found. This outcrop is approximately 0.5 mile from two proposed and one existing well, approximately 0.8 mile from the proposed Power Plant Site 5, and 0.65 mile from the proposed transmission line.

One rock feature provides roosts for a variety of raptors including golden eagles and prairie falcons. This outcrop is within 500 feet of an existing well.

3.13 BLM-DESIGNATED SENSITIVE SPECIES (ANIMALS AND PLANTS)

Regulatory Background

BLM Manual 6840 – Special Status Species Management

BLM Manual 6840 provides management policy for federally listed species and BLM-designated sensitive species. Species classified as BLM-designated sensitive must be native species found on BLM-administered lands for which the BLM has the capability to significantly affect the conservation status of the species through management, and either:

1. There is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range; or

2. The species depends on ecological refugia or specialized or unique habitats on BLM-administered lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk.

BLM protects and manages habitat for the enhancement and protection of the species future existence.

Methods

Biological resource surveys were conducted for BLM-designated sensitive species as described in **Section 3.9**, Vegetation. Potentially suitable plant communities for BLM-designated sensitive plants within the project footprint and buffer areas for all projects were examined during the time most suitable for identification (bloom period); however, the blanket surveys within the Vulcan Project Area did not occur during the appropriate timeframe for identification (Pondera 2010).

All ground burrows within project footprints and buffers were noted and examined for evidence of burrowing owls (e.g., feathers, pellets with insect

exoskeletons, whitewash). Additionally, areas that had good exposure, such as back dirt or rises that had little vegetative cover, were also examined for potential use by burrowing owls (Pondera 2010).

Regional Overview

Habitats within the Salt Wells Energy Projects Area were mapped using SWReGAP, as described in **Section 3.9**, Vegetation. Some of these habitats provide potentially suitable habitat for BLM designated species.

Table 3-22, BLM-Designated Sensitive Species Potentially Occurring in the Projects Area, was distilled from the list given by the SFO biologist. The table includes only those species that might have potentially suitable habitat within or directly adjacent to the Projects Area as determined by field surveys, NDOW comments, NNHP data query, or other sources. Those species which are not likely to occur in the Salt Wells Energy Projects Area are only addressed in the table. Species with the potential to occur are discussed in greater detail below (Pondera 2010). All BLM-designated sensitive bird species are discussed in **Section 3.12**, Migratory Birds.

No federally listed species have been observed within the Salt Wells Energy Projects Area, nor is there suitable habitat for these species. Greater-sage grouse (*Centrocercus urophasianus*) is a candidate species under the ESA, but no suitable habitat (i.e., sagebrush) is within three miles of the Projects Area. Yellow-billed cuckoo (*Coccyzus americanus occidentalis)* is also a candidate species and has been documented migrating through the Carson Lake and Pasture area (Chisholm and Neel 2002), though no suitable nesting habitat occurs within the Projects Area. Pygmy rabbit (*Brachylagus idahoensis*) was listed as a species of concern for the project region by NDOW and USFWS. Pygmy rabbit habitat, particularly big sagebrush, was not located within or adjacent to the Projects Area. These three species are not addressed further in this document.

Unlike BLM, Reclamation policy does not require any species to be addressed beyond those covered under ESA, although the agency can address additional species if they choose. BLM-designated sensitive species found within Reclamation and private lands are addressed as if they were within BLM managed lands (Pondera 2010).

BLM-Designated Sensitive Species

Plants

Two plant species were identified as potentially occurring within or adjacent to the Projects Area based on literature reviews, NNHP data search and habitat assessment. Both species primarily occur in sandy, stabilized dune/mixed salt desert habitats. Surveys for oryctes, an annual, and Nevada dune beardtongue, a perennial, occurred during the most reasonable time for identification. Due to a long rainy season, the 2010 spring season was greatly extended. The floral

Table 3-22
BLM-Designated Sensitive Species Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
		Plants	
Oryctes *Oryctes nevadensis*	S/--	Deep loose sand of stabilized dunes, washes, and valley flats. Annual appears under optimal temperature and rain fall conditions. Blooms May-June.	Could occur; Potentially suitable habitat exists in sandy areas. (Morefield 2001).
Nevada dune beardtongue *Penstemon arenarius*	S/--	Deep loose sandy soil in valley bottoms, eolian deposits and alkaline areas in shadscale habitats. Blooms May-June.	Could occur; potentially suitable habitat is present with the Vulcan Project Area. Known to occur in northern Churchill County along the Carson Sink (Morefield 2001).
		Invertebrates	
Hardy's aegialian scarab *Aegialia hardyi*	S/--	Found only within dune habitats.	Unlikely to occur; known to occur at Sand Mountain and could occur at Blow Sand Mountains directly south of the southern edge of the Salt Wells Energy Projects Area. Suitable dune habitat does not occur in the Projects Area.
Pallid wood nymph *Cercyonis oetus pallescens*	S/--	Alkaline flats	Could occur; potentially suitable habitat exists along playas where alkali meadows occur. Has been documented in Churchill County.
		Birds	
Black tern *Chlidonias niger*	S/--	Nests colonially within freshwater marshes with emergent vegetation.	Unlikely to occur; known to occur in the freshwater marshes with emergent vegetation of Carson Lake and Pasture. This habitat is not present in the Projects Area.
Burrowing owl *Athene cunicularia*	S/--	Burrow sites in open, dry annual or perennial grasslands, deserts, and	Could occur; all sites provide limited burrow

Table 3-22
BLM-Designated Sensitive Species Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
		scrublands with low-growing vegetation and burrowing mammal populations.	opportunities. Most suitable habitat occurs within the SPPC alignment along pastures. Known to occur near Fallon (NDOW) and Carson Lake and Pasture (Floyd et al. 2007).
Ferruginous hawk *Buteo regalis*	S/BSCC	Associated with a variety of open habitats with single juniper or pine trees for perch or nest.	Unlikely to occur; suitable nesting habitat does not occur in Projects Area. NDOW designates a distribution line along the southern edge of the Projects Area.
Golden eagle *Aquila chrysaetos*	S/BSCC	Nests on rocky scarps with large expanses of hunting territory.	Known to occur; observed during 2010 surveys, nests were located less than one kilometer from Vulcan well locations.
Loggerhead shrike *Lanius ludovicianus*	S/BSCC	Uses a wide range of open habitats including shrublands, pinyon juniper, pastures, and agricultural fields.	Known to occur; Suitable habitat present. Observed during the 2010 surveys and have been documented within Lahontan Valley (Floyd et al. 2007).
Long-billed curlew *Numenius americanus*	S/BSCC	Nests in naturally short grasslands and agricultural fields with flooded fields or near wetlands with mudflats, wet soils along shallow shorelines.	Known to occur; nesting curlew was noted during 2010 surveys. Known to nest at Carson Lake and Pasture, agricultural fields, meadow, and playa wetland habitats provide suitable nesting sites (GBBO 2010; Floyd et al. 2007).
Northern goshawk *Accipiter gentilis*	S/--	Nests in a wide variety of forest types; habitat requirements in winter are poorly understood.	Could occur. Potential foraging or wintering habitat.

Table 3-22
BLM-Designated Sensitive Species Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
Prairie falcon *Falco mexicanus*	S/--	Nests on cliff faces adjacent to foraging habitat of saltbush, sagebrush, creosote bush, greasewood, agricultural crops, and native perennial grasses.	Known to occur; suitable nesting habitat exists on rock outcrops. Seen in 2010 surveys. Known to occur in the Lahontan Valley (Floyd et al. 2007, NDOW 2010).
Short-eared owl *Asio flammeus*	S/--	Nests on ground. Expansive wet meadow or pasture and hay crops, or similar grassland buffered by open shrublands, marsh component beneficial, little or no urban encroachment.	Could occur; suitable habitat occurs within the agricultural and wet meadow areas. Known to occur near Fallon and Carson Lake and Pasture (Floyd et al. 2007).
Snowy plover *Charadrius alexandrinus*	S/BSCC	Associated with barren shorelines of playa lakes that contain water but have little or no emergent or shoreline vegetation.	Likely to occur; known to nest at Carson Lake and Pasture, and other sites in the Lahontan Valley (GBBO 2010; Floyd et al. 2007); wetland playa sites provide suitable nesting habitat.
Swainson's hawk *Buteo swainsoni*	S/--	Nests in single old growth cottonwoods, adjacent to foraging habitat of open riparian woodlands with significant expanses of pasture, agricultural fields, wet meadow, or open shrublands with grass cover in immediate vicinity.	Known to occur; Swainson's hawks were noted during 2010 surveys. Suitable nesting and foraging habitat occurs along the Carson Lake and Pasture area and along the SPPC alignment. Two occupied nests were documented in the Projects Area during 2010 surveys. Known to occur throughout the Fallon area (Floyd et al. 2007).
		Mammals	
Pallid Bat *Antrozous pallidus*	S/--	Found in a variety of habitats from low desert to brushy terrain to coniferous forest and non-coniferous woodlands. Roosts in a	Known to occur; foraging habitat available, roost sites exist within rock outcrops. One dead pallid

Table 3-22
BLM-Designated Sensitive Species Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
		variety of settings (rocks, trees, buildings, caves, adits, etc.).	bat was noted within the Projects Area at a rock outcrop during the 2010 surveys. Known to occur elsewhere in Lahontan Valley (Bradley et al. 2006).
Townsend's Big-eared Bat *Corynorhinus townsendii*	S/--	Highly associated with caves and mines. Found primarily in rural settings from deserts to lower, mid to high-elevation mixed coniferous-deciduous forest.	Could occur; only foraging habitat available. Documented in Lahontan Valley (Bradley et al. 2006).
Big Brown Bat *Eptesicus fuscus*	S/--	Occurs in a variety of habitats, including pinyon-juniper, blackbrush, creosote, sagebrush, agriculture, and urban habitats. Roosts in a variety of settings.	Could occur; foraging habitat available, roost sites exist within rock outcrops. Known to occur in Lahontan Valley (Bradley et al. 2006).
Hoary Bat *Lasiurus cinereus*	S/--	Tree-associated species. Found primarily in forested upland habitats as well as in gallery-forest riparian zones, and agriculture habitats. Roots primarily in trees.	Could occur; foraging habitat available. Documented in Lahontan Valley (Bradley et al. 2006).
California Myotis *Myotis evotis*	S/--	Found in a variety of habitats from desert scrub to forests, but more common in the Mojave. Roosts in a variety of settings.	Likely to occur; foraging habitat available, roost sites exist within rock outcrops. Known to occur in Lahontan Valley (Bradley et al. 2006).
Small-footed Myotis *Myotis ciliolabrum*	S/--	Inhabits a variety of habitats including desert scrub, grasslands, sagebrush steppe, and blackbrush, greasewood, pinyon-juniper woodlands, pine-fir forests, agriculture, and urban areas. Roots in caves, mines, and trees.	Likely to occur; foraging habitat available, roost sites exist within rock outcrops. Known to occur in Lahontan Valley (Bradley et al. 2006).
Little Brown Myotis *Myotis lucifugus*	S/--	Found primarily at higher elevations and higher latitudes, often associated with coniferous forest. Requires a nearby water source.	Could occur; foraging habitat available, roost sites exist within rock outcrops. Known to occur

Table 3-22
BLM-Designated Sensitive Species Potentially Occurring in the Projects Area

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
		Roosts in a variety of settings.	east of Lahontan Valley in the Desatoya Mountains (Bradley et al. 2006).
Fringed Myotis *Myotis thysanodes*	S/--	Found in a wide range of habitats from low desert scrub habitats to high elevation coniferous forests. Roosts in a variety of settings.	Likely to occur; foraging habitat available, roost sites exist within rock outcrops. Known to occur in Lahontan Valley (Bradley et al. 2006).
Desert Bighorn Sheep *Ovis canadensis nelsoni*	S/--	Typically occur in steep, mountain rocky terrain with perennial water sources (natural or human made).	Unlikely to occur; NDOW mapped distribution south of Projects Area in the Cocoon Mountains; one mile east of Cocoon Switching Station. The majority of this habitat marginal as it is eolian sandy dunes.

[1] **Legal Status Definitions**
BLM Listing Categories
S BLM-designated sensitive Species
USFWS Listing Categories
BSCC Bird Species of Conservation Concern
G Game Birds Below Desired Condition

[2] **Potential for Occurrence Definitions**
Unlikely to occur: Potentially suitable habitat present but species unlikely to be present in the Salt Wells Projects Area because of current status of the species and very restricted distribution.
Could occur: Suitable habitat is available in the Projects Area; however, there are few or no other indicators that the species might be present.
Likely to occur: Habitat conditions, behavior of the species, known occurrences in the project vicinity, or other factors indicate a relatively high likelihood that the species would occur in the Projects Area.
Known to occur: The species, or evidence of its presence, was observed in the Projects Area during surveys or was reported by others.
Source: NNHP 2010, Bradley et al. 2006, Floyd et al. 2007, and GBBO 2010

annual display was notable and the likelihood of encountering oryctes was reasonable given the plant's fickle nature. Field surveys did not reveal the plant's presence. Surveys for the Nevada dune beardtongue occurred during the early part of the typical bloom period, but the species was not encountered (Pondera 2010).

Invertebrates

Surveys were not conducted for the pallid wood nymph, but potentially suitable habitat occurs within Eightmile Flat, where wet meadow habitat (both seasonal and perennial wetlands) occurs. Little published literature is available regarding the ecology of this butterfly species but it has been documented in Churchill County and may occur in the Projects Area. Surveys were conducted during the general flight time for most butterfly species. However, some days were windy enough to preclude butterfly flight, particularly in Eightmile Flat (Pondera 2010).

Mammals. Bats are the only BLM-designated sensitive mammal species in the Salt Wells Energy Projects Area. A variety of bats forage within the wetland and agricultural habitats of the Projects Area, as they provide ample insect prey. Mist-netting and sonar detection were utilized by NDOW to determine presence of eight species of bats within the Lahontan Valley. Several species are likely to use rock outcrops of the Projects Area (pallid bat, California myotis, and small-footed myotis). Surveys specifically for bats were not conducted, but outcrops were examined for the sign of bats (guano). Bats were found to utilize the outcrops and usage is more concentrated the closer the outcrop is to foraging habitat. One dead pallid bat was found at the base of an outcrop adjacent to Vulcan's existing well. This outcrop appears to be a roost for numerous bats and raptors (Pondera 2010).

SPPC Project Area

Besides BLM-designated sensitive bird species, discussed in **Section 3.12**, Migratory Birds, the only BLM-designated sensitive species that are likely to occur within the SPPC Project Area are bats, which could use the area for foraging (Pondera 2010).

Ormat Project Area

Besides BLM-designated sensitive bird species, discussed in **Section 3.12**, Migratory Birds, the Ormat Project Area provides potentially suitable habitat for pallid wood nymph as well as foraging habitat for bat species (Pondera 2010).

Vulcan Project Area

Besides BLM-designated sensitive bird species, discussed in **Section 3.12**, Migratory Birds, pallid bat was observed within the Project Area. The habitat within the Project Area includes emergent marsh, greasewood flat, mixed salt desert scrub, rock outcrops, and vegetated (wetlands) and barren playa. Potentially suitable habitat exists for pallid wood nymph. Bat species could occur within rock outcrops (Pondera 2010).

One rock feature supported roosting bats, including pallid bat. This outcrop is within 500 feet of an existing well.

The southern three miles of the Vulcan alternative transmission line has the most potentially suitable habitat, sandy soils, for oryctes and Nevada dune beardtongue, two BLM-designated sensitive plants.

3.14 CULTURAL RESOURCES

Cultural resources are locations or objects of human activity, occupation, or use. These resources include archaeological; historic; architectural sites, structures, and places with important public and scientific values; and locations of traditional cultural or religious importance to specific social or cultural groups. Cultural resources discussed in this section include districts, sites, buildings, structures, and objects listed on or eligible for the National Register of Historic Places (NRHP). These are historic properties. Historic properties may also include sites of traditional religious and cultural importance to Indian tribes, termed a traditional cultural property (TCP). The cultural resource component of the affected environment is covered by several legislative authorities including Section 106 of the NHPA, the Archaeological Resources Protection Act (ARPA), the American Indian Religious Freedom Act and Executive Order 13007, and the NAGPRA. Cultural resources within the Salt Wells Energy Projects also fall under purview of the Programmatic Agreement among the BLM, Reclamation, and the Nevada SHPO regarding the Salt Wells Energy Projects (2010) and the BLM Nationwide Programmatic Agreement and a State Protocol Agreement between BLM Nevada and Nevada SHPO (2009c).

The cultural resources of the Salt Wells area have an important role in the Native American, archaeological, architectural, and public communities in the region. This category typically includes objects, general locations such as historic trail corridors, discrete sites, structures, and buildings. Here, the category is expanded to include Native American resources, discussed in **Section 3.15**, Native American Religious Concerns. Many sites contribute significant information to scientific inquiry and provide vital connections to the traditional knowledge and practices of the native peoples who still call the area home. The foundations of much of western Great Basin prehistory and ethnology were developed in this region. The area of potential effect (APE) for cultural resources encompasses the surface area and depths to which the proposed action and facilities operation could disturb cultural resources. It is extended to an indirect APE to include any TCPs, sacred sites, buildings, districts, or historic properties that could be indirectly affected by the proposed action and its visual effects.

Prehistoric sites in the region played a seminal role in the development and understanding of regional prehistory spanning the last 10,000 years and the historical record has proved equally rich. Regional historic developments, initially peripheral to emigrant goals in California, became nationally important with the discovery of the Comstock Lode in 1859. The region is crossed by historic 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. There are several historic trails in this region managed and protected under the National Trails System Act and two are in close proximity to the APE. The Pony Express National Historic Trail and the Simpson Route, an early version of the Overland

Stage Route, pass under the southern extent of the proposed SPPC transmission line and over the Vulcan Alternative 1 transmission line. The Carson River Route of the California Trail passes north of the APE near Fallon.

The Cultural Resource Overview, Carson District, West Central Nevada (Pendleton et al. 1982) presents a detailed background of regional prehistoric and historic research and sites. Although this overview provides an almost complete inventory of prehistoric and historic sites found within the BLM Carson City District and a comprehensive history of research, more than two decades of time and anthropological research and theory have passed since its publication. Much of this research has been presented in survey reports developed as a result of commercial development in the Salt Wells area (Young and Wriston 2004; Obermayr and Branch 2007; Memmot et al. 2009) and this overview is based in part on these documents.

Prehistoric Background

The Salt Wells region is rich in prehistoric archaeological sites. Rock shelters, utilized caves, rock art, hunting blinds, tool stone quarries, open-air year-round occupations, temporary camps, and task specific locations are among the archaeological site types represented. The size, location, and complexity of these sites vary through time and reflect changes in resource availability, population dynamics, and environmental conditions. Archaeological patterns observed in the Salt Wells Energy Project Area parallel those found over much of the western Great Basin. The following chronological discussion was developed from patterns observed in the regional archaeological record.

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 archaeological record spanning roughly 10,000 to 7,000 years BP 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). Milling equipment is occasionally present in Terminal Pleistocene and Early Holocene components and more prevalent in later time periods. 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 1982, 1986; 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. Northeast of the Salt Wells Energy Projects Area, human remains and artifacts associated with this period were recovered in Spirit Cave (Tuohy and Dansie 1997). 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/Early Archaic Period

Mazama Ash (ca. 7,000 BP) is the primary stratigraphic marker for the beginning of this period that extends from about 7,000 to 3,500 BP. 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). Additionally, there are numerous flake tool scrapers, bifacial knives, heavy core tools, and, for the first time, abundant ground and battered stone milling equipment. Although few single component Early Archaic sites have been investigated, nearly every major cave deposit and many open-air sites contain at least some Early Archaic material (Beck 1995; Elston 1982; Pendleton et al. 1982). Even more numerous in the region are hundreds of small Early Archaic upland camps.

The Early Archaic period witnessed an overall 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 (ca. 7,200 to 3,440 BP) may have played a role in this transition, although it is not immediately clear how local environmental changes affected specific plant and animal resources. The increased archaeological visibility may also be due to increasing population densities, with the exception of apparent population decreases prior to 4,500 BP. Within this framework, the Early Archaic period witnessed the initial rise of settlement hierarchies in this region of the Great Basin and corresponds to the archaeological equivalents of base camps, field camps, and task stations. It has been suggested that adaptive strategies during this period involved water sources, such as rivers and springs, and that substantial occupations were focused on these locations. Hidden Cave was initially occupied during this period (Rhode 2003; Thomas 1985). This may have been a result of the comparatively drier and warmer climate.

Middle Archaic Period

The Middle Archaic period (ca. 3,500 to 1,300 BP) 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), possibly spurred by the wetter and cooler Late Holocene (3,440 BP to present) climate. This is manifested in the archaeological record through a variety of textiles and other perishable remains, an 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. Occupations at Hidden Cave, Gatecliff Shelter, short-term camps at the James Creek and South Fork shelters, and activities at the Tosawihi quarries all increased during the Middle Archaic.

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. These sites reflect 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. Middle Archaic adaptations throughout the western Great Basin 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 and 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 Late Archaic period (ca. 1,300 to 700 BP) was a time of profound cultural change in the western Great Basin induced by a combination of severe drought, population increases, resource imbalances, ethnic displacements, changes in technology, and social conflict. 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 present 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 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 replaced by numerous flake tools. Ground stone milling equipment shows a similar trend toward unshaped artifacts that were rarely cached. 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. 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

The Terminal Prehistoric (circa 700 BP to AD 1820) comprises a generally sparse archaeological record with respect to settlement patterns. 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. House construction techniques are very informal, often leaving no more than shallow, circular zones of soil discoloration suggestive of very short-term, single- or multi-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. 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. Quarrying activities at Tosawihi increased and villages were established in less hospitable environments, such as high altitudes, which may signify an expansion of a surplus population. However, 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. The arrow points of this time are reflected in the Desert Side-notched and Cottonwood-series. Lahontan Valley and the shorelines of Carson Lake and the Carson River slough between Carson Lake and the northerly Carson Sink and Stillwater Marsh region contain a wealth of small and larger sites of this period that persist to historic Paiute use of the same area.

Ethnographic Overview

The Native American group whose evidence is most commonly found in the region is the Northern Paiute. The Toi Ticutta (also referred to as Toidikadi) or "Cattail-eaters" retain close ties to the Salt Wells Energy Projects Area. The Northern Paiute are a Uto-Aztecan speaking group that ranged over western Nevada and the Owens Valley portion of eastern California. The Northern Paiute were semi-nomadic, moving between environmental zones to take advantage of resources as they became available (Bengston 2003). Fowler (1992) provides extensive background and detailed accounts of lifeways among the Toi Ticutta, who are known to have visited and lived around the Salt Wells Basin. Settlement and subsistence patterns varied according to type and abundance of resources available within a group's territory. The wetland environments of Carson Lake and surrounding basins allowed a more centralized settlement and subsistence strategy than that of neighboring bands. However, the annual round was somewhat consistent from group to group. Winters were spent in multifamily villages, composed of three to ten houses. Winter houses included a conical pole framework built around a shallow depression and covered with tule mats. During spring and summer, small groups moved away from the winter

village. They roamed widely, residing in camps located near resource concentrations. A broad range of plants and animals from the diverse environments within their territory were used for subsistence. The primary resource base was derived from the wetland areas at Stillwater and Carson Lake. Important resources included waterfowl and their eggs, the fishery with tui chub, Tahoe sucker, and speckled dace, the abundant freshwater mussels, and marsh plants such as cattails, bulrush, sago pondweed, pickleweed, seepweed, and common reed. Later in the fall, some groups traveled to areas where pine nuts could be collected. Fall also was the preferred hunting season. Mountain sheep and deer were hunted, and antelope were taken in communal drives. With the onset of winter, groups once again congregated and lived off stores assembled over the summer and fall (Bengston 2003).

In the 1820s, British and American fur trappers began penetrating the Great Basin, which includes northern and western Nevada. In 1830, Peter Skene Ogden was the first documented non-Indian to enter the current Carson City BLM District boundary and encounter Native American populations there (Fowler 1992; d'Azevedo 1986a). By the 1850s, land acquisitions, ecological changes, and cultural disruptions caused by non-Indians immigrating into the region were curtailing traditional lifeways of the Northern Paiute to the extent that they were becoming dependent on non-Indian communities (Malouf and Findlay 1986).

Historic Background

Several themes and time periods can be used to discuss the Historic Period of the lower Carson River and Salt Wells Basin: Exploration, Emigration and Settlement, Development, and Modern (Obermayr and Branch 2007; Pendleton et al. 1982; Elliot and Rowley 1987).

Exploration

Euro-American fur trappers and traders made their first forays into the central Great Basin during the Exploration period (AD 1820 to 1850), amid competition from British and American firms to exploit the Humboldt River trapping grounds and other regional streams. Between 1826 and 1830, both Jedediah Smith of the Rocky Mountain Fur Company and Peter Skene Ogden of the Hudson's Bay Company led expeditions across modern-day Nevada. However, fur-trapping potential was always marginal in the Great Basin, and expeditions ended in the early 1840s. As fur trapping declined, official government mapping and exploration expeditions were expanded into the Great Basin, partially to establish an American presence in what was, until 1848, Mexican territory. The Walker expedition in 1833 and the John C. Fremont expeditions between 1843 and 1853 are likely the most notable. Fremont's expeditions produced comprehensive maps and descriptions of the region and provided invaluable resources for later settlement and development. Explorations in the project vicinity included the 1845-1846 crossing by E.M. Kern of the Fremont expedition on the east margin of Carson Lake and J.

Simpson's survey for the overland wagon route in 1859 which skirted the eastern and southern margins of Carson Lake, extending through Alkali Valley to the east (Simpson 1983).

Emigration and Settlement

The Emigration and Settlement Period (AD 1840 to 1880) encompasses the phases of westward migration to and the settlement of California, the California Gold Rush of the late 1840s, and the settlement and development of the Comstock following the 1859 silver strikes. 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). The Bidwell-Bartleson group was the first emigrant party to make the trans-Sierran journey to California, following the Humboldt River through Nevada in 1841 and crossing the Sierra Nevada at Sonora Pass. They were followed in 1844 by the Stevens party that established an alternative route along the Truckee River, crossing the Sierra instead at Donner Pass. The trickle of settlers and gold-seeking emigrants increased during the 1840s and 1850s. The Carson River Route of the California Trail eventually became a major thoroughfare. Some of the earliest permanent settlements were established along the route as supply points.

These included Mormon Station, or Genoa, in Carson Valley in 1850 and Ragtown, 20 miles northwest of the Salt Wells Energy Projects Area on the Carson River. Ragtown, with its seasonal camps of merchants, was the first freshwater source emigrants would have encountered after crossing the Forty Mile Desert. A permanent post was established in 1854. Comstock silver strikes in 1859 brought additional prospectors to the Virginia Range, approximately 55 miles west of the Projects Area. Industrial development of lode mining and milling there created an expanded, relatively urbanized population in Virginia City, Gold Hill, and Silver City. Farming and ranching expanded along the Carson River and nearby valleys to support the new population centers. Other previous metal discoveries and urban development followed across central Nevada, although such instances were often short lived.

Some of these mineral discoveries occurred in the Salt Wells Energy Projects Area and included salt deposits at Sand Springs and borax along the western edge of Eightmile Flat. These borax works contain evidence of Chinese workers and extraction strategies. Salt was an important component of nineteenth century ore processing and borax an important commodity in and of itself. The new population centers and mineral discoveries gave rise to regional wagon road networks connecting markets to supply points and mineral sources to mills. Of these freight roads, the Reese River Road passes just north of the Projects Area, and the Fort Churchill to Sand Springs Road crosses the southern portion of the Projects Area along the Pony Express National Historic Trail and Overland Telegraph routes of 1860-1861 and 1861-1869, respectively. Many of the initial roads ran east-west for delivery to California, but with the

completion of the transcontinental railroad along the Humboldt River corridor in 1869, freight roads running north-south linking railheads with interior mining districts began to be established. One of these roads was the Wadsworth and Columbus Freight Road, which runs through the Projects Area.

Development

Evolution of agriculture and transportation along the lower Carson River east of the Projects Area characterize the Development Period (AD 1880 to 1941). However, much of that evolution had little direct impact on the Salt Wells Basin or the neighboring Bunejug Mountains. Extensive areas of the Carson Desert became irrigated and Fallon was developed as an urban center as a result of the National Reclamation Act of 1902 and construction of the Newlands Project, one of five projects initially authorized in the 1902 throughout the west. The Newlands Project includes much of the western half of Salt Wells Energy Projects (Hardesty and Buhr 2001). A few wagon road networks were expanded and developed into Nevada's federal highway system.

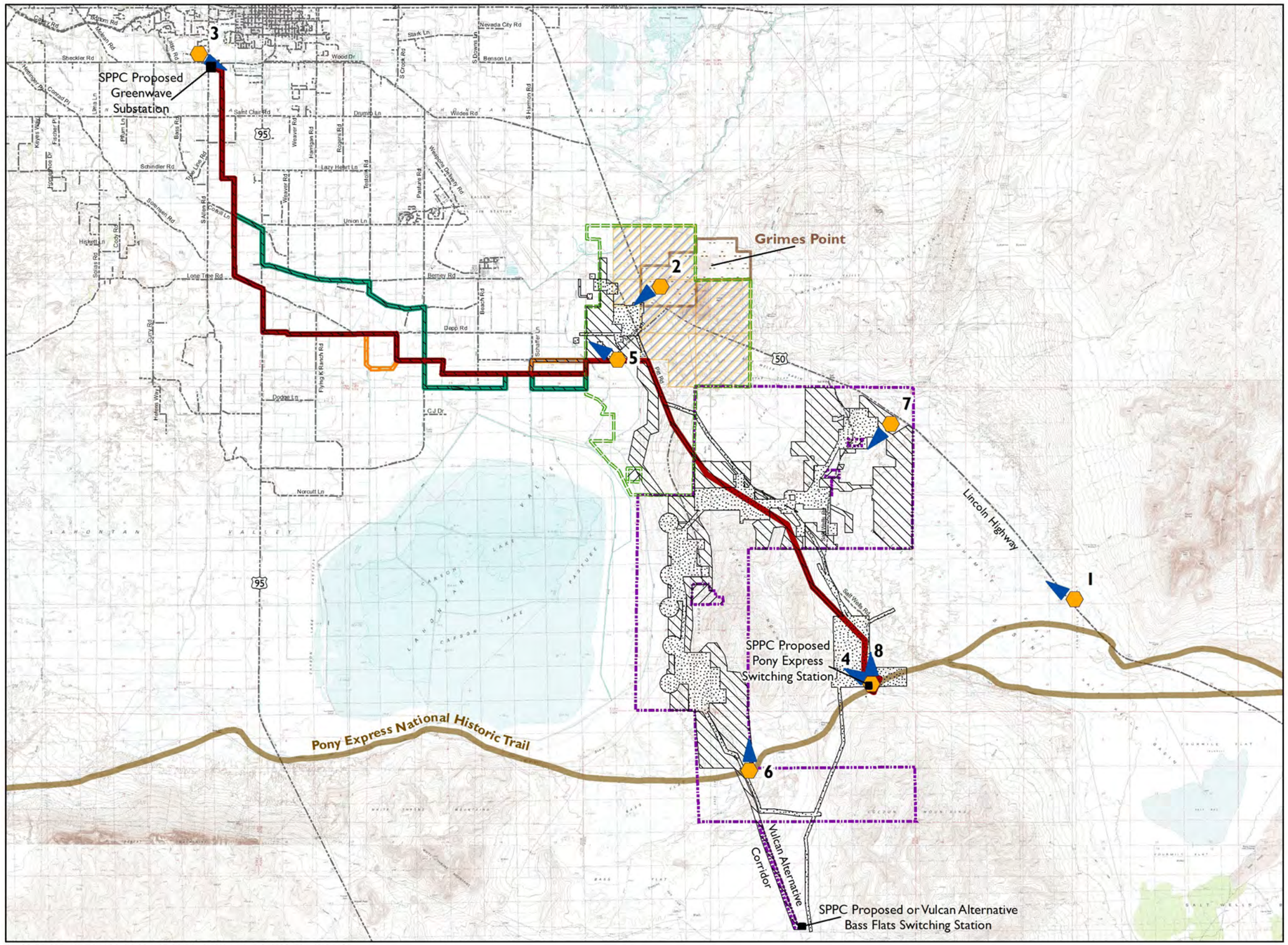
The Reese River Road on the northern margin and crossing the Projects Area became the Lincoln Highway and was renamed US Highway 50 in the 1920s (See **Figure 3-21**, Cultural and Visual Resources).

The importance of mining in Nevada's economy faded between 1880 and 1900 as no new discoveries were made and areas that had been developed in connection with mining declined. The "Central Route," crossing the southern margin of the Projects Area, faded in importance and was gradually abandoned during the mining depression. Tonopah and Goldfield produced a boom in the early 1900s, and smaller districts, closer to the Projects Area, such as Wonder (1906), Fairview (1906), Rawhide (1908 to 1920), and Westgate (1915), also contributed to mining and milling and energized the local freighting networks. The Fallon Reservation was established in 1887, contains 5,540 acres, and continues to the present as a federally recognized tribe of Northern Paiute and Western Shoshone.

Modern

The Modern Period (AD 1941 to present) has experienced continued agricultural and community growth in the Fallon area, even though the Newlands Project is limited in the amount of land that can be irrigated.

NAS Fallon was established just southeast of Fallon in 1942 in support of World War II efforts. It was deactivated for a time after World War II but was reopened as a Navy Auxiliary Air Station in 1951. The base provides training facilities for Navy and Marine Corps pilots and ground crews. One flight path to the base landing strip passes directly over the Projects Area.



Cultural and Visual Resources

Churchill County, Nevada

Cultural Survey Area
- 2010 Survey Area
- Previous Surveys

Visual Analysis
- Key Observation Point
- Direction of Visual Analysis

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Grimes Point
- Pony Express National Historic Trail
- No Surface Occupancy
- Excluded from Lease Area

Source: BLM, Ormat, SPPC, Vulcan 2010, Farwestern 2010, NPS 2011, USFWS 2010

0 0.5 1 2

Miles

July 2011

NAD 1983 HARN State Plane Nevada West

Disclaimer: 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.

*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-21

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Regional Overview

Far Western Anthropological Research Group, Inc. (Far Western) completed cultural resources BLM Class I and Class III inventories (as per Barker 1990 guidelines) of proposed blocks, transmission line corridors and alternatives, switching stations, and substations for the Salt Wells Energy Projects' APE during the summer and fall of 2010. Far Western also retained Zeier and Associates, LLC, to complete an architectural inventory of historic standing structures within one-half mile of the proposed transmission line corridors and alternatives in the fall of 2010. Surveys covered public (BLM and Reclamation) and private lands. Inventoried blocks include ample areas encompassing access roads, wells, pipelines, lay-down areas, and associated facilities necessary to plan, construct, and operate the project.

The Class I inventory archival records search of nearly 80,000 acres revealed that numerous cultural resource studies have taken place within the geothermal lease blocks and along the proposed project transmission line corridors. These studies include archaeological surveys associated with geothermal testing, gravel pits for highway maintenance, highway and road betterment projects, agency and university-based studies and surveys in and around the Grimes Point and Stillwater Slough areas, a few large motorcycle race track courses, mining and exploration, fiber optic and utilities development, corral and water haul sites, fence and cattleguards, NAS Fallon activities, a pending Reclamation land transfer, fairgrounds and rodeo arena, fish and wildlife lands, and a golf course.

In total, Salt Wells Energy Projects Class I study area crosses or passes within one mile of 99 previous study areas. Sixty-two (62) of these cultural resource projects resulted in the discovery of one or more archaeological sites and four were Class I studies.

Three hundred forty-two (342) cultural resources were previously recorded within one mile of the Salt Wells Projects Area where geothermal testing, gravel pits and highway maintenance, and academic studies have resulted in intensive surveys and archaeological testing and evaluations along US Highway 50, around Carson Lake and Pasture, Grimes Point, and in Salt Wells Basin. The sites represent a diverse archaeological and historical record, including small lithic scatters, large habitation sites with ground stone and constructed features ethnohistoric sites, tool stone quarries, rock art, caves and rock shelters, one repatriated burial, historic borax mining facilities and claims, stage and Pony Express stations, ranching-related debris and facilities, canals and drains associated with the Newlands Project, historical road and trail segments, and debris scatters.

The 338 previously documented cultural resources with site records within the Class I study area can be described in terms of their evaluation for listing in the NRHP. One hundred fifty-four (154) sites have been determined ineligible to the NRHP, 94 sites are unevaluated for the NRHP, 64 sites are determined eligible

and thus considered historic properties with 5 of those nominated to the NRHP. Twenty-six (26) of the resources are isolates and are also considered ineligible for the NRHP. Cultural resources nominated to the NRHP include the Simpson Pass Segment of the Pony Express National Historic Trail, the Sand Hill Station/Wells Station, the Simpson Pass XP Ledge Site, the Newlands Project NRHP District, and the Pony Express and Overland Stage Route.

There are 57 previously documented cultural resources within the Salt Wells Projects APE including alternatives, and many of these were revisited and updated as part of this project. Thirty (30) sites have been determined ineligible for listing in the NRHP, seven (7) are unevaluated, and 20 sites have been determined eligible and are considered historic properties. Ten of the sites eligible for the NRHP are prehistoric, three are mixed prehistoric and historic-era, five are historic-era, and two are ethnohistoric camps. The five eligible historic-era sites include the Pony Express and Overland Stage Route, the Fort Churchill and Sand Springs Toll Road Dugout, the Lincoln Highway, the Newlands Project NRHP District, and a borax extraction complex. These resources are reported under their respective project areas below.

The Newlands Project NRHP District, and a large prehistoric scatter (26Ch546/CrNV-03-651) occur in both the Ormat and SPPC Project Area APEs. The Pony Express National Historic Trail and a large complex prehistoric habitation site (CrNV-03-5947) cross both the Vulcan and SPPC APEs. These sites are included in each Project summary.

For the Class III Cultural Resources Archaeology survey, a total of approximately 6,200 acres, including 320 acres in the Ormat Project Area, was inventoried by Far Western and Pacific Legacy archaeologists with preliminary findings and NRHP recommendations provided in each summary below and in **Table 3-23**, Salt Wells Energy Projects Archaeological Site Summary. Findings and NRHP recommendations are pending agency, BLM, Reclamation, and Nevada SHPO review and concurrence.

For the Class III Cultural Resources Historic Architecture survey, a total of about 430 Churchill County Assessor Parcels (APNs) within the APE were assessed. Of these, 115 were inventoried by Far Western's architectural historians, Zeier and Associates, LLC, during the fall of 2010, and several additional APNs are in the process of review at this time. Three additional APNs are in the process of review at this time to assess SPPC Alternative 3 (Preferred).

Preliminary findings and NRHP recommendations are provided in each summary below and in **Table 3-24**, Salt Wells Energy Projects Area Architectural Summary. Findings and NRHP recommendations are pending agency, BLM, Reclamation, and Nevada SHPO review and concurrence.

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
				Vulcan Project Area Sites		
3-7928		V1	BLM	CFS (Complex Flaked Stone Assemblage)	Eligible: D	Avoidance
31-1194	598	V2	BLM	Fort Churchill and Sand Springs Toll Road	Eligible: A, D	Avoidance
3-5099	2668	V3	BLM	Pony Express National Historic Trail segment	Eligible: A	Avoidance; Mitigation through NPS consultation
3-7855		V4	BLM	Rock Features	Unevaluated	Avoidance
3-7856		V5	BLM	Electric RR	Ineligible segments	None
3-7857		V6	BLM	Historic-era Dump	Ineligible	None
3-7858		V7	BLM	Ethnohistoric Scatter	Ineligible	None
3-7859		V8	BLM	Ethnohistoric Camp	Eligible: D	Avoidance
3-7860		V9	BLM	CGS (Complex Ground Stone Assemblage) with Features	Eligible: D	Avoidance
3-7861		V10	BLM	SGS (Simple Ground Stone Assemblage)	Ineligible	None
3-7862		V11	BLM	SGS	Eligible: D	Avoidance
3-7863		V12	BLM	SFS	Eligible: D	Avoidance
3-7864		V13	BLM	SFS	Eligible: D	Avoidance
3-7865		V14	BLM/ Reclamation	SFS	Ineligible	Avoidance
3-7866		V15	Reclamation	CGS with Features	Eligible: D	Avoidance

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
3-6924	2567	V16	Reclamation	SFS	Ineligible	None
3-478	486	V17	Reclamation	CGS with Features	Eligible: D	Avoidance
3-7867		V18	BLM	SGS	Ineligible	None
3-7868		V19	BLM	CGS with Features	Eligible: D	Avoidance
3-7869		V20	BLM	CGS with Features	Eligible: D	Avoidance
3-7870		V21	BLM	CGS with Feature	Ineligible	None
3-7871		V22	BLM	CGS with Feature	Ineligible	None
31-4140	2191	V23	BLM	Wadsworth to Columbus Freight Road segments	Eligible: A originally; bladed areas now ineligible due to loss of integrity	None; segment in Vulcan Project Area has been mitigated (Obermayer 2007)
3-7872		V24	BLM	SGS	Ineligible	None
31-3387	968	V25	BLM	CGS with Features	Eligible: D	Avoidance
3-7873		V26	BLM	SGS	Ineligible	None
3-7874		V27	BLM	SGS	Ineligible	None
3-7875		V28	BLM	CFS with Feature	Ineligible	None
31-225		V29	BLM	CGS with Features	Eligible: D	Avoidance
3-7876		V30	BLM	SGS	Ineligible	None
3-568/ 226/ 523	18/89	V31	BLM	CGS locus with Feature	Ineligible component in APE	None
3-7877		V32	BLM	Historic-era linear road segments	Ineligible segments in APE	None

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
3-7878		V33	BLM	SFS	Ineligible	None
3-7879		V34	BLM	CGS with Features	Eligible: D	Avoidance
3-7880		V35	BLM	SFS	Ineligible	None
3-7881		V36	BLM	Historic linear road segment	Ineligible segment in APE	None
3-7882		V37	BLM	SGS with Loci	Eligible: D	Avoidance
3-7883		V38	BLM	SGS	Ineligible	None
3-7884		V39	BLM	SFS	Ineligible	None
3-6900	2579	V40	BLM	Three Rock Cairns	Ineligible	None
3-6902	2577	V41	BLM	SFS	Ineligible	None
3-7885		V42	BLM	SFS	Ineligible	None
3-7886		V43	BLM	SFS with Rock Circle	Ineligible	None
3-7887		V44	BLM	SFS	Ineligible	None
3-7888		V45	BLM	SFS; SRL (Single Reduction Locus)	Ineligible	None
3-7889		V46	BLM	Historic-era dumps; late 20th century; Salt Wells Brothel	Ineligible	None
3-665	560	V47	BLM	CGS with Features	Eligible: D within APE	Avoidance
3-7890		V48	BLM	Historic-era Telephone Line Segment	Ineligible segment in APE	None
3-7891		V49	BLM	Historic-era Rock Features	Ineligible	None
3-3830	1157	V50	BLM	SFS Chert Source Area	Ineligible	None

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
3-5937		V51	BLM	Historic-era debris associated with Wadsworth and Columbus Freight Road; Isolated biface associated with 3-3830	Ineligible	None
3-7892		V52	BLM	Multi-component: Prehistoric SFS Chert Source Area; Historic-era Rock Cairn with Bottle	Both components Ineligible	None
3-7893		V53	BLM	SFS	Ineligible	None
3-7894		V54	BLM	SFS	Ineligible	None
3-7895		V55	BLM	Historic-era Road Segment	Ineligible road segment in APE	None
3-5419		V56/O1/S	BLM/ Reclamation/NAS Fallon/ County	Lincoln Highway Segments (Grimes Point, Berney Road), ROW Markers (near Salt Wells)	Eligible: A; some contributing elements	Avoid or Mitigate eligible segments
3-6894	2594	V57	BLM	Historic-era borax complex with Chinese residence locus, features	Eligible: A, D	Avoidance
3-7896		V58	BLM	CGS with Features	Eligible: D	Avoidance
3-6737	2514	V59	BLM	SFS	Ineligible	None
31-3368	967	V60	BLM	Historic-era residential complex, Chinese component	Eligible: A, D	Avoidance
Ormat Project Area Sites						
3-7929		O2	Reclamation	CGS with FAR	Eligible: D	Avoidance

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
3-6630, 3-5940	Newlands Project	O3	Reclamation/NAS Fallon	Newlands Project, Historic-era L-12 Lateral segment, CCC gate on L-12	Eligible: A segments in APE	Crossed by SPPC proposed transmission line, Mitigation-Public Interpretation
3-522	1408	O4	Reclamation/NAS Fallon	NW Margin of Grimes Point Archaeological Site Complex; CGSA with Ethnohistoric Component; Historic-era Refuse	Prehistoric, Ethnohistoric Eligible: D; Historic: Ineligible	Avoidance
3-7897		O5	Reclamation	CGS with FAR	Eligible: D	Avoidance
3-7898		O6	Reclamation	SGS	Ineligible	None
3-7899		O7	Reclamation	CGS with Features	Eligible: D	Avoidance
3-6622		O8	Reclamation	CGS; Historic-era debris	Prehistoric Eligible: D; Historic: Ineligible	Avoidance
3-6615		O9	Reclamation	CGS with Feature; Historic-era debris	Prehistoric, Ethnohistoric Eligible: D; Historic: Ineligible	Avoidance
31-3750	1235	O10	Reclamation	SW Margin of Grimes Point Archaeological Site Complex; CGS with Features; Ethnohistoric; Historic-era	Prehistoric, Ethnohistoric; Eligible: D; Historic: Ineligible	Avoidance
3-6605		O11	Reclamation	Historic-era road segment	Ineligible	None
3-7900		O12	Reclamation	CGS with Features; Ethnohistoric; Historic-era debris	Prehistoric, Ethnohistoric Eligible: D; Historic: Ineligible	Avoidance

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
3-6613		O13	Reclamation	CGS with Deflated Features; Historic-era debris in FAR scatter	Ineligible	None
3-6616		O14	Reclamation	CGS with Features; Ethnohistoric; Historic-era to modern debris	Prehistoric, Ethnohistoric; Eligible: D; Historic: Ineligible	Avoidance
3-5941		O15	Reclamation	CGS; Ethnohistoric Features; Historic-era debris	Prehistoric, Ethnohistoric; Eligible: D; Historic: Ineligible	Avoidance
3-651	546	O16; O17; O19	Reclamation	SFS; Historic-era debris locus and a historic-era to modern landfill locus	Ineligible	None
3-7901		O18	Reclamation	CGS with FAR	Eligible: D	Avoidance
3-7902		O20	Reclamation	SGS	Ineligible	None
3-652	547	O21	Reclamation	CGS with FAR Features; Ethnohistoric; Historic-era dozed locus	Prehistoric, Ethnohistoric; Eligible: D; Historic: Ineligible	Avoidance
3-7903		O22	Reclamation	SGS with FAR: and Rusted Metal	Ineligible	None
3-7904		O23	Reclamation	CGS with FAR Feature	Eligible: D	Avoidance
3-7905		O24	Reclamation	CGS with FAR Feature; Historic-era to Modern Debris	Prehistoric; Eligible: D; Historic: Ineligible	Avoidance
3-5942		O25	Reclamation	CGS with FAR Features: Historic-era Debris	Prehistoric; Eligible: D; Historic: Ineligible	Avoidance
3-7906		O26	Reclamation	CGS with FAR Features;	Prehistoric, Ethnohistoric	Avoidance

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
				Ethnohistoric	Eligible: D	
3-7907		O28	Reclamation	Historic-era bottle fragments	Ineligible	None
3-7908		O29	Reclamation	SGS	Ineligible	None
3-6610		O30	Reclamation	Historic-era to Modern Landfill	Ineligible	None
3-7909		O31	Reclamation	Historic-era Refuse Deposits	Ineligible	None
3-7910		O32	Private	Historic-era Truck and Wagon Parts	Ineligible	None
3-7911		O33	Private	CGS with FAR Features; Historic-era Refuse Deposits	Prehistoric/Ethnohistoric Eligible: D; Historic Ineligible	Avoidance
3-7912		O34	Private	1928 Fey Homestead	Eligible	Avoidance
3-7913		O35	Reclamation	CGS with Feature	Eligible: D	Avoidance
3-7914		O36	Reclamation	CGS with FAR Features	Eligible: D	Avoidance
3-7915		O37	Reclamation	CGS with FAR Features	Eligible: D	Avoidance
3-7916		O38	Reclamation	CFS with FAR Feature	Eligible: D	Avoidance
3-7917		O39	Reclamation	CGS with FAR Features	Eligible: D	Avoidance
3-7918		O40	Reclamation	SFS and Historic-era Dump	Ineligible	None
3-7919		O41	Reclamation	CGS with FAR Features and Ethnohistoric	Eligible: D	Avoidance
3-7920		O42	Reclamation	CGS with FAR Features	Eligible: D	Avoidance
3-7921		O43	Reclamation	CGS with FAR Features	Eligible: D	Avoidance
3-7922		O44/Pacific	Reclamation	CGS with FAR Features	Eligible: D (this recording),	Avoidance

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
		Legacy CL-A167			previously ineligible by Pacific Legacy	
3-7923		O45	Reclamation	CGS with FAR Features	Eligible: D	Avoidance
03-5947		O46/Pacific Legacy CL-A162	Reclamation	CGS with FAR Features	Eligible: D (this recording), previously ineligible	Avoidance
PACIFIC LEGACY Sites in ORMAT Project Area (not visited by FW)						
	2980	CL-A117	Reclamation	CFS with FAR and Historic-era Artifacts	Ineligible P and H (all recommendations Pacific Legacy)	
	2981	CL-A118	Reclamation	SFS	Ineligible	
	2982	CL-A119	Reclamation	CFS with FAR	Ineligible	
	2983	CL-A120	Reclamation	CFS with FAR	Ineligible	
	2984	CL-A121	Reclamation	CFS with FAR Features, Ethnohistoric trade bead (bead was collected)	Eligible: D	
	2985	CL-A122	Reclamation	CGS with FAR Features	Eligible: D	
	2986	CL-A123	Reclamation	CGS with FAR Features; tested with FAR and flakes to 40 cm below surface	Ineligible	
	2987	CL-A124	Reclamation	CGS with FAR Features (obsidian point and Olivella shell disk bead collected)	Eligible: D	
	2988	CL-A125	Reclamation	CGS with FAR Features	Eligible: D	

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
	3003	CL-A144	Reclamation	CGS with FAR Feature	Ineligible	
	3005	CL-A146	Reclamation	CGS with FAR Feature	Ineligible	
	3027	CL-A169	Reclamation	SGS	Ineligible	
	3028	CL-A170	Reclamation	CGS with FAR Features and Ethnohistoric trade bead (obsidian core and flakes, and glass trade bead collected)	Ineligible	
	3029	CL-A171	Reclamation	SGS	Ineligible	
	3030	CL-A172	Reclamation	CGS with FAR and charcoal stain features	Eligible: D	
	3031	CL-A173	Reclamation	CGS with FAR and lithic concentrations (Olivella shell beads and 36 obsidian flakes, and two obsidian points collected); Historic debris ca. 1900-1950	Prehistoric Eligible: D; Historic : Ineligible	
	3032	CL-A174	Reclamation	SFS	Ineligible	
	3042	CL-A184	Reclamation	CGS with FAR Features and Ethnohistoric glass trade beads (trade beads collected)	Ineligible	
				SPPC Sites (in Progress)		
Newlands Project		S1	Private	Newlands Project Ditches and Associated Features	Some contributing elements to the Newlands Project NRHP District in APE: A	Mitigation-Public Interpretation
Newlands		S2/O27	Private	Newlands Project Drains and Associated Features/O27	Some contributing elements to the Newlands	Mitigation-Public Interpretation

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Type	NRHP Eligibility Recommendation and Criteria	Treatment Recommendations
Project				Pierson Slough	Project NRHP District in APE: A	
3-7924		S3	BLM	SFS	Ineligible	None
3-7925		S4	BLM	CGS	Eligible: D	Avoidance
3-7926		S5	Reclamation	CGS with FAR Features	Eligible: D	Avoidance
3-7927		S6	Private	SGS	Ineligible	None
3-8064		S7	Private	SGS	Ineligible	None

Table 3-24
Salt Wells Energy Projects Area Architectural Summary

APN	Parcel Eligible	Buildings Eligible	Proposed Action	Alternative 1	Alternative 2	Alternative 3 (Preferred)
001-871-97			x	x	x	x
008-851-28		x	x	x	x	x
008-851-09			x	x	x	x
008-831-81			x	x	x	x
008-831-84			x	x	x	x
008-871-04			x	x	x	x
001-871-98	x	x	x	x	x	x
006-191-06			x	x	x	x
006-211-32	x	x	x	x	x	x
006-211-45			x	x	x	x
006-191-16		x	x	x	x	x
006-351-03			x	x	x	x
006-351-02	x	x	x	x	x	x
006-351-30			x	x	x	x
006-351-33	x	x	x	x	x	x
006-411-44	x	x	x	x	x	x
006-411-62		x	x		x	x
006-491-36			x		x	x
006-411-02		x	x		x	x
006-411-03		x	x		x	x
006-541-01						
006-541-40						
006-553-48	x	x				
006-553-49		x				
006-031-02		x				
006-031-16		x				
006-031-15						
006-351-16		x	x	x	x	x
006-351-22	x	x	x	x	x	x
006-351-09			x	x	x	x
006-351-46	x	x	x	x	x	x
006-411-46		x	x	x	x	x
006-331-15	x	x	x	x	x	x
006-871-04	x	x	x	x	x	x
006-831-29		x		x		
006-851-20	x			x		
006-851-03				x		
006-851-79				x		
006-851-39	x	x		x		
008-831-25			x	x	x	x

Table 3-24
Salt Wells Energy Projects Area Architectural Summary

APN	Parcel Eligible	Buildings Eligible	Proposed Action	Alternative 1	Alternative 2	Alternative 3 (Preferred)
006-831-36			x	x	x	x
006-411-26	x	x	x	x	x	x
006-411-38		x	x	x	x	x
006-411-42		x	x	x	x	x
006-351-11		x	x	x	x	x
006-351-27			x	x	x	x
006-031-14	x	x				
006-851-75	x	x		x		
006-851-11	x	x		x		
006-091-33	x	x	x	x	x	
006-091-75		x	x	x	x	x
006-091-04		x		x		
006-831-19	x	x	x	x	x	x
006-851-09	x	x	x	x	x	x
006-591-04	x	x				
006-101-02		x	x		x	x
006-091-19		x				x
006-831-05				x		x
006-851-17		x		x		
006-531-13			x	x	x	x
006-511-06			x	x	x	x
006-531-03		x	x		x	x
006-531-08	x	x	x		x	x
006-541-47		x				
006-871-46			x	x	x	x
006-871-25	x	x	x	x	x	x
006-871-57			x	x	x	x
003-011-04*	x	x	x	x	x	x
001-304-04	x	x	x	x	x	x
001-304-06		x	x	x	x	x
006-191-11			x	x	x	x
006-111-26		x				
006-111-27		x				
006-091-58	x	x	x	x	x	x
006-091-09		x	x	x	x	x
006-091-08		x		x		
006-071-01	x	x	x	x	x	x
006-091-20						
006-111-04						

Table 3-24
Salt Wells Energy Projects Area Architectural Summary

APN	Parcel Eligible	Buildings Eligible	Proposed Action	Alternative 1	Alternative 2	Alternative 3 (Preferred)
006-091-17	x	x				
006-111-28	x	x				
006-191-14	x	x	x	x	x	x
006-391-02			x	x	x	x
006-811-38		x		x		
006-811-82		x		x		
006-411-29			x	x	x	x
006-411-37	x	x	x	x	x	x
006-411-30			x	x	x	x
006-811-11				x		
006-811-31		x		x		
006-811-12	x	x		x		
006-411-04			x	x	x	x
006-831-10		x	x	x	x	x
006-831-11		x	x	x	x	x
006-511-09		x	x	x	x	x
006-831-18	x	x	x	x	x	x
006-511-02	x	x	x	x	x	x
006-511-03			x	x	x	x
006-531-01		x	x	x	x	x
006-851-08	x	x	x	x	x	x
006-591-05	x	x				
006-031-17	x	x				
006-031-18	x	x				
006-031-20						
006-051-02						
006-191-03			x	x	x	x
006-191-20		x	x	x	x	x
006-211-03			x	x	x	x
006-191-17		x	x	x	x	x
006-211-20			x	x	x	x
006-811-09				x		
006-811-48				x		
006-831-02				x		
006-831-34				x		
001-871-01	x	x	x	x	x	x
006-091-63**	tbd	tbd				x
006-101-01**	tbd	tbd				x
006-091-71**	tbd	tbd				x

Table 3-24
Salt Wells Energy Projects Area Architectural Summary

APN	Parcel Eligible	Buildings Eligible	Proposed Action	Alternative 1	Alternative 2	Alternative 3 (Preferred)

* Also in Ormat Project Area.
** Additional parcels included in SPPC Alternative 3 (Preferred), which are currently under review.
Note: All **bold** APN parcels are recommended eligible to the NRHP under Criterion C.
All *italicized* APN parcels are recommended ineligible to the NRHP under all significance criteria.

SPPC Project Area

Cultural Resource Inventory

As originally proposed, about 21.7 miles of the Proposed Action and four Alternatives covering an additional 32.6 miles, the Greenwave Substation, and the Pony Express Switching Station were studied in the Class I file search. The Class I file search area included an area one mile either side of the proposed transmission line corridor, the four alternative corridors, the substation, and the switching station. In consultation with the BLM, the APE for archaeological site study was determined to be a 300-foot-wide corridor following the proposed and alternative routes, a 500-foot by 500-foot (6 acre) area for the switching stations, and an irregular 14-acre substation area, totaling approximately 1,600 acres. The Class I study indicated 131 acres of the preferred transmission line corridor had been surveyed in the last 10 years and did not require additional study. As well during the study, two of the proposed alternatives were dropped by the BLM and no further archaeological inventory was completed for Alternatives 3 and 4, thus allowing the total SPPC Project Class III cultural resource survey to include about 900 acres.

Historical architecture inventories were completed for the proposed SPPC Proposed Action and four Alternatives across private lands where standing structures belonging to farms, ranches, dairies, and family residences occur within close visual proximity to the proposed project. In consultation with the BLM and SHPO, the architectural inventory APE was determined to be a one-half-mile area on both sides of the proposed centerline and four alternatives, including the entirety of each APN touched by the one-half mile APE. The APE cut-off date for recording was 45 years or older, including structures with build dates of 1965 or earlier. Alternatives 3 and 4 were dropped after initial architectural fieldwork was completed, therefore, architectural resources will be reported per BLM Protocol.

Class I File Search

There are 10 previously recorded cultural resources in the SPPC APE including alternatives. Two sites are unevaluated and managed as eligible, four sites are eligible to the NRHP, and four sites are considered ineligible to the NRHP. The unevaluated sites include the historic Fort Churchill and Sand Springs Toll Road and a prehistoric lithic scatter. Three of the four eligible cultural resources are

historic, including the Fort Churchill and Sand Springs Toll Road Dugout, the Pony Express National Historic Trail and Overland Stage Route, and the Newlands Project NRHP District. The fourth eligible site is a large, prehistoric habitation site with ground stone.

The aforementioned sites are all on the proposed 230-kV transmission line corridor. The Newlands Project NRHP District, including contributing canals, drains and associated features, crosses the SPPC Proposed Action and all Alternatives within the SPPC Project Area APE.

Class III Cultural Resource Archaeological Findings

Six cultural resources sites and multiple contributing and non-contributing elements of the Newlands Project NRHP District were recorded in the SPPC Project Area APE during the Salt Wells Energy Projects Class III inventory. Two NRHP eligible prehistoric sites; three ineligible prehistoric sites; NRHP eligible laterals, drains, and associated features of the Newlands Project NRHP District; and the Berney Road segment of the NRHP eligible Lincoln Highway occur.

Class III Cultural Resource Historical Architecture Findings

Most of the architectural resources within the Salt Wells Energy Projects Area occur on the SPPC APE. Of the 115 parcels recorded, 114 are on the SPPC Project Area, all on private lands. Of the 114 parcels, 72 contain NRHP eligible buildings or structures. These are recommended to the NRHP under Criterion C either as significant parcels such as farmsteads, dairies, or ranches that hold several historic buildings and are related thematically, or as individually important buildings that may represent a building type such as a cellar, barn, or tank house within an otherwise modern architectural environment.

Ormat Project Area

Cultural Resource Inventory

The Class I file search study for the Ormat Project Area included an expansive one mile reach around the Ormat geothermal lease boundary. In consultation with BLM, within the Ormat lease boundary, block areas covering 828 acres were surveyed to BLM Class III standards (pedestrian coverage spaced no greater than 30 meters apart). Interval coverage at 5 to 10 meter spacing was used for recording when cultural resources were found. Two parcels with standing structures were identified and recorded by architectural historians within the Ormat blocks. A 320-acre portion of the Ormat Project Area was surveyed from 2008 to 2010 by Pacific Legacy (Jackson et al. 2011). Preliminary site recording and recommendations from that report are used here per discussion with BLM and Reclamation, and collaboration with Pacific Legacy.

Class I File Search

There are 34 previously recorded cultural resources within the Ormat Project APE. Two sites are unevaluated, 13 sites are NRHP eligible, and 19 sites are considered ineligible to the NRHP. The unevaluated sites consist of one

prehistoric lithic scatter and one mixed component cultural resource. Seven of the eligible sites are prehistoric, three are mixed component prehistoric and historic-era resources, two are ethnohistoric sites, and one is the Newlands Project NRHP District. Eighteen of these previously recorded sites were recently recorded by Pacific Legacy (Jackson et al. 2011) and have not received agency review. These include 12 recommended ineligible, and six recommended eligible (three prehistoric, two ethnohistoric, and one mixed component cultural resource) to the NRHP.

Class III Cultural Resource Archaeological Findings

There were 58 cultural resources sites documented in the Ormat Project Area APE during the Salt Wells Energy Projects Class III inventory. Cultural resources comprise 37 NRHP eligible sites, and 21 ineligible sites. The eligible resources include 19 prehistoric sites, two ethnohistoric sites, 11 mixed component (historic, ethnohistoric, prehistoric), two historic sites, and three prehistoric/ethnohistoric resources.

Eleven eligible sites were recorded during previous inventories and updated during the current inventory, those include, a Newlands Project L-12 Lateral segment and CCC feature (CrNV-03-6630/CrNV-03-5940), two large multi-component prehistoric, ethnohistoric, and historic habitation sites on the margin of the Grimes Point Archaeological Site complex (26CH1408/CrNV-03-522; 26CH1235/CrNV-03-3750), a prehistoric habitation site with ground stone (CrNV-03-6622), four large multi-component prehistoric, ethnohistoric, and historic habitation sites with ground stone and features (CrNV-03-6615; CrNV-03-6616; CrNV-03-5941; 26CH547/CrNV-03-652; CrNV-03-5947), and two mixed historic-era and prehistoric sites (26CH546/CrNV-03-651; CrNV-03-5942).

Eighteen of these previously recorded sites were recently recorded by Pacific Legacy (Jackson et al. 2011) and have not received agency review. Per BLM consultation, Far Western did not visit any of these 18 cultural resources. These include 12 recommended ineligible to the NRHP, and six recommended eligible (three prehistoric, two ethnohistoric, and one mixed component cultural resource) to the NRHP.

Class III Cultural Resource Historical Architecture Findings

There is only one historic (1965 or older) parcel, APN 003-011-004, within the Ormat Project Area. This private parcel contains one residence considered eligible to the NRHP under Criterion C.

Vulcan Project Area

Cultural Resource Inventory

As in the Ormat Project Area, the Class I study area included one mile around the Vulcan lease block. In consultation with BLM, a Class III pedestrian inventory for Vulcan included block areas covering 4,065 acres, and 3.2 miles (196 acres)

of a proposed 500-foot-wide transmission line corridor and the Bass Flat Switching Station (12 acres). No standing architectural resources are present or previously recorded within the Vulcan Project Area.

Class I File Search

There are 17 previously documented cultural resources in the Vulcan Project Area APE. Four sites are unevaluated, six sites are considered eligible to the NRHP, and seven sites are considered ineligible. The unevaluated sites consist of two prehistoric, one ethnohistoric, and one historic debris scatter. Two eligible sites are historic resources and consist of a borax extraction complex and a segment of the Lincoln Highway. Three of the eligible resources are prehistoric and consist of two large habitation sites and one lithic scatter. The Pony Express National Historic Trail and Overland Stage Route cross the Vulcan Alternative transmission line corridor.

Class III Cultural Resource Archaeological Findings

Sixty (60) cultural resources sites were recorded or revisited in the Vulcan Project Area APE during the Salt Wells Energy Projects Class III inventory. Cultural resources comprise three unevaluated, 22 NRHP eligible, and 35 ineligible sites. The unevaluated sites include one prehistoric habitation site with ground stone and constructed features, one site with rock features, and an historic-era telephone line. The NRHP eligible cultural resources consist of 13 prehistoric, one ethnohistoric, six historic, and two mixed component resources. The six eligible historic sites include the Pony Express National Historic Trail, the Wadsworth to Columbus Freight Road (which contains contributing and non-contributing segments), the Lincoln Highway, a borax complex with a Chinese component, a residential complex with a Chinese component, and the Fort Churchill and Sand Springs Toll Road.

Ten eligible sites were recorded during previous inventories and updated during the current inventory, those include, the Fort Churchill and Sand Springs Toll Road (26CH598/CrNV-31-1194), the Pony Express National Historic Trail (26CH2128/CrNV-03-5079), four large prehistoric habitation sites with ground stone and features (CrNV-31-225; 26CH486/CrNV-03-478; 26CH560/CrNV-03-665; 26CH968/CrNV-31-3387;), the Wadsworth to Columbus Freight Road (26CH2191/CrNV-31-4140), the Lincoln Highway (CrNV-03-5419), a historic-era borax extraction and processing complex with Chinese artifacts (26CH2594/CrNV-03-6894), and a historic residential complex with Chinese artifacts (26CH967/CrNV-31-3368).

Class III Cultural Resource Historical Architecture Findings

There are no architectural resources in the Vulcan Project Area.

3.15 NATIVE AMERICAN RELIGIOUS CONCERNS

Regional Overview

Native American resources are defined under various authorities, including FLPMA, the American Indian Religious Freedom Act, Executive Order 13007, NAGPRA, and NHPA. Under these authorities, federal agencies have 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, such as plants and animals, 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 and resources, traditional use areas, sacred and ceremonial sites, and TCPs.

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, a federal agency has the legal authority to determine how these resources would be managed and what, if any, mitigation would be used to avoid undue and unnecessary impacts on these resources. Ethnographic information indicates that Northern Paiute occupied the Salt Wells area, and their way of life is characterized by the concept of living in harmony with the natural environment. Rituals and ceremonies ensure that plants, animals, and physical elements flourish. The continued welfare of the people depends on these rituals and ceremonies being performed properly and the resources being available. The manner of performing the rituals and ceremonies, the places at which they are performed, and perhaps even the time of their performance are often prescribed.

Religious expression takes several primary forms, including ceremonies, individual prayer, and use of power spots for vision questing, curing, and doctoring. The most frequent form of expression is the individual prayer. Prayers are made to the spirits and were especially important in connection with places where spirits may live or places regarded as power spots.

The concept of *Spirit Power* (*Puha,* in Northern Paiute) and its impact on places, people, or events provide the basis for understanding the nature and distribution of places important to Northern Paiute people in the Salt Wells area. As described in Fowler (1992; d'Azevedo 1986b) the Northern Paiute 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.

Ethnohistoric Sites

Tribal ethnohistoric sites are most familiar to non-Indians because they are similar to the kinds of sites 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. As summarized in Bengston (2003) for the Northern Paiute, 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, would 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 individuals. In addition, what non-Indians regard as identical resources in identical places (e.g., any pinyon 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, important traditional use areas include: pinyon 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 Executive Order 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, 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. These allow mountains to gather and hold *Spirit Power* and are important tribal heritage resources throughout the Salt Wells region. Mountains host resources, such as pinyon and stream origins, 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).

Waters

Since *Spirit Power* flows through the earth and all living things, water (also a scarce resource in a desert ecosystem) is sacred to the Northern Paiute (Fowler 1992). 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 would 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 the Northern Paiute. 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 the Northern Paiute (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 Northern Paiute 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 are rock art sites, which have been of interest to archaeologists for decades.

Traditional Cultural Properties

The term Traditional Cultural Property was coined in NRHP Bulletin 38 to refer to a property that may be eligible for inclusion on the NRHP 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 NRHP." 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 NRHP eligibility 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 NRHP 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.

Consultation

Consultation regarding the Salt Wells Energy Projects between the BLM and federally recognized Native American tribes is ongoing.

Consultation was initiated with the Fallon Paiute-Shoshone Tribe on February 25, 2010. Subsequent correspondence provided the results of the initial cultural resource inventory and subsequent final report (March 27 and April 30, 2010). Face to face meetings were conducted between the BLM and tribal staff on April 13, 2010, and August 25, 2010. As a result of the April 13th meeting, the no surface occupancy stipulation on Ormat Lease NVN-079104 was amended to "allow for the proposed project so long as all the required environmental and other permitting, including any additional cultural surveys and consultation with Nevada SHPO and the Fallon Paiute-Shoshone Tribe, is completed and approved by the BLM" (BLM 2010e).

3.16 PALEONTOLOGICAL RESOURCES

Paleontological resources (fossils) are the remains of prehistoric animals and plants. This section identifies the regulations and existing conditions pertaining to paleontological resources in the Salt Wells Project Areas. The overview

presented in this section conforms to Society of Vertebrate Paleontology criteria.

Regulatory Framework

A variety of federal, state, and local regulations and policies protect paleontological resources. These include NEPA, the Federal Antiquities Act of 1906, the National Natural Landmarks (NNL) Program, and the recently enacted Federal Paleontological Resources Preservation Act of 2002 (PRPA). The following paragraphs describe key regulatory provisions relating to paleontological resources.

Federal Regulations

Antiquities Act

The Antiquities Act of 1906 was enacted with the primary goal of protecting cultural resources in the US. As such, it explicitly prohibits appropriation, excavation, injury, and destruction of "any historic or prehistoric ruin or monument, or any object of antiquity" located on lands owned or controlled by the federal government, without permission of the secretary of the federal department with jurisdiction. It also establishes criminal penalties, including fines and/or imprisonment, for these acts. Neither the Antiquities Act itself nor its implementing regulations (Title 43, CFR, Part 3) specifically mentions paleontological resources. However, several federal agencies—including the National Park Service, the BLM, and the USFS—have interpreted "objects of antiquity" as including fossil resources.

National Environmental Policy Act

Like the Antiquities Act, NEPA does not provide specific guidance regarding paleontological resources. However, NEPA does require that federal agencies take all practicable measures to "preserve important historic, cultural, and natural aspects of our national heritage" (NEPA Sec. 101[b][4]). This has been interpreted to apply to paleontological materials.

Paleontological Resources Preservation Act

The PRPA was specifically intended to codify the generally accepted practice of limiting collection of vertebrate fossils and other rare and scientifically significant fossils to qualified researchers who obtain a permit from the appropriate state or federal agency and agree to donate any materials recovered to recognized public institutions where they would remain accessible to the public and to other researchers. The PRPA incorporates the following key findings of a recent report issued by the Secretary of the Interior with input from staff of the Smithsonian Institution, the USGS, various federal land management agencies, paleontological experts, and the public (Society of Vertebrate Paleontology 2003).

- Most vertebrate fossils and some fossils of other types (invertebrates, plants) represent a rare resource.

- Illegal collection and theft of fossil materials from public lands is a serious problem; penalties for fossil theft should be strengthened.
- Effective stewardship requires accurate information; federal fossil collections should be preserved and made available for research and educational use.
- Federal management of fossil resources should emphasize opportunities for public involvement.

Paleontological Potential

Information about the geological units and known fossil localities in the region was used to identify the paleontological potential of geological units within the Salt Wells Energy Projects Area. Paleontological potential levels were assigned to each geological unit using the Potential Fossil Yield Classification (PFYC) system for assessing paleontological potential on federal land that was adopted by the BLM in 2007 (BLM 2008). The PFYC system is a five-tiered system that the BLM uses to classify geological units based on the relative abundance of vertebrate fossils or scientifically significant invertebrate and plant fossils and their potential to be impacted, with a higher class number indicating a higher potential. This classification system is applied to the geological formation, member, or other distinguishable map unit, preferably at the most detailed mappable level. This approach was followed in recognition of the direct relationship that exists between paleontological resources and the geological units. By knowing the geology of a particular area and the fossil productivity of particular geological units that occur in the area, it is possible to predict where fossils would likely be found. Each class is defined as follows:

- **Class 1. Very Low Potential –** geological units not likely to contain recognizable fossil remains. These units include igneous, metamorphic, and Precambrian rocks.
- **Class 2. Low Potential –** sedimentary geological units not likely to contain vertebrate fossils or scientifically significant non-vertebrate fossils; these units include Aeolian, diagenetically altered, and Holocene sediments.
- **Class 3. Moderate or Unknown Potential –** fossiliferous sedimentary geological units where fossil content varies in significance, abundance, and predictable occurrence; sedimentary units of unknown fossil potential. Class 3 is divided into two parts:
  - **Class 3a. Moderate Potential –** the units are known to contain vertebrate fossils or scientifically significant non-vertebrate fossils, but these occurrences are widely scattered; common invertebrate or plant fossils may be found in the area.
  - **Class 3b. Unknown Potential –** the units exhibit geological features and preservational conditions that suggest significant

fossils could be present, but little information about the paleontological resources of the unit or area is known. This may indicate the unit or area is poorly studied and field surveys may uncover significant fossils.

- **Class 4. High Potential –** geological units that contain a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability.
- **Class 5. Very High Potential –** highly fossiliferous geological units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils.

Regional Overview

The projects are located within the Lahontan Valley, Carson Desert, and northwestern portion of the Salt Wells Basin in west-central Nevada, which is located in the western part of the Basin and Range physiographic province (Fenneman 1931). The Basin and Range physiographic province is characterized by north-south trending mountain ranges that are separated by alluvium-filled, nearly flat to gently sloping valleys. The mountain ranges surrounding the Salt Wells Energy Projects Area consist of Tertiary volcanic rocks, including basalt, rhyolite, silicic tuffs, and other related rocks. Also present in the mountain ranges are Tertiary and Mesozoic intrusive rocks, such as granite and dioritic rocks. These rocks may also include Tertiary silicic, intermediate, and mafic porphyritic or aphanitic intrusive rocks. The valleys contain Quaternary alluvial deposits that may include parent materials that are of Tertiary age (Stewart 1980).

The Basin and Range Province formed through regional, crustal extension of the western part of the North American continental plate, with fault blocks sliding downward, forming basins that are separated by mountain ranges (Eaton 1982). The eastern side of the Salt Wells Energy Projects Area is bounded by the Lahontan, Cocoon, and Bunejug Mountain Ranges. The Dead Camel Mountains are located southwest of the Projects Area and the Virginia Range is located to the west. To the north and east are the Hot Springs Mountains.

The Lahontan Valley is a portion of Pleistocene Lake Lahontan, which existed in northwestern Nevada between 20,000 and 9,000 years BP. At its peak approximately 12,700 years ago, the Lake Lahontan had a surface area of over 8,500 square miles (22,015 square kilometers), with its largest component centered at the location of the Lahontan Valley and Carson Sink. The Carson Lake wetlands, immediately west of the Vulcan Project Area, encompass a significant portion of the Lahontan Valley wetlands at the terminus of the Carson River. This wetland is one of the remaining natural features of Lake Lahontan.

The Carson River, located north and west of the Salt Wells Energy Projects Area, flows east from northern California. It originates in the Sierra Nevada Mountains and flows generally northeast into Nevada, emptying into the enclosed Carson Sink, just west of the Projects Area. It is impounded by the Lahontan Dam, approximately 30 miles west of Carson Lake. Downstream from the dam, the river flows east past Fallon then northeast into the Carson Sink. Elevation in the Projects Area ranges from 3,911 feet amsl at the floor of Salt Wells Basin to higher than 4,662 feet amsl at the top of Sehoo Mountain.

SPPC Project Area

The SPPC Project Area consists primarily of Quaternary alluvial and playa deposits, which are the most common geological units within the Carson Desert and Lahontan Valley. At the western edge of the southeastern portion of the corridor, a Tertiary upper volcanic deposit is also mapped (Stewart and Carlson 1977). These geological units are named, respectively: (1) Alluvial and Playa Deposits (Qa); and (2) Upper Volcanic Rocks (Tvu). At this time, no project-related paleontological surveys have been conducted within the Project Area.

Literature evidence indicates that the alluvial and playa deposits exposed in the transmission line corridor area are relatively young (Pleistocene/Holocene) and are not lithified. This bed has been assigned a PFYC value by the BLM based upon its physical nature, depositional history, probable fossil content, and age. The alluvial deposits are the youngest geological unit within the transmission line corridor. These alluvial deposits have a low potential for paleontological resources and have been assigned a PFYC of 2 as a result of their age, which decreases the chances of preserving paleontological resources.

The upper volcanic rocks located on the southeastern side of the transmission line corridor have low paleontological sensitivity because fossils are only very rarely preserved within these units which are deposited at extremely high temperatures. It is for this reason that these deposits have been assigned a PFYC of 1. It should be noted that volcanic rocks in the Dead Camel Range, approximately 10 to 15 miles west of the transmission line corridor, are interbedded with lacustrine, fossil-bearing shales. These shales contain large amounts of fossilized flora, which are generally considered non-significant. If Tertiary upper volcanic rocks in the surrounding Lahontan, Cocoon, Bunejug, Virginia, and Hot Springs Ranges are interbedded with older lacustrine shales, it is possible that fossilized flora and fauna may be present.

Ormat Project Area

The Ormat Project Area consists primarily of Quaternary alluvial and playa deposits, which are the most common geological units within the Carson Desert and Lahontan Valley. At the eastern edge of the Project Area, a Tertiary upper volcanic deposit is also mapped (Stewart and Carlson 1977). These

geological units are named, respectively: (1) Alluvial and Playa Deposits (Qa); and (2) Upper Volcanic Rocks (Tvu).

Literature evidence indicates that the alluvial and playa deposits exposed in the Project Area are relatively young (Pleistocene/Holocene) and are not lithified. This bed has been assigned a PFYC value by the BLM based upon its physical nature, depositional history, probable fossil content, and age. The alluvial deposits are the youngest geological unit within the Project Area. These alluvial deposits have a low potential for paleontological resources and have been assigned a PFYC of 2 as a result of their age, which decreases the chances of preserving paleontological resources.

The Tertiary upper volcanic rocks located on the east side of the Project Area have low paleontological sensitivity because fossils are only very rarely preserved within these units which are deposited at extremely high temperatures. It is for this reason that these deposits have been assigned a PFYC of 1. It should be noted that volcanic rocks in the Dead Camel Range, approximately 10 to 15 miles west of the Project Area, are interbedded with lacustrine, fossil-bearing shales. These shales contain large amounts of fossilized flora, which are generally considered non-significant. If Tertiary upper volcanic rocks in the surrounding Lahontan, Cocoon, Bunejug, Virginia, and Hot Springs Ranges are interbedded with older lacustrine shales, it is possible that fossilized flora and fauna may be present.

Vulcan Project Area

The Vulcan Project Area consists of Quaternary alluvial and playa deposits (Qa), separated in the central portion of the Project Area by Tertiary age Upper Volcanic Rocks (Tvu). The Quaternary alluvium and playa deposits are part of Carson Lake on the west side of the Project Area and the Salt Wells Basin on the northeast side of the Project Area (Stewart and Carlson 1977). These deposits consist of a deep deposit of silt, sand, gravel, and cobbles. The alluvial and playa deposits are Holocene to Recent in age (10,000 years old to present) and generally consist of Tertiary-age parent material from the surrounding volcanic mountain ranges.

Literature evidence indicates that the alluvial and playa deposits exposed in the Project Area are relatively young (Pleistocene/Holocene) and are not lithified. This bed has been assigned a PFYC value by the BLM based upon its physical nature, depositional history, probable fossil content, and age. The alluvial deposits are the youngest geological unit within the Project Area. These alluvial deposits have a low potential for paleontological resources and have been assigned a PFYC of 2 as a result of their age, which decreases the chances of preserving paleontological resources.

The Tertiary upper volcanic rocks located on the east side of the Project Area have low paleontological sensitivity because fossils are only very rarely preserved within these units which are deposited at extremely high

temperatures. It is for this reason that these deposits have been assigned a PFYC of 1. It should be noted that volcanic rocks in the Dead Camel Range, approximately 10 to 15 miles west of the Project Area, are interbedded with lacustrine, fossil-bearing shales. These shales contain large amounts of fossilized flora, which are generally considered non-significant. If Tertiary upper volcanic rocks in the surrounding Lahontan, Cocoon, Bunejug, Virginia, and Hot Springs Ranges are interbedded with older lacustrine shales, it is possible that fossilized flora and fauna may be present.

3.17 VISUAL RESOURCES

Regional Overview

This section is a description of the visual quality of lands within 1.5 miles on either side of the proposed transmission line routes, pipeline corridors, power plants, and associated facilities One mile is generally the extent at which man-made features are visible; in general, features beyond this zone are so distant that only forms and outlines are discernable and visual impacts are negligible. Visual resources include seven key factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications (BLM 1984). Each of these factors is considered during an inventory and contrast rating.

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 uses a rating system to identify and guide the management of visual resources. Visual Resources Management (VRM) classes for public land within the Salt Wells Energy Projects Area are all categorized as Class III (See Figure 3-21, Cultural and Visual Resources). The management objective of VRM Class III areas is to partially retain the existing character of the landscape. The level of change to the characteristic landscape is allowed to be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominating natural features of the characteristic landscape of the region.

The scenic features of the area are composed of natural features and cultural modifications. A cultural modification is any man-caused change in the land form, water form, vegetation, or the addition of a structure which creates a visual contrast in the basic elements (form, line, color, texture) of the naturalistic character of a landscape (BLM 1986a). There are various existing cultural modifications in the region. Transmission lines run through several parts of the valley. There are also several structures, mostly industrial in character and in colors that blend in with the landscape, in the Projects Area.

Natural scenic features are characteristic of the Great Basin area of the western US. The form, color, and texture of the Great Basin landscape are influenced by the arid climate. Sunlight is a dominant element in the area, and white fluffy clouds often appear in the bright blue sky. Barren expanses interspersed with

low desert brush populate the valley lowlands. The vegetation typically grows low and patchy on the valley floor, consists of mainly monochromatic colors, and allows expansive views from the valleys to the surrounding mountains. The valley lowlands are light in color, consisting of yellow, browns, and greenish tones. The higher elevations support vegetation that is darker green. Surrounding mountains around the valley are rocky, darker in color, and provide visual diversity. Visual sensitivity in the Projects Area is primarily related to major roads and Grimes Point. Major roadways include Highway 50 on the east side of the Projects Area and Highway 95 on the west side of the Projects Area. The closest population center from which people could view portions of the Proposed Action is the city of Fallon. The majority of the Projects Area would not be visible from Fallon. Sensitive receptors in the Projects Area include residents of Fallon, Lahontan Elementary School, Churchill County High School, visitors to the Grimes Point Archaeological Site, drivers looking south and west from Highway 50, and people recreating in the area. Recreational activities in the area include OHV drivers and visitors to the Pony Express National Historic Trail.

SPPC Project Area

Public lands in the proposed transmission line corridor are classified as Class III Management objective. The proposed transmission line corridor has various scenic resources. Lahontan Elementary School and Churchill County High School, both located in Fallon, are sensitive receptors located close to the SPPC Project Area.

Another sensitive receptor, the Grimes Point Lookout, provides scenic views of the valley in the foreground and mountains in the background. The Grimes Point Archaeological Site is one of the largest and most accessible petroglyph sites in Nevada (Nevada SHPO 2010). The Grimes Point Lookout has a kiosk and rest area for recreational purposes. Almost no development is visible from the Grimes Point Lookout, and what can be seen is faint and distant.

The SPPC Project Area is located in a low valley, which is mostly flat with small hills and little topographic change. Dominating colors of the valley are browns, tans, yellows, and greens. Contrasts of color and elevation make the mountains in the background an important visual resource. There are several existing transmission lines, a pipeline, and a power plant in the proposed corridor area. The area is sparsely populated but in some areas there are fences, roads, and agricultural lands. The portion of the SPPC Project Area from the Macari Switching Station to the Greenwave Substation is characterized by agricultural operations, conservation easements, and residences.

Ormat Project Area

The Ormat Project Area is flat with expansive views of the surrounding valley and mountains in the background. A portion of the Grimes Point Archeological Site overlaps the Ormat Project Area. The vegetation is low and a linear canal is

visible adjacent to the Project Area. Colors in the Project Area include bright greens, yellows, brown, and usually blue sky. The grass and other green vegetation contrast with sandy and dry ground in surrounding areas. Structures from the nearby air station are also visible. They are industrial in character and include grays, red, white, and brown. Airplanes fly over the area often.

Vulcan Project Area

The Vulcan Project Area is mostly flat with some small hills. There is some contrasting color, vegetation, and elevation. Colors in the area are mostly greens, yellows, and browns against the bright blue sky. Expansive views are available across the valley to the rugged mountains in the distance. A large salt flat area is visible at some points in the Project Area. Vegetation in the area consists of mostly low, patchy shrubs.

Two existing transmission lines, a pipeline, and a geothermal plant are visible structures from within the Project Area. These structures consist of mostly horizontal lines on the horizon and blend in fairly well with the natural surroundings since they are brown, tan, and gray. The Pony Express National Historic Trail runs through the Vulcan Project Area.

3.18 LIVESTOCK GRAZING

Regional Overview

This section describes grazing resources and regulations in the Salt Wells Energy Projects Area. The grazing resources are discussed for the allotments and pastures within the Salt Wells Energy Projects Area.

The BLM manages livestock grazing in distinct allotments within the district. Reclamation manages grazing in distinct pastures with a cattle number restriction rather than as allotments with AUMs. **Table 3-25**, BLM Grazing Allotments and Reclamation Pastures Within the Salt Wells Project Areas, and **Figure 3-22**, Grazing, identify the BLM allotments and Reclamation pastures that fall within the Salt Wells Projects Area.

The BLM manages grazing under the authority of the Taylor Grazing Act of 1934, FLPMA, 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 in compliance with the Sierra Front-Northwestern Great Basin Area Standards and Guidelines for Rangeland Health (Standards and Guidelines).

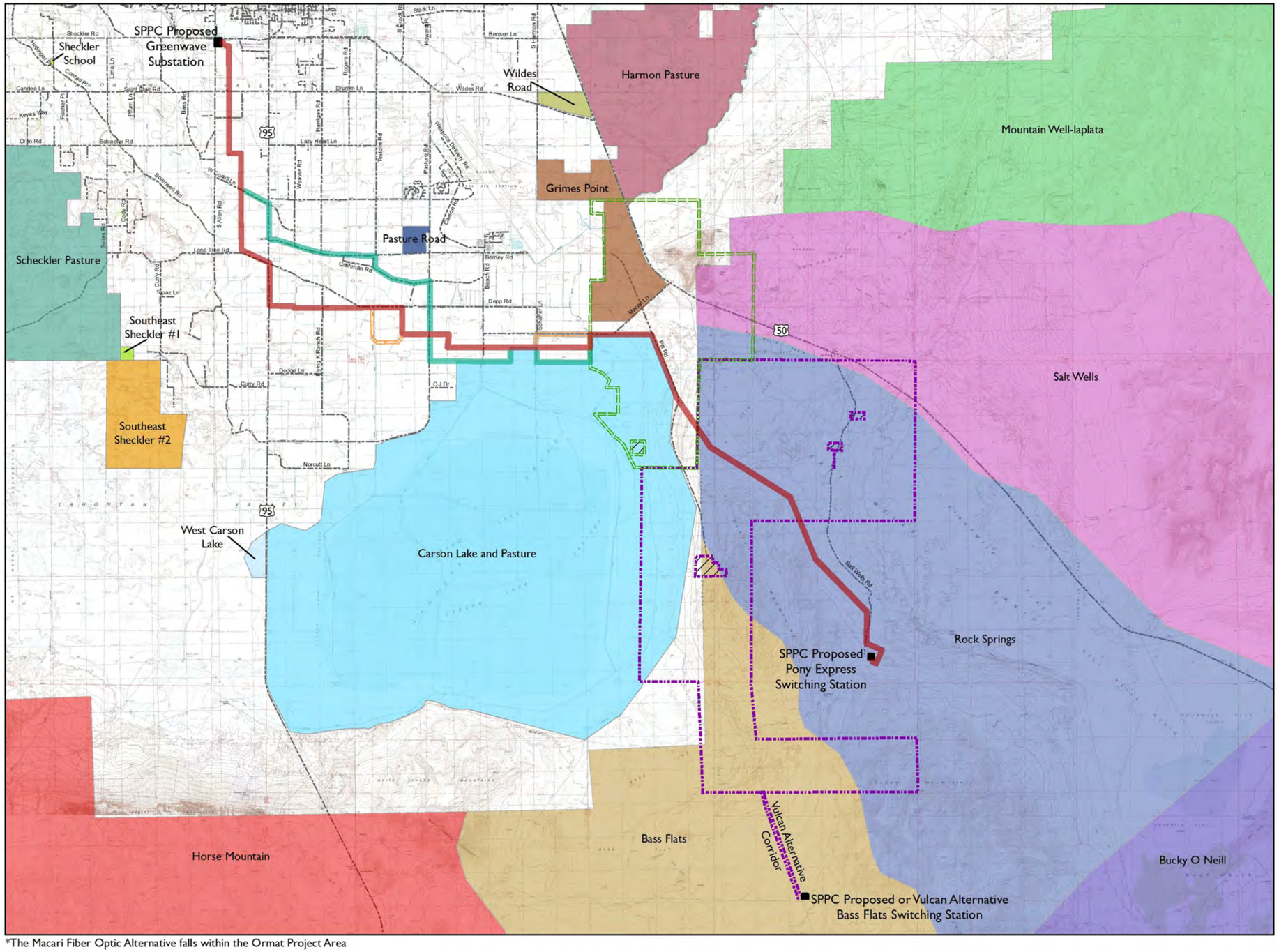
Table 3-25
BLM Grazing Allotments and Reclamation Pastures Within the Salt Wells Project Areas

Allotment or Pasture Name	Land Owner	Total Allotment or Pasture Acreage	AUMs on Allotment	Livestock Currently Permitted on Allotment or Pasture	Season of Use
Bass Flat	BLM	34,915	1,589	320 Cattle	November 15-April 15
Carson Lake and Pasture	Reclamation	28,603	NA	2,300	April to November
Grimes Point Pasture	Reclamation	1,801	NA	16	Annually
Harmon Pasture	Reclamation	5789	NA	338	April 1 to November 15
Rock Springs	BLM	42,193	535	98 Cattle	November 1-April 15
Salt Wells	BLM	45,293	1,626	270 Cattle	October 15-April 15

The Standards and Guidelines are written to accomplish the four fundamentals of rangeland health, insofar as they are affected by livestock grazing practices. Those fundamentals are:

- Watersheds are properly functioning,
- Ecological processes are in order;
- Water quality complies with State Standards; and
- Habitat of protected species are in order.

This BLM grazing program also includes proper management of livestock grazing and such improvements as fences and water developments. In 2007, the BLM grazing allotments in the Salt Wells Energy Projects Area were evaluated for permit renewal. The results from the permit renewal and monitoring since 2007 are identified below. Actual use dates for the three allotments are identified in **Tables 3-26**, Bass Flat Allotment Actual Use Data, **3-27**, Rock Springs Allotment Actual Use Data, and **3-28**, Salt Wells Allotment Actual Use Data, respectively.



Grazing

Churchill County, Nevada

Bureau of Reclamation Permit Areas
- Carson Lake and Pasture
- Grimes Point
- Harmon Pasture
- Pasture Road
- Sheckler Pasture
- Sheckler School
- Southeast Sheckler #1
- Southeast Sheckler #2
- West Carson Lake
- Wildes Road

Bureau of Land Management Grazing Allotment
- Bass Flats
- Bucky O Neill
- Horse Mountain
- Mountain Well-Laplata
- Rock Springs
- Salt Wells

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Excluded from Lease Area

Source: BLM, Ormat, SPPC, Vulcan 2010, BOR 2010

0 0.5 1 2
Miles

July 2011
NAD 1983 HARN State Plane Nevada West
Disclaimer: 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.

*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-22

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Table 3-26
Bass Flat Allotment Actual Use Data

Grazing Year	Livestock Type	Use Period	% Public Land	Total AUM's Used
1980-1981	C	11/16/80 – 04/15/81	100	1,503
1981-1982	C	11/16/81 – 04/15/82	100	1,688
1982-1983	C	11/01/82 – 04/15/83	100	2,060
1983-1984	C	10/16/83 – 04/20/84	100	2,557
1984-1985	C	10/24/84 – 04/29/85	100	2,225
1985-1986	C	10/11/85 – 05/16/86	100	2,375
1986-1987	C	10/16/86 – 04/24/87	100	2,309
1987-1988	C	10/19/87 – 04/29/88	100	2,031
1988-1989	C	10/16/88 – 04/15/89	100	2,398
1989-1990	C	11/01/89 – 04/15/90	100	1,092
1990-1991	C	10/02/90 – 04/15/91	100	1,933
1991-1992	-	Non-use	Non-use	Non-use
1992-1993	-	Non-use	Non-use	Non-use
1993-1994	-	Non-use	Non-use	Non-use
1994-1995	-	Non-use	Non-use	Non-use
1995-1996	-	Non-Use	Non-use	Non-use
1996-1997	-	Non-Use	Non-use	Non-use
1997-1998	C	12/01/97 – 04/24/98	100	1,617
1998-1999	C	12/07/98 – 04/22/99	100	1,602
1999-2000	C	11/01/99 – 04/21/00	100	2,484
2000-2001	C	11/30/00 – 05/02/01	100	1,400
2001-2002	C	11/16/01 – 02/28/02	100	1,589*
2002-2003	C	12/27/02 – 04/17/03	100	1,131
2003-2004	C	12/18/03 – 04/16/04	100	583*
2004-2005	-	Non-use	Non-use	Non-use
2005-2006	C	12/13/05 – 04/29/06	100	1,288
2006-2007	C	12/10/06 – 04/20/07	100	1,297

*Indicates actual use data was not available; billing amounts used instead.

Bass Flat Grazing Allotment

Riparian
The standards for riparian/wetlands do not apply to this area because there are no surface water sources within the allotment.

Water Quality
The standards for riparian/wetlands do not apply to this area because there are no surface water sources within the allotment.

Soils
The soil processes were generally appropriate to the soil types, climate, and landforms. Throughout the grazing allotment there has been little evidence of soil movement such as rills, gullies, pedestalling or soil deposition. The exception was soil movement in the sand dunes. However, it was determined that the wind scoured blowouts, pedestalling, and soil deposition observed in these deep sandy areas were appropriate for the types of ecological sites sampled. No evidence of soil compaction was observed, but water infiltration

may be slightly altered at some of the sample sites due to a variation in plant species composition. Based on the ecological site descriptions, Indian ricegrass should be a dominant plant species by weight, but in reality shrubs and annual plants dominate the sites.

Hydrologic cycles, nutrient cycles, and energy flow are adequate for the vegetative communities. Native plant communities are present on the landscape and are persisting through time. The presence of vegetative communities is evidence that hydrologic, nutrient, and energy cycles are functioning.

Plant communities in general are diverse, vigorous and show evidence of recruitment. A portion of the salt desert shrub plant community has an abundance of annual species. In general ground cover provided by perennial plant species is less than expected in the salt desert shrub community, but the reduced amount of ground cover provided by perennial plants does not appear to have resulted in soil instability. The Standard is being met.

Plant and Animal Habitat

A BLM monitoring report documents high mortality rates in Indian ricegrass populations in the region around the Bass Flat Allotment in the early 1990's. The die off of native Indian ricegrass plants may have been due to the age of individual plants, past drought cycles, livestock grazing practices or possibly plant disease. Currently, the reduced abundance of ricegrass and the low reproductive success for this species indicate the rangeland health standard for this plant community has not been met but is making slow progress towards recovery at this time. The rate and extent of ricegrass recovery is the same in both grazed and ungrazed plant communities; therefore, current livestock grazing practices are not inhibiting recovery. The Standard is not being met, but livestock grazing practices are not significant factors.

Special Species Habitat

Alkali flats provide habitat for the Snowy Plover (*Charadrius alexandrinus*) which is a BLM sensitive species. Bass Flat is a large alkali flat located in the north western portion of the grazing allotment and may provide habitat for the plover. Currently the habitat for this species appears to be adequate and not impacted by livestock grazing. The Standard is being met.

Rock Springs Allotment

Riparian

Riparian assessments were performed on three springs in the Rock Springs Allotment. All three springs have been rated as proper functioning condition. Some use by cattle was noted, but impacts were not severe. These areas had the majority of the cattle signs (trampling and manure) on the whole allotment, so it was apparent that these spring areas and the associated vegetative community attract the cattle when there is standing water. There is no evidence

in the allotment file that these springs were assessed previously. The Standard is being met.

Table 3-27
Rock Springs Allotment Actual Use Data

Grazing Year	Livestock Type	Use Period	% Public Land	Actual Use AUMs	Billed AUM's
1989-1990	C	11/89 – 04/90	100	428	444
1990-1991	C	11/90 – 04/91	100	441	464
1991-1992	C	11/91 – 04/92	100	377	380
1992-1993	C	11/92 – 04/93	100	394	498
1993-1994	C	11/93 – 04/94	100	511	535
1994-1995	C	11/94 – 04/95	100	519	535
1995-1996	C	11/95 – 04/96	100	521	538
1996-1997	C	11/96 – 04/97	100	538	535
1997-1998	C	11/97 – 04/98	100	535	535
1998-1999	C	11/98 – 04/99	100	*	535
1999-2000	C	11/99 – 04/00	100	506	535
2000-2001	C	11/00 – 04/01	100	*	535
2001-2002	C	03/02 – 04/02	100	*	535
2002-2003	C	11/02 – 03/03	100	474	474
2003-2004	C	Non-Use	100	0	0
2004-2005	C	Non-Use	100	0	0
2005-2006	C	11/05 – 02/06	100	*	387
2006-2007	C	11/06 – 04/07	100	*	344
2007-2008	C	Non-Use	100	0	0

*Indicates actual use data was not available; billing amounts used instead.

Water Quality

No class waters or beneficial uses are designated within the Rock Springs Allotment. Therefore, only the descriptive water quality standards pertaining to all surface waters in Nevada (NAC 445A.121) apply to the three springs. During rangeland health evaluations and riparian assessments, no significant impacts to water quality due to current land uses, including livestock grazing, were observed. There were no visual signs, odors, or other indications that water quality was being impaired under the current grazing system. The Standard is being met.

Soils

The soils resource within the Rock Springs Allotment meets the first three indicators of the Rangeland Health Standard as outlined in the Sierra Front-Northwestern Great Basin Standards and Guidelines document; however, there is a moderate deviation in the two indicators concerning plant communities and cover. There was some slight coppicing and faint water flow patterns observed in the upland assessment area, but these features are not unusual for the site. Water infiltration is probably affected somewhat by the deviation in basal and canopy cover in the plant communities, but the overall soil resource is not being degraded at this time.

Currently, the reduced abundance of native perennial grasses and shrubs as well as the low reproductive success of the grass species indicate that the capacity of the biotic community is lacking and that the Rock Springs Allotment is not meeting the standards for Soils. There is very little evidence of cattle being present on the upland or the sandy dune areas of the allotment; therefore, current livestock grazing practices are not inhibiting recovery of the perennial grasses and shrubs.

Plant and Animal Habitat
Wildlife habitats are limited on the Rock Springs Allotment due to natural conditions of moisture and soil type. The species diversity of the allotment would be limited due to these factors. However, species such as Loggerhead Shrike, Snowy Plover, collared lizard, and pallid bat would be found on the allotment.

Yearlong pronghorn range lies adjacent to this allotment. Pronghorn sign was seen on the allotment in summer 2008; pronghorn may use the allotment seasonally in the winter but not for long periods. Numbers are probably low. No other game or upland game species would be expected to occur in this allotment due to natural ecological factors.

The Rock Springs Allotment has shown a poorer and/or lower seral plant composition and is thought to be related mostly to historic grazing levels that removed seed sources and exhausted soil seed reserves. It is possible that some of the upland area with poorer grass and forb composition cannot recover naturally even if livestock are removed totally. In the sandy areas, low seral desired perennial and acceptable annual plants are abundant. This is an indicator that the winter livestock grazing is not harming the allotment to a great extent and that it is slowly improving in condition in areas that can respond. The Standard is being met.

Special Species Habitat
A memorandum to the USFWS was prepared, dated July 1, 2008, requesting information on the potential for occurrence of any federally listed, candidate, or proposed species associated with the allotment area. In a memorandum from the USFWS dated July 24, 2008, the USFWS indicated there were no federally listed species associated with the Rock Springs Allotment. There are no issues related to federally listed species. The Standard is being met.

Salt Wells Allotment

Riparian
There are three riparian areas located in the Salt Wells Allotment, and these areas were assessed for proper functioning condition in 2006. The assessments determined that two springs, Sand Springs #1 and #2, were in proper functioning condition. The third area Tunnel Spring was not functioning. When

Table 3-28
Salt Wells Grazing Allotment Actual Use Data

Grazing Year	Livestock Type	Use Period	% Public Land	Total AUMs Used
1979-1980	C	10/16/79 – 04/15/80	100	1,593
1980-1981	C	10/16/80 – 04/15/81	100	1,550
1981-1982	C	10/16/81 – 04/30/82	100	1,659
1982-1983	C	10/16/82 – 04/22/83	100	1,601
1983-1984	C	10/16/83 – 04/30/84	100	1,659
1984-1985	C	10/16/84 – 04/30/85	100	1,649
1985-1986	C	10/16/85 – 04/30/86	100	1,648
1986-1987	C	10/16/86 – 04/15/87	100	1,482
1987-1988	C	10/16/87 – 04/15/88	100	1,245
1988-1989	C	10/16/88 – 04/15/89	100	1,187
1989-1990	C	11/05/89 – 04/15/90	100	862
1990-1991	C	10/15/90 – 04/15/91	100	1,624
1991-1992	C	10/20/91 – 05/14/92	100	2,701
1992-1993	C	10/15/92 – 04/15/93	100	1,624*
1993-1994	C	10/15/93 – 04/15/94	100	1,624*
1994-1995	C	10/15/94 – 04/15/95	100	1,624*
1995-1996	C	10/20/95 – 04/15/96	100	1,589
1996-1997	C	10/15/96 – 04/15/97	100	1,624*
1997-1998	C	10/15/97 – 04/15/98	100	1,522
1998-1999	C	10/20/98 – 04/15/99	100	1,429
1999-2000	C	10/15/99 – 04/15/00	100	1,478
2000-2001	C	11/01/00 – 04/15/01	100	1,518
2001-2002	C	10/15/01 – 02/28/02	100	1,216*
2002-2003	C	10/23/02 – 04/17/03	100	1,062
2003-2004	C	10/15/03 – 04/15/04	100	1,624*
2004-2005	C	10/15/04 – 04/15/05	100	1,624*
2005-2006	C	10/15/05 – 04/15/06	100	1,624*

*Indicates actual use data was not available; billing amounts used instead.

the assessment was completed at Tunnel Spring in June of 2006, there was only a wet area in the soil. No standing surface water was visible. The presence of an old water trough indicates that the spring might have been more productive in the past. Great Basin wildrye and the invasive species known as tamarisk, or saltcedar, are growing in the area which indicates the old spring area is more mesic than the surrounding uplands. The management recommendation is to remove the invasive saltcedar and see if this improves the flow of water. The Standard is being met for two of the three springs. The Standard is not being met for Tunnel Spring, but livestock grazing is not a significant factor.

Water Quality

No class or designated waters are located within the grazing allotment; therefore, only the descriptive water quality standards pertaining to all surface waters in Nevada (NAC 445A.121) apply to water resources on the allotment.

Water quality was not tested, but during the rangeland health evaluation and riparian assessments it appeared that significant impacts to water quality from

current land uses were unlikely. There were no visual signs, odors, or other indications that water quality was being impaired. The Standard is being met.

Soils

The soil processes were generally appropriate to the soil types, climate, and landforms. Throughout the grazing allotment there has been little evidence of soil movement such as rills, gullies, pedestalling, or soil deposition. The exception was soil movement in the sand dunes. However, it was determined that the wind scoured blowouts, pedestalling and soil deposition observed in these deep sandy areas were appropriate for the types of ecological sites sampled. No evidence of soil compaction was observed, but water infiltration may be slightly altered at some of the sample sites due to a variation in plant species composition. Based on the ecological site descriptions, Indian ricegrass should be a dominant plant species by weight, but, in reality, shrubs and annual plants dominate the sites.

Hydrologic cycles, nutrient cycles, and energy flow are adequate for the vegetative communities. Native plant communities are present on the landscape and are persisting through time. The presence of vegetative communities is evidence that hydrologic, nutrient, and energy cycles are functioning.

Plant communities in general are diverse, vigorous, and show evidence of recruitment. A portion of the salt desert shrub plant community has an abundance of annual species. In general ground cover provided by perennial plant species is less than expected in the salt desert shrub community, but the lack of ground cover in these areas does not appear to have resulted in soil instability. The Standard is being met.

Plant and Animal Habitat

Salt desert shrub plant communities suitable for wildlife species are present within the Salt Wells Allotment. The dominant perennial plant species in these types of salt desert shrub plant communities typically include Bailey's greasewood (*Sarcobatus baileyi*), fourwing saltbush (*Atriplex canescens*) and Indian Ricegrass (*Achnatherum hymenoides*). Overall, the shrub component of the plant community appears to be in good condition. There is a good diversity of shrub height, size, and distribution. In addition the number of wood stalks, seed stalks, and seed production are adequate for stand maintenance; however, low abundance of Indian ricegrass indicates there was a problem with the perennial grass portion of the plant community. In addition, the high abundance of invasive annual species such as cheatgrass and tumbleweed is an additional concern.

A BLM monitoring report documents high mortality rates in Indian ricegrass populations in and around the Salt Wells Allotment in the early 1990s. In addition, a large number of dead Indian ricegrass root crowns and an abundance of young ricegrass plants were noted within the allotment during the 2006 rangeland health monitoring. The die off of native Indian ricegrass plants may have been due to the age of individual plants, past drought cycles, livestock

grazing practices or possibly plant disease. Currently the reduced abundance of ricegrass indicates the rangeland health standard for this plant community has not been met, but the abundance of young ricegrass plants indicates significant progress towards recovery is being made.

A secondary concern for the salt desert shrub plant communities is fire due to abundance of annual invasive species such as cheatgrass. Salt desert shrub plant communities are not fire tolerant. The presence of cheatgrass in these communities provides a fine fuel source which increases the risk of fire and shortens the fire return interval. If the area is lost to fire or is completely converted to cheatgrass and/or weedy species, then this area will turn into very poor habitat for the current species which depend on it. Plant and animal habitat is not meeting the Standard but is making progress towards it.

Special Species Habitat
Habitat for four BLM sensitive species occurs within the Salt Wells Allotment.

Alkali flats provide habitat for the Snowy Plover (*Charadrius alexandrinus*), which is a BLM sensitive species. Alkali flats are located along the southern boundary of the grazing allotment and may provide habitat for the plover. Currently the habitat for this species appears to be adequate and not impacted by livestock grazing.

The eastern end of the allotment provides habitat for the Sand Mountain Blue Butterfly (*Euphilotes pallescens ssp.*), Hardy's Aegialian Scarab beetle (*Aegialia hardyi.*), and the plant Nevada Oryctes (*Oryctes Nevadensis*). Habitat for these species occurs around Sand Mountain at the ecotone between bare sand dunes and vegetation. There is no indication to date that suggests grazing has a significant adverse impact on these species. OHV traffic is the activity most likely to impact these populations by crushing the vegetation the butterflies and beetles depend upon and the Orcytes populations. The Standard is not being met, but livestock grazing is not a significant factor.

SPPC Project Area

The SPPC Project Area overlaps approximately 224.75 acres of the Rock Springs grazing allotment, 134 acres of Carson Lake and Pasture (Reclamation), and 5.75 acres of the Bass Flat grazing allotment (see Figure 3-22). Table 3-25 provides an overview of the grazing permits on the Project Area.

Ormat Project Area

The Ormat Project Area overlaps approximately 384 acres of the Rock Springs grazing allotment, 877 acres of the Salt Wells grazing allotment, 1,149 acres of the Grimes Point Pasture, 6 acres of the Harmon Pasture and 1,758 acres of Carson Lake and Pasture (see Figure 3-22). Table 3-25 provides an overview of the grazing permits on the Project Area.

Vulcan Project Area

The Vulcan Project Area overlaps approximately 8,811 acres of the Rock Springs Grazing Allotment, 3,329 acres of the Bass Flat Grazing Allotment, 412 acres of the Salt Wells Grazing Allotment and 1,912 acres of the Carson Lake and Pasture (See Figure 3-22). Table 3-25 provides an overview of the grazing permits on the Project Area.

3.19 RECREATION

Regional Overview

The Salt Wells Energy Projects Area is located adjacent to the Carson Lake and Pasture. The Pony Express National Historic Trail is located near and crosses a portion of the Projects Area. The closest recreation site is Grimes Point on the north side of US Highway 50. There are no developed or specially designated recreational areas within the Salt Wells Energy Projects Area. Recreation within the Projects Area is of a dispersed nature and includes OHV use, hunting and wildlife viewing. Each year, several BLM-permitted OHV races pass through the area, including the Vegas-to-Reno race, organized by Best in the Desert in August, and the Valley Off-Road Racing Association (VORRA) Fallon Desert Night Race in July. In addition, the Pony Express Re-ride rides through the area on the Pony Express National Historic Trail every June. The Pony Express National Historic Trail is discussed in detail in **Section 3.21**, National Scenic and Historic Trails. There are no state parks in the Salt Wells Energy Projects Area. County park and recreation areas are within the City of Fallon and near Sheckler and Harmon reservoirs (Wright 2002).

Grimes Point

Grimes Point is located on Highway 50 approximately 9 miles east of the City of Fallon. This site is considered to be one of the largest and most accessible prehistoric rock art sites in the US and dates back to 6,000 years of age and includes the Grimes Point Interpretive Trail and designated National Recreation Trail. Because the parking area, restrooms, and picnic tables are visible from the highway, Grimes Point has become a rest area for travelers along Highway 50 in addition to those who plan on visiting the site as a destination.

Hidden Cave

Hidden Cave is located one mile northeast of Grimes Point and is accessed by a dirt road that passes by the Grimes Point parking area. The cave is considered culturally significant since it was used by Native Americans more than 3,500 years ago to store grains and supplies. Although considered a separate destination point, this site can be considered part of the Grimes Point Archaeological Site.

Wildlife Viewing

The Salt Wells Energy Projects Area is located adjacent to Carson Lake and Pasture, which are part of the Lahontan Valley Wetlands Complex, an area

designated as a Nevada IBA as well as a Site of International Importance. The IBA was designated by the National Audubon Society working with Birdlife International. The significance of the wetlands can be understood from the perspective that it is one of only 39 recognized IBA areas in Nevada. To be designated, sites must provide essential breeding, migration, or wintering habitat for one or more species of birds and have at least one of the following designations to be considered for recognition:

- Sites important to Nevada species of concern;
- Sites harboring species restricted to unique/threatened habitat types;
- Sites where significant numbers of birds congregate;
- Sites supporting long-term avian research; or
- Sites providing outstanding educational opportunities.

Carson Lake and Pasture are also part of the Lahontan Valley Shorebird Reserve, one of only 16 sites recognized for their international importance by the Western Hemispheric Shorebird Reserve Network. It is also a Site of International Importance as designated by the Western Hemispheric Shorebird Reserve Network; and listed as a Global IBA by the American Bird Conservancy. The Carson Lake and Pasture are located on land managed by Reclamation, however adjacent lands to the east and south are federal lands managed by the BLM.

Off-Highway Vehicle Recreation

Several of the roads in the proposed Salt Wells Energy Projects Area were authorized by the BLM as designated OHV race routes prior to 1993 for annual race events. These routes are currently classified as existing routes of travel and provide opportunities for the motorized recreationists to access public lands. Two of the major events are the Vegas-to-Reno and the VORRA Fallon 250 Desert Night Race. The routes for these races are shown on **Figure 3-23**, Recreation. The Vegas-to-Reno race is a point-to-point race that starts north of Las Vegas and runs north to the town of Dayton. The VORRA Fallon race is a circuit type event with a 40-mile loop course that the participants run five times. Safety concerns were addressed previously for the existing ENEL Geothermal Power Plant and the race course was altered to avoid a collision of vehicles traveling in excess of 100 mph, often at night.

Hunting

NDOW has divided the state into discrete management areas called Hunt Units to manage recreational hunting of big game species, such as mule deer, Rocky Mountain Elk, bighorn sheep, antelope, and mountain goat. There are two management units that encompass the Salt Wells Energy Project Area: Hunt Units 181 and 182. While there are different periods established for hunting, depending upon the area, the species, and the method of take (archery,

muzzleloader, rifles, and handguns), the season for the two units falls within the following ranges:

- Bighorn Sheep, November 20-December 20
- Mountain Lion, March-February
- Antelope, August 1-September 5
- Mule Deer, August 1-November 2

Upland game birds, including grouse, turkey, chukar, quail, dove partridge and pheasant are usually in season from late fall through early spring. Waterfowl and migratory birds can be hunted at the Carson Lake and Pasture area during the hunt season that runs from fall to early spring. Small game mammals, such as rabbits and squirrels, can also be hunted within the units.

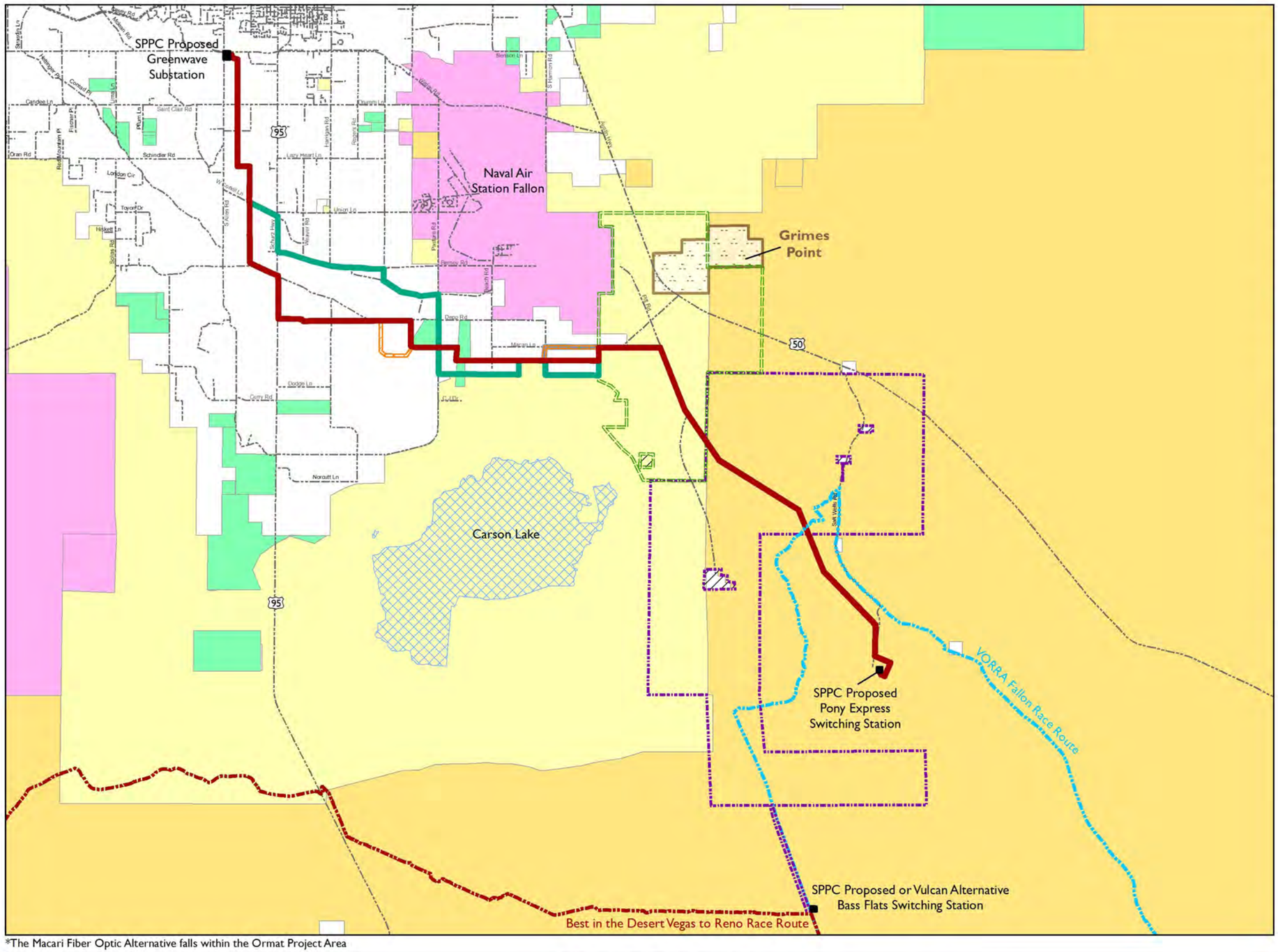
While the Salt Wells Energy Projects Area is not a prime hunting area for most of the big game animals, the roads within the Projects Area are utilized by hunters to access higher quality habitat in the region. Some species, such as the mule deer, as well as the game birds and waterfowl, are attracted to the water in the Carson Lake and Pasture area, and it would not be uncommon to encounter hunters in the Salt Wells Energy Projects Area from fall through spring.

SPPC Project Area

The SPPC Project Area is characterized by dispersed recreation as discussed in **Section 3.19**, Regional Overview. The SPPC Project Area is adjacent to the north and west boundaries of Carson Lake and Pasture, which is designated as an IBA, part of the Lahontan Valley Shorebird Reserve, which is a Site of International Importance as designated by the Western Hemispheric Shorebird Reserve Network, and listed as a Global IBA by the American Bird Conservancy. The area is also used for hunting and hunting access. The portion of the Project Area that runs from Macari Road to the Pony Express Switching Station is crossed by the route used for the VORRA OHV race. The race route currently runs parallel to a portion of the SPPC Project but is approximately one-half mile from the SPPC Project Area. The Vegas-to-Reno race route runs parallel to the existing Austin to Fort-Churchill 230-kV transmission line and past the Bass Flat Switching Station site.

Ormat Project Area

The Ormat Project Area is characterized by dispersed recreation as discussed in **Section 3.19**, Regional Overview. The OHV race routes do not currently cross the Ormat Project Area and the closest race route is several miles to the east. The Ormat Project Area overlaps the eastern boundary of the Carson Lake and Pasture, which is designated as an IBA, part of the Lahontan Valley Shorebird Reserve, which is a Site of International Importance as designated by the Western Hemispheric Shorebird Reserve Network, and listed as a Global



Recreation

Churchill County, Nevada

Race Course
- Best In the Desert Vegas to Reno Race Route
- VORRA Fallon Race Route

Archeological Site
- Grimes Point

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative 3 (Preferred) 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Open Water
- Excluded from Lease Area

Land Ownership
- Bureau of Land Management
- Bureau of Reclamation
- Department of Defense
- Fish and Wildlife Service
- Private Land (Including city and county lands)

Source: BLM, Ormat, SPPC, Vulcan 2010, USFWS 2010

0 0.5 1 2

Miles

July 2011
NAD 1983 HARN State Plane Nevada West
Disclaimer: 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.

*The Macari Fiber Optic Alternative falls within the Ormat Project Area

Figure 3-23

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IBA by the American Bird Conservancy. The area is also used for hunting as well as for hunting access and wildlife viewing.

Vulcan Project Area

The Vulcan Project Area is characterized by dispersed recreation as discussed in **Section 3.19**, Regional Overview. The OHV race routes traverse the southern and eastern portions of the Vulcan Project Area. The VORRA race route runs along most of Vulcan's alternative 230-kV transmission line corridor. Also, the Vegas to Reno race route runs parallel to the existing Austin to Fort Churchill 230-kV transmission line and past the Bass Flat Switching Station site. The Vulcan Project Area is adjacent to the eastern boundary of the Carson Lake and Pasture, which is designated as an IBA, part of the Lahontan Valley Shorebird Reserve, a Site of International Importance as designated by the Western Hemispheric Shorebird Reserve Network, and listed as a Global IBA by the American Bird Conservancy. The area is used for hunting as well as access for hunting and wildlife viewing.

3.20 NATIONAL SCENIC AND HISTORIC TRAILS

Regulatory Overview

National Trails System Act of 1968, as amended

The National Trails System Act establishes trails primarily near urban areas, and secondarily within scenic areas and along historic travel routes, which are often more remotely located. The national system of trails is composed of National Recreation Trails, National Scenic Trails, National Historic Trails, and connecting and side trails. ROWs are allowed to cross a National Trail.

National Trails System Memorandum of Understanding (2006)

This Memorandum of Understanding, between the BLM, National Park Service, USFWS, USFS, and the Federal Highway Administration, encourages long-term interagency coordination and cooperation, since many trails cross federal land, and these agencies are often the administrators of national trails. The agencies are responsible for maintaining and managing the trails, and are required to mitigate resource damage. Agencies should aim to enhance visitor satisfaction and cultural values, among other criteria.

Regional Overview

The Pony Express National Historic Trail runs from Highway 95 to the east near Buckland Station, crosses over Simpson Pass, and continues east past Sand Mountain. There are existing historical monuments on the west side of the Cocoon Ranges and at Simpson Pass, with an additional monument recently installed on the east side of the Cocoon Range near the ENEL Geothermal Plant. Each year, a re-ride of the entire Pony Express National Historic Trail, from Saint Joseph, Missouri to Sacramento, California is enacted by members of the national and local chapters of the Pony Express Association.

The trail also provides historical significance and educational opportunities to travelers. The trail and associated segments are of national significance, managed and protected under the National Trails System Act.

SPPC Project Area

The Pony Express National Historic Trail crosses the Pony Express Switching Station parcel and the south end of the preferred route near the existing ENEL Geothermal Power Plant. The Bass Flat Switching Station is located approximately 2.5 miles south of the trail.

Ormat Project Area

The Pony Express National Historic Trail is located approximately 6 miles south of the Ormat Project Area.

Vulcan Project Area

The Pony Express National Historic Trail is located approximately 2 miles south of Power Plant Site 5. Approximately 0.25 miles of the trail traverses the Vulcan alternative transmission line to Bass Flat.

3.21 NOISE

Noise is defined as unwanted sound and can be intermittent or continuous, steady or impulsive. Human response to noise is extremely diverse and varies according to the type of noise source, the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source and the receptor.

The decibel (dB) is the accepted unit of measurement for noise. Because human hearing is not equally sensitive to all sound frequencies, various frequency weighting schemes have been developed to approximate the way people hear sound. The A-weighted decibel scale (dBA) is normally used to approximate human hearing response to sound. Example sound noise levels are as follows:

- Audiometric testing booth is approximately 10 dB (barely audible);
- Quiet rural nighttime is approximately 10 to 20 dB;
- Rural daytime outdoors is approximately 45 dB;
- Quiet urban daytime is approximately 50 dB;
- Normal conversation is approximately 55 dB;
- Automobile at 100 feet is approximately 60 dB;
- Leaf blower at 50 feet is approximately 70 dB;
- Bulldozer at 50 feet is approximately 85 dB;
- Jackhammer at 50 feet is approximately 90 dB; and
- Commercial fireworks at 1,500 feet is approximately 115 dB.

Relative to human receptors, noise levels under 45 dBA are considered quiet, 46 to 65 dBA are considered moderately loud, 66 to 75 dBA are considered loud, 66 to 110 dBA are considered very loud, and 111 dB and above are considered uncomfortable.

LAeq refers to the "equivalent" average sound level. During daytime, few people are highly annoyed at LAeq levels below 55 dBA, and few are moderately annoyed at LAeq levels below 50 dBA (World Health Organization 1999); however, in quiet rural settings, noise levels well below 50 dBA could be considered annoying (Leitner undated).

To avoid annoyance and interference with normal human activity, sound levels during the evening and night are recommended to be 5 to 10 dB lower than during the day. Indoor guideline values for bedrooms are 30 dBA LAeq for continuous noise and 45 dBA as the maximum for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source. At nighttime, outside sound levels about 3 feet from the exterior of living spaces are recommended to not exceed 45 dBA LAeq, so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15 dBA (World Health Organization 1999).

Applicable Noise Regulations

The Federal Geothermal Resources Operational Order Number 4 mandates that noise levels must be 65 dBA or less at the geothermal lease boundary or 0.5 mile from the source, whichever is greater. Churchill County has recently adopted regulations with acceptable noise limits.

Past Citizen Response to Geothermal-Related Noise

Citizen noise complaints from geothermal development operations at The Geysers geothermal field in California have been analyzed by the Lake County Air Pollution Control District and by Long/Davy/Associates for the Noise Element of Lake County General Plan. They found that most community annoyance is related to noise from steam venting, well drilling, and truck traffic. Community response appears to follow fairly well a typical curve between the severity of public reaction and the magnitude of the outdoor day/night average sound level. The most common complaints are in response to receptor sound-pressure levels of 60 to 70 dBA or higher; however, in some cases, levels as low as 40 to 55 dBA have drawn a more frequent response than would be expected in a typical urban or suburban community. It is not clear whether such complaints are related to the low ambient noise levels of the region or to nonacoustic factors, such as opposition to geothermal development in general (Leitner 1978).

Regional Overview

Noise sources in Churchill County are generally associated with agricultural activities, vehicles on roadways, aircraft, and weather. The primary and

dominant noise source within the Salt Wells Energy Projects Area is the military jet overflight activity from the top gun training program based at NAS Fallon.

SPPC Project Area

Existing Noise Setting

The proposed transmission line, switching stations, and the substation are generally in a rural and agricultural environment with a nearby NAS, but the northern portion of the transmission line would cross into the City of Fallon near sensitive noise receptors, including residences, schools, and churches.

The primary noise source in the SPPC Project Area is from the Naval Fighter Weapons School at NAS Fallon. NAS Fallon uses seven ranges that are from 8 to 30 miles from the base and runways (Global Security 2010). Pilots flying to these training areas pass over the Project Area and generate considerable noise levels that overshadow the natural soundscape, which includes wind, weather and wildlife, the sounds of traffic, dispersed recreation, and, on a seasonal basis, farming activities. While ambient sound levels for wilderness and rural areas typically range between 30 and 40 dBA (US EPA 1978), sound levels in the Project Area are considerably higher, although no measurements are available.

The agricultural areas have a low density of residences. The primary sources of noise in rural residential and agricultural areas include dispersed recreational use, highway traffic, and farm equipment on a seasonal basis. In rural residential areas, typical background noise levels reach 40 dBA and in agricultural areas they can reach 45 dBA (US EPA 1978).

Another source of noise in the southern portion of the proposed Project Area is ENEL's existing Salt Wells Geothermal Power Plant, located at the site of SPPC's proposed Pony Express Switching Station. While no noise data is available for the existing facility, its cooling towers are considered to be the main source of noise. Cooling towers have been recorded in the past as having noise levels of 75 to 85 dBA at a distance of 50 feet (Leitner undated) and are generally acknowledged as being the greatest source of noise at geothermal power plants.

Sensitive Receptors

Sensitive noise receptors are generally considered to be homes, hospitals, schools, libraries, and churches. Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the Project Area. Due to the expected noise levels and short-term nature of the noise that would be generated from the SPPC project components, sensitive receptors were identified within 0.1 mile (500 feet) of the transmission line, substation, and switching stations.

Ormat Project Area

Existing Noise Setting

The Ormat Project Area is part of a rural environment and within close proximity to NAS Fallon. Existing noise levels are as described in **Section 3.22.2.**

Sensitive Receptors

The closest sensitive receptor to the Project Area is a residence 0.34 mile west of Ormat's proposed geothermal plant site. This house is 0.22 mile from the Ormat project boundary. Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the Project Area.

Vulcan Project Area

Existing Noise Setting

The Vulcan Project Area is in a rural agricultural environment with NAS Fallon approximately 3 miles to the northwest of the project boundary and the existing ENEL Geothermal Power Plant approximately 1 mile from the project boundary. As described in **Section 3.22.2**, the primary noise source in the Project Area is the overflight activity from the Naval Fighter Weapons School at NAS Fallon. While no noise data is available for the existing power plant, its cooling towers are considered to be the main source of noise. Cooling towers have been recorded in the past as having noise levels of 75 to 85 dBA at a distance of 50 feet (Leitner undated). This reference noise level is translated into estimated noise levels at the Project Area of between 8 and 18 dBA, which are barely perceptible. This noise level does not take into account any topographical barriers or trees between the power plant and the Project Area, both of which would absorb and deflect sound waves, thereby further reducing noise levels.

Sensitive Receptors

There are no sensitive receptors found within 0.5 miles of the Vulcan Project Area. Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the Project Area.

3.22 PUBLIC HEALTH AND SAFETY

Public health and safety issues from geothermal activity generally include hazardous materials, worker safety, and aircraft safety within Salt Wells Energy Projects Area airspace. The affected environment and potential impacts associated with airspace and hazardous materials are addressed in **Sections 3.2**, **4.2**, **3.25**, and **4.25**, respectively. Additionally, generation, delivery and use of electricity, produce electric and magnetic fields (EMFs).

There are no known worker safety issues within the Salt Wells Energy Projects Area.

Electric and Magnetic Fields

EMFs occur both naturally by weather and earth's geomagnetic field and as a result of human activity, such as generation, transmission and use of electricity. In developed areas, EMFs are prevalent from the use of electronic appliances and existing electric power lines. In undeveloped and natural areas, only low level, naturally occurring EMFs exist.

Transmission lines and substations create EMFs. The frequency of a power line is determined by the rate at which EMFs change their direction each second. Fields produced by electric power transmission lines in the US reverse direction at a frequency of 60 cycles per second (60 Hertz [Hz]). The frequency of 60 Hz is considered to be "extremely low" and is referred to as "extremely low frequency electric and magnetic fields". The frequency of EMFs from transmission lines is the same as the frequency of EMFs coming from household electrical wiring.

Electric Fields

Electric fields are experienced in all electrified homes at all times. Plugging a wire into an outlet creates electric fields in the air surrounding the appliance. The higher the voltage the stronger the field produced. Since the voltage can exist even when no current is flowing, the appliance does not have to be turned on for an electric field to exist in the room surrounding it. Electric field corresponds to the change in voltage over a distance and is measured in units of volts per meter or kV per meter. These fields result from the voltage of the transmission line phase conductors with respect to the ground. Electric fields produced by substations are due to the voltage on station components, which act as point sources of electric field, similar to an appliance in a home. The electric field is stronger near a charged object and decreases with distance away from the object. In addition, substation equipment electric fields outside the fenced equipment area are typically very low due to shielding by metallic substation components and the distance created by fencing. An acknowledged potential public health impact from electric transmission lines is the hazard of electric shock due to accidental contact with energized wires.

Magnetic Fields

Magnetic fields are created only when electric current flows. Magnetic fields and electric fields then exist together in the home environment. **Table 3-29**, Magnetic Field and Household Appliances, lists the measured outputs of the magnetic field from household appliances. A greater current results in a stronger magnetic field. High voltages are used for the transmission and distribution of electricity whereas relatively low voltages are used in the home. The voltages used by power transmission equipment vary little from day to day, whereas currents through a transmission line vary with power consumption.

Table 3-29
Magnetic Fields and Household Appliances

Appliance	12 Inches Away	Maximum Strength
	Magnetic Fields (mG)	
Electric Range	3 to 30	100 to 1,200
Electric Oven	2 to 25	10 to 50
Garbage Disposal	10 to 20	850 to 1,250
Refrigerator	0.3 to 3	4 to 15
Clothes Washer	2 to 30	10 to 400
Clothes Dryer	1 to 3	3 to 80
Coffee Maker	0.8 to 1	15 to 250
Toaster	0.6 to 8	70 to 150
Crock Pot	0.8 to 1	15 to 80
Iron	1 to 3	90 to 300
Can Opener	35 to 250	10,000 to 20,000
Mixer	6 to 100	500 to 7,000
Blender, Food Processor	6 to 20	250 to 1,050
Vacuum Cleaner	20 to 200	2,000 to 8,000
Portable Heater	1 to 40	100 to 1,100
Fan/Blower	0.4 to 40	20 to 300
Hair Dryer	1 to 70	60 to 20,000
Electric Shaver	1 to 100	150 to 15,000
Color TV	9 to 20	150 to 500
Fluorescent Light Fixture	2 to 40	140 to 2,000
Fluorescent Desk Lamp	6 to 20	400 to 3,500
Circular Saw	10 to 250	2,000 to 10,000
Electric Drill	25 to 35	4,000 to 8,000

Source: SPPC 2003

Magnetic fields in transmission lines and substations are created by electric currents running through lines and station components and are typically measured in units of milligauss. As with electric fields, magnetic field strength decreases with greater distance from the transmission line; however, unlike electric fields, magnetic fields are not easily shielded by objects or materials.

Health Effects from EMFs

There have been long-standing questions as to whether human exposure to extremely low frequency EMFs has health effects. In 1992, Congress authorized the Electric and Magnetic Fields Research and Public Information Dissemination Program (EMF-RAPID Program) in the Energy Policy Act (NIEHS 2002a). The EMF-RAPID Program was funded jointly by federal and matching private funds, with substantial financial support from the utility industry. Congress instructed the National Institute of Environmental Health Sciences (NIEHS) and the

Department of Energy to direct and manage a program of research and analysis aimed at providing scientific evidence to clarify the potential for health risks from exposure to extremely low frequency EMF. (The NIEHS is one of 25 institutes and centers of the National Institutes of Health and Human Services). The EMF-RAPID Program had the following three basic components:

- A research program focusing on health effects research;
- Information compilation and public outreach; and
- A health assessment for evaluating any potential hazards arising from exposure to extremely low frequency EMF.

The NIEHS was directed to oversee the health effects research and evaluation (NIEHS 2002a). Upon completion of the program, the director of the NIEHS was mandated to provide a report outlining the possible human health risks associated with exposure to extremely low frequency EMF. The document that responds to this requirement of the law is the *NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields.*

In the report, the NIEHS concludes that extremely low frequency EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In the opinion of the NIEHS, "this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to extremely low frequency EMF, passive regulatory action is warranted, such as a continued emphasis on educating both the public and the regulated community on the means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern" (NIEHS 2002a).

There are no federal standards limiting occupational or residential exposure to 60-Hz EMF. At least six states have set standards for transmission line electric fields, and two of these states also have standards for magnetic fields. In most cases, the maximum fields permitted are the maximum fields that existing lines produce at maximum load carrying conditions in each state. The most stringent state standard for electric fields on the ROW is 7.0 kV/m. The most stringent state standard for electric fields at the edge of the ROW is 1.0 kV/m. The second most stringent state standard for electric fields at the edge of the right of way is 1.6 kV/m. The most stringent state standard for magnetic fields at the edge of the ROW is 150 mG under maximum loading of 69 to 230 kV lines. To ensure that electric current induced into large metal objects, such as trucks and buses, does not represent an electric shock hazard, some states further limit electric field strength at road crossings (NIEHS 2002b).

The majority of the Projects Area is rural and undeveloped where only low level naturally occurring EMFs exist. The portion of the Project Area closer to the

City of Fallon is more developed and greater EMFs would be present due to the use of electronic appliances and existing electric power lines.

SPPC Project Area

The Project Area is generally rural and undeveloped where only low level naturally occurring EMFs exist.

Ormat Project Area

The Project Area site is generally rural and undeveloped where only low level naturally occurring EMFs exist.

Vulcan Project Area

The Project Area is generally rural and undeveloped where only low level naturally occurring EMFs exist.

3.23 FIRE MANAGEMENT

Regional Overview

The Great Basin is known for its year-round dry climate and occurrence of wildfires from July through September, sometimes lasting until December. The Salt Wells Energy Projects Area is populated by sparse vegetation and has minimal fire history. Lands managed by the CCDO are assigned fire management categories in the CCDO CRMP. Lands within the Salt Wells Energy Projects Area are designated by BLM as categories C or D. Category C is for areas where fire has a significant role in the environment, and wildfires with some localized constraint should be used to accomplish resource management goals. Category D is for areas where wildfires should be allowed to burn in a mostly unrestricted fashion to achieve resource objectives.

SPPC Project Area

The proposed transmission line and switching stations would occur on lands designated by BLM as categories C or D.

Ormat Project Area

Ormat's proposed project features would occur on lands designated by BLM as categories C or D.

Vulcan Project Area

Vulcan's proposed project features would occur on lands designated by BLM as categories C or D.

3.24 WASTES, HAZARDOUS OR SOLID

Regional Overview

Hazardous materials are used and stored in the Salt Wells Energy Projects Area by small businesses, such as lube and oil shops, automobile repair shops, and by the TCID and NAS Fallon (US EPA 2010).

SPPC Project Area

No hazardous materials are known to be stored or used within the SPPC Project Area and the EPA has no record of contaminated soil or groundwater in the Survey Area (US EPA 2010).

Ormat Project Area

No hazardous materials are known to be stored or used in the Ormat Project Area and the EPA has no record of contaminated soil or groundwater in the Survey Area (US EPA 2010).

Vulcan Project Area

No hazardous materials are known to be stored or used in the Vulcan Project Area and the EPA has no record of contaminated soil or groundwater in the Survey Area (US EPA 2010).

3.25 SOCIAL AND ECONOMIC VALUES

This section provides an overview of the population, housing, employment, and economic characteristics of Churchill County and the City of Fallon. The described social and economic factors provide context for analyzing the potential effects that could result from construction and operation, such as effects on population increases, housing availability, property values, employment and income growth, and public services.

Regional Overview

The Project Area is located in Churchill County Nevada to the southeast of the City of Fallon and south of NAS Fallon. Churchill County covers 4,929 square miles with 4.9 persons per square mile as of 2000 (US Census Bureau 2010).

Population and Housing

Population and associated housing are presented within Churchill County and Fallon. Described in this section are the current population estimates, recent population growth rates, and the projected future population for Churchill County. Housing occupancy, vacancy, and current inventory details are provided.

According to the Nevada State Demographer's estimates, the population of Churchill County in July 2009 was 26,859, which was a decline of 0.5 percent from July 2008. The City of Fallon also experienced a decline with 9,115 persons in July 2009 compared to 9,258 persons in July 2008. This decline is less than that experienced by the state as a whole with a decline of one percent during the same time period. The Fallon populations decrease was greater than the county or the state with a decline of 1.5 percent between July 2008 and July 2009. These declines followed a period of record growth for the area and the State of Nevada as a whole. The Nevada State Demographer estimates that the population of Churchill County will increase by 5,251 by 2028. Using a range of population estimates for planning illustrates the speculative nature of population

projections and emphasizes the need to plan incremental increases to public services and other demand-based infrastructure and service needs.

Housing units in Churchill County and Fallon totaled 9,732 and 3,283 in 2000 and 2008, respectively (US Census Bureau 2010). Occupied homes in Churchill County totaled 8,912, with 3,367 owner occupied and 2,942 tenant occupied. The City of Fallon had a total of 2,954 occupied housing units, with 1,102 owner occupied and 1,651 tenant occupied. Vacancy rates were 10 percent and 8.4 percent for Churchill County and the City of Fallon respectively in 2000. Housing units in Churchill County in 2009 were estimated at 11,007 with a vacancy rate of 19.5 percent (US Census Bureau 2010).

According to the 2006 to 2008 census data from the American Community Survey, the median housing price in Churchill County was $201,200. Housing prices have declined since 2008, and additional foreclosures have commenced. According to data for the second quarter of 2010, the average sales price of homes in Fallon was approximately $130,500, a decline of 2.75 percent from the previous quarter (RealtyTrac 2010). The foreclosure rate in Churchill County kept pace with the state of Nevada for new foreclosures in the second quarter of 2010 at 1.22 percent of units (RealtyTrac 2010).

Employment and the Economy

Employment and general economic characteristics describing current employment levels, income levels, and the provision of public services are discussed for Churchill County. These descriptions serve as background information for analyzing economic effects of the Proposed Actions and Alternatives.

Employment characteristics of Churchill County in 2000 and 2008 are detailed in **Table 3-30**, Full-time and Part-time Employment by Industry, along with comparison data for Nevada and the US (Bureau of Economic Affairs 2010). Employment categories for Churchill County, including forestry, mining, health, and education services, are not shown in the data provided by the Bureau of Economic Affairs as it is proprietary, however, according to the US Census Bureau estimates for 2006 to 2008, forestry, mining, and related industries accounted for 6.4 percent of employment in the County, while education and health services accounted for 14 percent. The annual unemployment rate in Churchill County was 6.2 percent in 2000 and 9.1 percent in 2009, compared to a rate of 4.5 and 11.8 for the same periods for the State of Nevada (Bureau of Labor Statistics 2010).

The median household income in Churchill County for 2008 was $53,618. The median income for the State of Nevada in 2008 was slightly higher at $56,432. However, the poverty level in Churchill County was 10.6 percent in 2008, lower than for the state as a whole at 11.2 percent (US Census Bureau 2010).

Table 3-30
Full-time and Part-time Employment by Industry

Employment by Place of Work	Churchill County		Nevada		United States	
	2001	2008	2001	2008	2001	2008
Total Employment	16,249	22,953	1,270,320	1,638,004	165,510,200	181,755,100
Farm Employment	784	713	5,303	4,788	3,060,000	2,642,000
Nonfarm employment	15,465	22,240	1,265,017	1,633,216	162,450,200	179,113,100
Forestry, Fishing and Related Activities	74	Not shown	1,343	1,760	801,499	858,500
Mining	38	Not shown	11,871	16,580	806,400	1,155,900
Utilities	94	111	4,594	4,781	615,800	590,700
Construction	850	1,642	106,532	138,624	9,817,700	11,151,000
Manufacturing	709	616	46,157	52,593	16,913,600	14,090,900
Wholesale Trade	305	416	38,003	44,051	6,231,400	6,570,500
Retail Trade	1,750	1,866	134,773	167,731	18,256,800	18,862,200
Transportation and Warehousing	394	844	42,216	58,578	5,478,000	6,019,500
Information	159	304	21,890	20,297	4,047,800	3,529,800
Finance and Insurance	830	1,360	62,521	84,182	7,805,600	9,023,400
Real Estate and Rental and Leasing	1,116	2,610	52,651	105,856	5,547,401	8,369,700
Professional, Scientific, and Technical Services	Not shown	1,446	61,593	89,615	10,272,800	12,347,100
Management of companies and Enterprises	Not shown	45	8,963	20,316	1,786,300	1,933,300
Administrative and Waste Services	1,375	1,618	81,039	103,361	9,604,500	10,999,200
Educational Services	Not shown	Not shown	5,925	12,081	3,019,300	3,877,000
Health Care and Social Assistance	Not shown	Not shown	74,697	104,263	15,247,400	18,593,400

Table 3-30
Full-time and Part-time Employment by Industry

Employment by Place of Work	Churchill County		Nevada		United States	
	2001	2008	2001	2008	2001	2008
Arts, Entertainment, and Recreation	986	1,418	40,521	50,871	3,165,100	3,860,200
Accommodation and Food Services	703	991	282,646	311,893	10,807,200	12,314,700
Other Services, except public administration	861	1,831	51,551	72,576	9,074,600	10,329,100
Government and Government Enterprises	3,127	3,015	135,531	173,207	23,151,000	24,577,000

Law enforcement and emergency response in the Salt Wells Energy Projects Area is provided by the Churchill County Sheriff's Office. Fire protection for the private lands is provided by the Fallon/Churchill Volunteer Fire Department. The BLM is responsible for wildland fire protection on BLM-administered lands.

The Churchill Unified School District serves Churchill County, with one preschool, five elementary schools, a junior high school, and one high school, with a total enrollment in the 2008-2009 school year of approximately 4,350 students (Churchill County School District 2010). Enrollment has slightly decreased over the past 10 years, with total enrollment in the 2005-2006 school year at 4,584 and 4,860 in the 1999-2000 school year (Nevada Department of Education 2006, 2010). All of the schools within this district are within the City of Fallon.

Bureau estimates for 2006 to 2008, forestry, mining, and related industries accounted for 6.4 percent of employment in the County, while education and health services accounted for 14 percent. The annual unemployment rate in Churchill County was 6.2 percent in 2000 and 9.1 percent in 2009, compared to a rate of 4.5 and 11.8 for the same periods for the State of Nevada (Bureau of Labor Statistics 2010).

The median household income in Churchill County for 2008 was $53,618. The median income for the State of Nevada in 2008 was slightly higher at $56,432. However, the poverty level in Churchill County was 10.6 percent in 2008, lower than for the state as a whole at 11.2 percent (US Census Bureau 2010).

Law enforcement and emergency response in the Salt Wells Energy Projects Area is provided by the Churchill County Sheriff's Office. Fire protection for the private lands is provided by the Fallon/Churchill Volunteer Fire Department. The BLM is responsible for wildland fire protection on BLM-administered lands.

The Churchill Unified School District serves Churchill County, with one preschool, five elementary schools, a junior high school, and one high school, with a total enrollment in the 2008-2009 school year of approximately 4,350 students (Churchill County School District 2010). Enrollment has slightly decreased over the past 10 years, with total enrollment in the 2005-2006 school year at 4,584 and 4,860 in the 1999-2000 school year (Nevada Department of Education 2006, 2010). All of the schools within this district are within the City of Fallon.

SPPC Project Area

The SPPC Project Area covers approximately 428 acres of public land in Churchill County, Nevada. Churchill County was identified as the ROI for social and economic values analysis, since most of the effects on the population and economy would occur within this region. Data for the City of Fallon is presented where appropriate, since Fallon is the County's only incorporated city and the city closest to the Project Area. Population, housing and economic data are based on the data for Churchill County, which were outlined previously in **Section 3.26**, Regional Overview.

Ormat Project Area

The Ormat Project Area covers approximately 6,790 acres of public land in Churchill County, Nevada. Churchill County was identified as the ROI for social and economic values analysis, since most of the effects on the population and economy would occur within this region. Data for the City of Fallon is presented where appropriate, since Fallon is the County's only incorporated city and the city closest to the Project Area. Population, housing, and economic data are based on the data for Churchill County, which were outlined previously **Section 3.26**, Regional Overview.

Vulcan Project Area

The Vulcan Project Area covers approximately 15,622 acres of public land in Churchill County, Nevada. Churchill County was identified as the ROI for social and economic values analysis, since most of the effects on the population and economy would occur within this region. Data for the City of Fallon is presented where appropriate, since Fallon is the County's only incorporated city and the city closest to the Project Area. Population, housing and economic data for Churchill County and Fallon are the same as that for the SPPC and Ormat Projects, which were outlined previously in **Section 3.26**, Regional Overview.

3.26 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton signed Executive Order 12898, requiring all federal agencies to seek to achieve environmental justice by "…identifying and addressing effects of its programs, policies, and activities on minority and low-income populations." This section provides an overview of minority and low-income populations in the Salt Wells Energy Projects Area, the City of Fallon, Nevada, and Churchill County.

Non-white racial groups are typically referred to as minority populations within the context of environmental justice analysis. Churchill County and Fallon minority population characteristics are outlined in **Table 3-31**, Minority Population Characteristics. The 2000 Census identified the white population as being approximately 84.2 percent of the entire county population and 81.3 percent of the population in Fallon. In the context of analyzing the proposed project for potential effects on minorities, any area containing a minority population greater than 50 percent of the total population or containing a minority population meaningfully greater than the minority population in Churchill County would be identified as a minority population within the Salt Wells Energy Projects Area. The Projects Area is adjacent to the City of Fallon and rural and agricultural areas of Churchill County. The Fallon Paiute-Shoshone Tribe of the Fallon Reservation and Colony consists of 60 acres two miles northeast of Fallon and 8,000 acres 12 miles to the northeast of Fallon. There are no known minority populations fitting the definition for environmental justice concerns within the Projects Area.

Table 3-31
Minority Population Characteristics

Reporting Group	Fallon Percentage	Churchill County Percentage	State of Nevada Percentage
White[1]	81.3	84.2	75.2
Black or African American[1]	2.0	1.6	6.8
American Indian and Alaska Native[1]	3.4	4.8	1.3
Asian[1]	5.0	2.7	4.5
Native Hawaiian and Other Pacific Islander[1]	0.4	0.2	0.4
Persons Reporting some other race[1]	4.5	3.2	8.0
Persons Reporting two or more Races	3.4	3.3	3.8
Hispanic or Latino (of any race)[2]	4.5	8.7	19.7

[1]Includes persons reporting only one race
[2]Hispanics may be of any race so also are included in applicable race categories.
Source: US Census Bureau 2002

Within Churchill County and Fallon, approximately 8.7 and 12.6 percent of people lived below the poverty level in 2000, respectively. It is assumed that the poverty levels within the County and Fallon would be similar for the residents

within the Projects Area and there would be no meaningfully greater low-income population than for the County as a whole.