DRAFT
ENVIRONMENTAL IMPACT STATEMENT
SALT WELLS ENERGY PROJECTS

LEAD AGENCY:	**US Department of the Interior** **Bureau of Land Management** **Carson City District** **Stillwater Field Office**
COOPERATING AGENCIES:	**US Bureau of Reclamation** **Churchill County** **City of Fallon** **Naval Air Station Fallon** **State of Nevada, Department of Wildlife** **State of Nevada, Division of Minerals**
PROJECT LOCATION:	**Churchill County, Nevada**
COMMENTS ON THIS DRAFT EIS: **SHOULD BE DIRECTED TO**	**Ms. Colleen Sievers** **EIS Project Manager** **Stillwater Field Office** **5665 Morgan Mill Road** **Carson City, Nevada 89701** **(775) 885-6000** **saltwells_eis@blm.gov**

PROJECT WEBSITE:
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ABSTRACT

This Draft Environmental Impact Statement (EIS) analyzes the potential impacts associated with three separate geothermal energy and transmission projects proposed by Sierra Pacific Power Company, Ormat Technologies, Inc., and Vulcan Power Company in the Salt Wells area of Nevada. Together the three projects are referred to as the Salt Wells Energy Projects (Proposed Actions). The Projects Area encompassed by the three proposals covers approximately 24,152 acres in the Salt Wells area of Nevada, including an area just southwest of Fallon to approximately 24 miles southeast of Fallon. Combined, the three proposals could result in up to five 30- to 60-megawatt geothermal power plants with up to 71 associated wells (39 for the proposed actions and the remainder previously authorized), pipelines and associated facilities, and a 22-mile, up to 125-foot-wide right-of-way for a new transmission line, with substations and switching stations. Five alternatives to the Proposed Actions are analyzed in the EIS. In addition, a No Action Alternative for each of the Proposed Actions is analyzed.

Responsible Official for EIS	Teresa J. Knutson Stillwater Field Office Manager

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EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This draft environmental impact statement (DEIS) documents and summarizes the environmental analysis of three separate geothermal energy and transmission projects proposed by Sierra Pacific Power Company (SPPC), Ormat Technologies, Inc. (Ormat), and Vulcan Power Company (Vulcan) in the Salt Wells area of Nevada. Together, the three projects are referred to as the Salt Wells Energy Projects (Proposed Actions).

Combined, the three proposals could result in up to five 30- to 60-megawatt (MW) geothermal power plants with 39 associated wells, pipelines, and other facilities, and a 22-mile, up to 125-foot-wide right-of-way (ROW) for a new transmission line, with substations and switching stations. **Chapter 2**, Description of the Proposed Actions and Alternatives, describes the Proposed Actions and facilities, and **Appendix A**, Typical Geothermal Resource Development and Transmission Tools, explains the functions of these components in further detail. The proposed facilities would be sited on a combination of private property and federal land in the Carson City Consolidated Resource Area in Churchill County, Nevada, managed by the United States (US) Department of Interior (DOI), Bureau of Land Management (BLM) Stillwater Field Office (SFO) and the US Bureau of Reclamation (Reclamation).

In accordance with 43 Code of Federal Regulations (CFR) Parts 2800 and 3200, the BLM needs to consider whether to approve the applications to construct, operate, and maintain the proposed Salt Wells Energy Projects. Title V of the Federal Land Policy and Management Act of 1976 (FLPMA) authorizes the Secretary of the Interior (through the BLM) to grant ROWs over, upon, under, or through public lands for the purposes of generating and transmitting electric energy. Because this is an externally generated proposal, the BLM must respond to the application filed by the applicants. In addition, Reclamation would use this analysis and Record of Decision (ROD) to decide whether to approve and use authorization in the form of a ROW for the transmission line under its own regulations at 43 CFR Part 400. The regulations and management decisions for Reclamation are described in detail in Chapters 1 and 2 of the DEIS.

The National Energy Policy Act of 2005 (EPAct 2005; Public Law 109-58) amended the Geothermal Steam Act and encourages the development of renewable and alternative energy resources, including geothermal energy, as

part of an overall strategy to develop a diverse portfolio of domestic energy supplies. Section 211 of the Act calls for the Secretary of the Interior to approve non-hydropower renewable energy projects located on public lands, where appropriate, with a generation capacity of at least 10,000 MW of electricity by 2015. Additionally, the BLM's implementation strategy titled, BLM Implementation of the National Energy Policy, and other federal policies, including the Geothermal Steam Act of 1970, amended and supplemented by the EPAct of 2005; the Mining and Mineral Policy Act of 1970; the FLPMA; and the National Materials and Mineral Policy, Research and Development Act of 1980, direct the federal government to foster and encourage private enterprise to develop alternative energy resources with appropriate environmental constraints. If approved, the Salt Wells Energy Projects would provide new renewable energy sources and contribute to meeting these goals.

ES.2 SUMMARY OF PROPOSED ACTIONS

SPPC Proposed Action

SPPC is proposing to build two switching stations, one 230-kilovolt (kV) transmission line, two 60-kV electric line folds, and one substation. The new Switching Station, Bass Flat, would be constructed at the junction of the existing Fort Churchill to Austin 230-kV transmission line and the SPPC 230-kV transmission line leading from the existing ENEL Geothermal Power Plant to the Fort Churchill to Austin line. The new Pony Express Switching Station would be constructed adjacent to the existing ENEL Geothermal Power Plant. In addition, a new Greenwave Substation would be constructed on the south side of Sheckler Road in Fallon, Nevada, and a 230-kV transmission line would connect the proposed Pony Express Switching Station to the proposed Greenwave Substation. The transmission line would be approximately 22 miles long. Two 60-kV electric line folds would also be installed on four single-pole structures connecting the proposed Greenwave Substation to the existing 60-kV lines that are connected to the existing Fallon Substation north of Hammond Road. **Figure ES-1**, Sierra Pacific Power Company Proposed Action and Alternatives, shows the SPPC Proposed Action and the Alternatives described in Section 1.3.

Prior to construction, SPPC would finalize the Plan of Development (POD) to outline the specifics of how the proposed project would be constructed, operated, and maintained and would include monitoring measures to ensure all commitments are fulfilled. SPPC would implement the best management practices (BMPs) identified in **Appendix E**, Environmental Protection Measures and Best Management Practices, during construction and operation of the project.

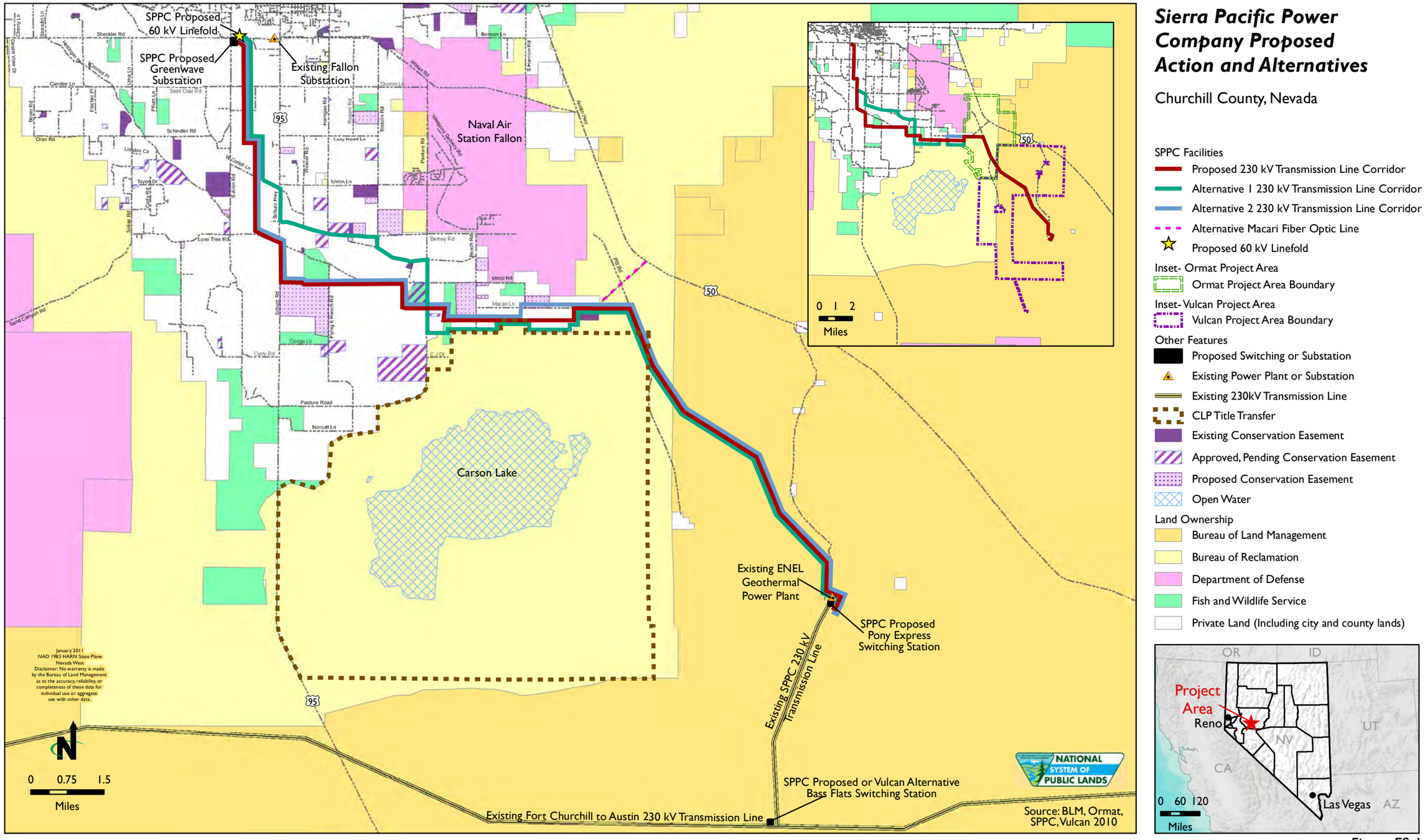
Sierra Pacific Power Company Proposed Action and Alternatives
Churchill County, Nevada
SPPC Facilities
Proposed 230 kV Transmission Line Corridor
Alternative 1 230 kV Transmission Line Corridor
Alternative 2 230 kV Transmission Line Corridor
Alternative Macari Fiber Optic Line
Proposed 60 kV Linefold
Inset- Ormat Project Area
Ormat Project Area Boundary
Inset- Vulcan Project Area
Vulcan Project Area Boundary
Other Features
Proposed Switching or Substation
Existing Power Plant or Substation
Existing 230kV Transmission Line
CLP Title Transfer
Existing Conservation Easement
Approved, Pending Conservation Easement
Proposed Conservation Easement
Open Water
Land Ownership
Bureau of Land Management
Bureau of Reclamation
Department of Defense
Fish and Wildlife Service
Private Land (Including city and county lands)
SPPC Proposed 60 kV Linefold
SPPC Proposed Greenwave Substation
Existing Fallon Substation
Naval Air Station Fallon
Carson Lake
Existing ENEL Geothermal Power Plant
SPPC Proposed Pony Express Switching Station
Existing SPPC 230 kV Transmission Line
SPPC Proposed or Vulcan Alternative Bass Flats Switching Station
Existing Fort Churchill to Austin 230 kV Transmission Line
0 1 2
Miles
0 0.75 1.5
Miles
0 60 120
Miles
Project Area
Reno
Las Vegas
OR
ID
UT
NV
CA
AZ
NATIONAL SYSTEM OF PUBLIC LANDS
Source: BLM, Ormat, SPPC, Vulcan 2010
January 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.

Figure ES-1

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Ormat Proposed Action

Ormat is proposing to develop the Carson Lake Binary Power Plant and Substation, the Macari Switching Station, a 230-kV transmission line between the Carson Lake Substation and the Macari Switching Station, and an electric line fold for the SPPC 230-kV transmission line. The power plant would produce up to 40 MW (gross) electricity. These facilities would be developed on a private 80-acre parcel. Up to 13 well pads in addition to the 12 previously approved well pads (11 well pads were analyzed in the Environmental Assessment [EA] EA-NV-030-07-006 and authorized by BLM on July 25, 2008 and one well pad was approved under a determination of NEPA adequacy [DNA]), associated pipelines, and roads would also be constructed on federal land. Ormat would adhere to the lease stipulations identified in **Appendix B**, Lease Stipulations and Conditions of Approval, during construction and operation of the project. Ormat would finalize the Plan of Utilization (POU) Plan prior to construction of their power facilities, similar to that described under the SPPC Proposed Action. Appropriate procedures as identified in **Appendix E**, Environmental Protection Measures and Best Management Practices, and mitigation measures outlined in this EIS would be included in the POU. **Figure ES-2**, Ormat Power Company Proposed Action and Alternative, shows the Ormat Proposed Action and the Alternative described in Section 1.3.

Vulcan Proposed Action

Vulcan is proposing to develop up to four power plants and associated substations at five possible locations for a maximum production of 120 MW (net). In addition, a 230-kV interconnection transmission line would be constructed to connect the power plant(s) to Vulcan's proposed Bunejug Switching Station and include an electric line fold to the SPPC 230-kV transmission line. Vulcan would also construct up to 26 well pads and associated wells, roads, and pipelines in addition to the 20 previously approved well pads (10 well pads were analyzed in EA-NV-030-07-05 ad authorized February 6, 2007 and 10 well pads were analyzed in EA number DOI-BLM-NV-C010-2009-0006-EA and authorized April 24, 2009).

Vulcan would adhere to the lease stipulations identified in **Appendix B**, Lease Stipulations and Conditions of Approval, during construction and operation of the project. Vulcan would finalize the POU and develop a POD prior to construction of their power facilities and transmission line, similar to those described under the SPPC and Ormat Proposed Actions. Appropriate procedures, as identified in **Appendix E**, Environmental Protection Measures and Best Management Practices, and mitigation measures outlined in this EIS would be included in the POU. **Figure ES-3**, Vulcan Power Company Proposed Action and Alternative, shows the Vulcan Proposed Action and Alternative described in Section 1.3.

ES.3 ALTERNATIVES

SPPC Alternatives

Three alternatives to the SPPC Proposed Action are evaluated in this EIS: Alternative 1 (Figure 2-13), Alternative 2 (Figure 2-14) and the Macari Fiber Optic Alternative (Figure 2-17). Alternatives 1 and2 consider alternate routes for the proposed 230-kV transmission line. They represent a reasonable range of alternatives to the Proposed Action. The Macari Fiber Optic Alternative includes construction of an additional fiber optic line to connect communications from Highway 50.

Ormat Alternatives

For the Ormat Project, the BLM developed an alternative to relocate Well Sites U and V and that portion of the pipeline and associated access road running from Well Site T to W (Figure 2-7) to protect riparian and surface waters within canals.

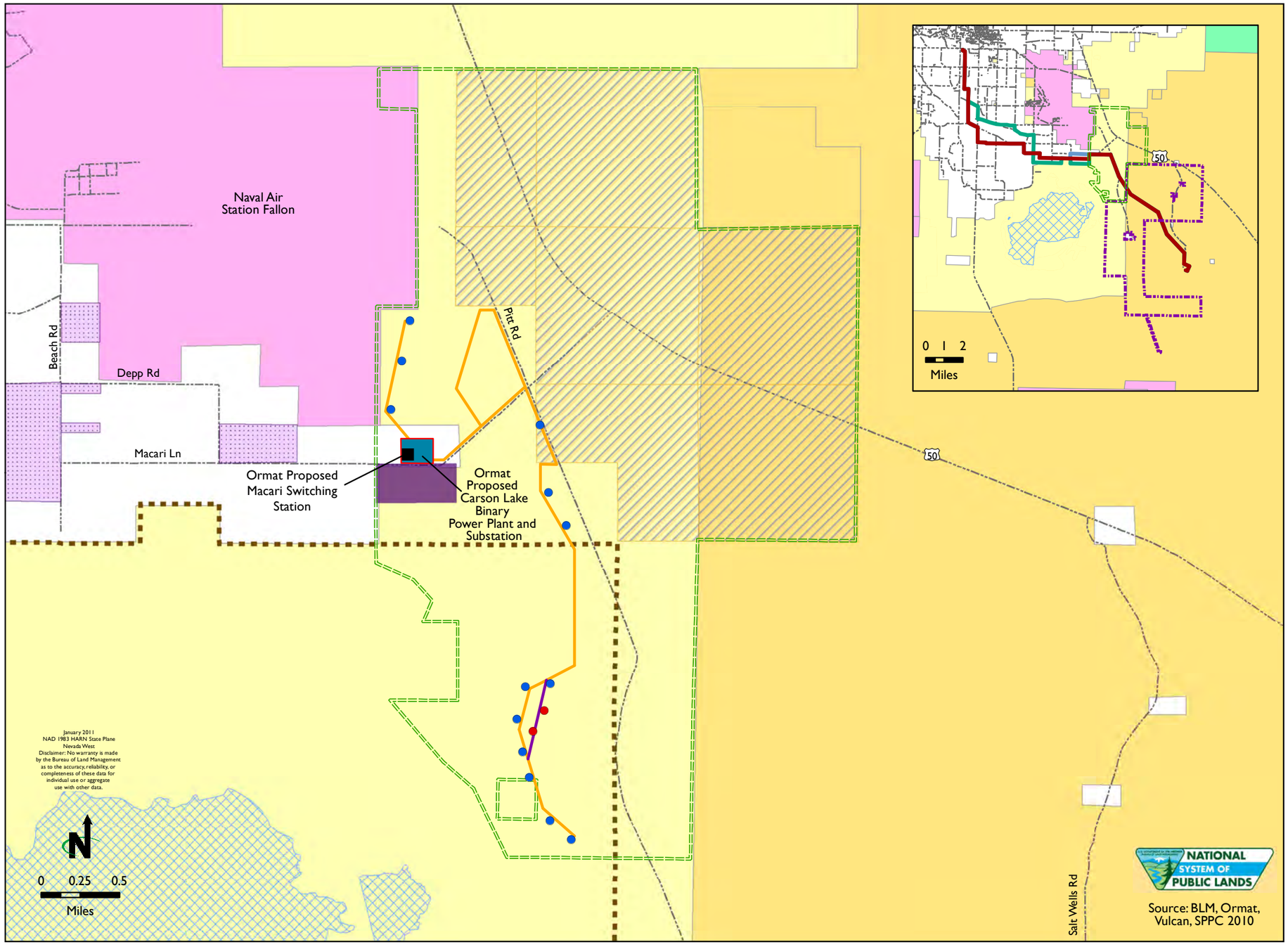
Vulcan Alternatives

An alternative for the Vulcan project, should SPPC elect not to build its project, would be for Vulcan to build the Bass Flat Switching Station and extend its proposed 230-kV interconnection transmission line from the Power Plant Site 5 to their Alternative Bass Flat Switching Station (Figure 2-8). The alternative Bass Flat Switching Station would be constructed as described under the SPPC Proposed Action and would allow Vulcan to tie into the existing Austin to Fort Churchill 230-kV transmission line (Figure 2-12). The transmission line from Power Plant Site 5 to the Bass Flat Switching Station would be constructed adjacent to an existing road. This transmission line extension would be constructed off lease and require an additional ROW application. Should this alternative be selected, Vulcan would prepare a POD prior to construction of the transmission line or switching station.

ES.4 ISSUES SUMMARY

The primary issues were identified during public scoping and agency review of the proposed Salt Wells Energy Projects. To address the issues, the following land resources and uses are evaluated in the EIS:

- Land use authorizations, airspace, and access;
- Air quality;
- Minerals/geology;
- Soils;
- Farm lands (Prime or Unique);
- Water quality and quantity;
- Floodplains, wetlands, and riparian zones;
- Vegetation;



Ormat Power Company Proposed Action and Alternative

Churchill County, Nevada

Ormat Facilities
- Ormat Project Area Boundary
- Proposed Well Pad
- Alternative Well Pad
- Proposed Pipeline
- Alternative Pipeline
- Proposed Power Plant and Substation

Inset Map- SPPC Project Area
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor

Inset Map- Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching Station
- CLP Title Transfer
- Existing Conservation Easement
- Proposed Conservation Easement
- No Surface Occupancy
- Open Water

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

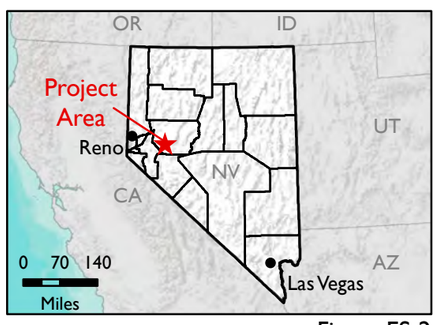


Figure ES-2

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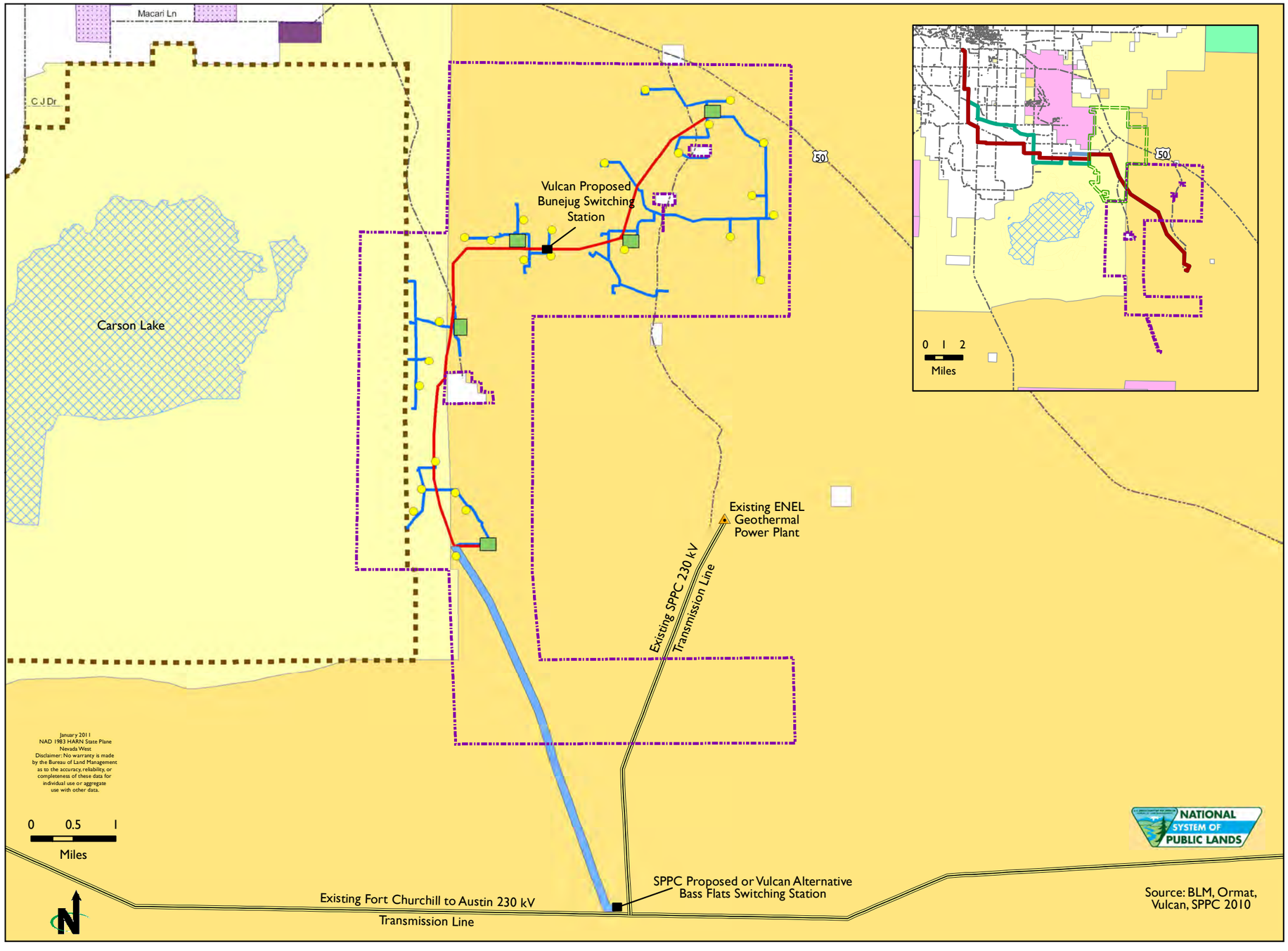

Vulcan Power Company Proposed Action and Alternative

Churchill County, Nevada

Vulcan Facilities
- Vulcan Project Area Boundary
- Proposed Well Pad
- Proposed Steamfield Pipeline and Associated Road
- Proposed 230 kV Interconnection Line
- Proposed Power Plant and Substation
- Alternative 230 kV Interconnection Line Corridor

Inset Map-SPPC Project Area
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor

Inset Map- Ormat Project Area
- Ormat Project Area Boundary

Other Features
- Proposed Switching Station
- Existing Power Plant
- Existing 230kV Transmission Line
- CLP Title Transfer
- Existing Conservation Easement
- Proposed Conservation Easement
- Open Water

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

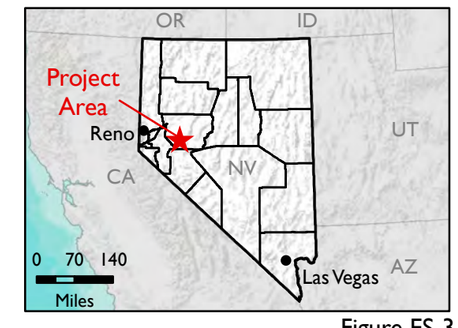

Figure ES-3

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- Invasive, nonnative species;
- Wildlife;
- Migratory birds;
- BLM-designated sensitive species (animal and plant);
- Cultural resources;
- Native American religious concerns;
- Paleontological resources;
- Visual resources;
- Livestock grazing;
- Recreation;
- Special designations (including Areas of Critical Environmental Concern and Wilderness);
- National scenic and historic trails;
- Noise;
- Public health and safety;
- Fire management;
- Wastes, hazardous or solid;
- Social and economic values; and
- Environmental justice.

ES.5 SUMMARY OF IMPACTS

Where potential impacts associated with the Proposed Actions are unique to the SPPC Project, Ormat Project, or Vulcan Project, the description of those impacts are distinguished. Where potential impacts are common to all three Proposed Projects, no distinction is noted. **Table ES-1**, Acres of Proposed Disturbance by Project, summarizes the total acres of temporary and permanent disturbance by project and alternatives.

Land Use Authorizations, Airspace, and Access

SPPC Project

Implementation of the Proposed Action or Alternatives would not change any land uses within the SPPC Project Area. Construction and maintenance of the transmission line could have impacts on the adjacent land uses where the Proposed Action route crosses conservation easements. Alternative 1 would avoid existing and proposed conservation easements.

Table ES-1
Acres of Proposed Disturbance by Project

Project or Alternative	Temporary Disturbance (acres)	Permanent Disturbance (acres)
SPPC Project	813	352
SPPC – Alternative 1	838	362
SPPC – Alternative 2	813	352
SPPC – Macari Fiber Optic Alternative	1	1
Ormat Project	321	197
Ormat Alternative	318	195
Vulcan Project	1,254	750
Vulcan Alternative	1,427	826

A portion of the Proposed Action and alternative routes would be located within APZ2, which is a Navy-designated accident potential zone (APZ) with a low potential for aircraft accidents. No impacts on land use, airspace, and access from the Greenwave Substation or Bass Flat Switching Station are anticipated.

Access would be via existing roads where feasible. Use of the existing roads and the temporary spur and centerline roads would not impact access in the region of influence (ROI).

Ormat Project
Implementation of the Proposed Action and Alternative 1 would not change any land uses within the ROI. The project would not conflict with existing federal, state, and local land uses, plans, and policies or with existing BLM or Reclamation land use authorizations (See **Appendix F**, Land Use Authorizations in the Salt Wells Energy Projects Area).

As proposed, the wells, pipelines, and power plant located within the APZ1 and APZ2 areas would not have impacts on naval operations or increase risks for aircraft accidents.

The Project Area would be accessed via Highway 50 and Macari Lane. Impacts on access would occur if the historic segments of the Lincoln Highway or Old Highway 50 were damaged during construction and operation under the Proposed Action. A mitigation measure would be implemented to reduce the likelihood for impacts.

Vulcan Project
Impacts on land use authorizations would be similar to those described for the Ormat Project. Impacts on access would be similar to those described for the Ormat Project.

The power plant and well locations proposed under the Proposed Action would not be located in or near an APZ area. The Proposed Action would not conflict with proposed naval operations or impact airspace in the ROI.

Air Quality

Salt Wells Energy Projects

For all Proposed Actions and Alternatives, construction and well drilling activities would be the greatest source of emissions. Site grading would generate temporary and localized fugitive dust emissions. Vehicle use would generate temporary criteria air pollutants and greenhouse gas emissions. The quantities of emitted pollutants would vary by project (Tables 4-1, 4-2, 4-3, 4-4, 4-5). BMPs would be implemented to reduce impacts. Operation of the Salt Wells Energy Projects would not result in any violations of state or federal air quality standards.

Minerals/Geology

Salt Wells Energy Projects

No potential impacts on geological and mineral resources are expected to result from any of the Proposed Actions and for most of the alternatives. Construction and operation of the proposed geothermal power plants and ancillary wells and pipeline infrastructure would not limit access to mineral resources and would not preclude development of mineral resources in the SPPC Project Area. The exception is that SPPC Alternative 2 could cause increases in erosion and runoff rates at construction sites.

Soils

Salt Wells Energy Projects

For all Proposed Actions and Alternatives, potential direct impacts on soil resources would occur during soil salvage operations and soil redistribution activities, where soil could be lost, or biological, physical, and chemical activity within the soils could be altered. Soils would be directly impacted by grading activities during construction. In addition, some areas may be subject to deposition of wind-blown material outside the footprint of construction areas, or loss of soil due to wind erosion. Impacts would differ among alternatives relative to the amount of acreage that would be disturbed. BMPs and measures in the POD/POU would be implemented to reduce impacts.

Farm Lands (Prime or Unique)

SPPC Project

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

Farmland. The Proposed Action would cause the least temporary disturbance to potential Prime Farmland under all Alternatives (Table 4-6). For all Alternatives, slightly more than one acre of potential Prime Farmland would be converted directly to non-farm land. Mitigation measures would be implemented to reduce impacts.

Ormat Project

There are 198.6 acres of potential Prime Farmland in the Ormat Survey Area, of which 193 acres would require abatement of salts and sodium to qualify as Prime Farmland. Under the Proposed Action, all of this acreage would be permanently unavailable as Prime Farmland. Impacts from Alternative 1 would be similar, though slightly less. Environmental Protection Measures in **Appendix E** would be implemented to reduce impacts.

Vulcan Project

No Prime or Unique Farmlands are located in the Vulcan Project Area; therefore, the Proposed Action and Alternatives would not impact Prime or Unique Farmlands.

Water Quality and Quantity

SPPC Project

Potential impacts on water resources such as spills of hazardous materials, erosion, and sedimentation would be temporary and would be reduced by implementation of BMPs, Environmental Protection Measures, and measures within the POD. Impacts would vary among Alternatives relative to the amount of acreage that would be disturbed.

Ormat Project

Impacts on water quality and quantity for the Proposed Action and Alternative would be similar to those described for the SPPC Project. Temporary impacts could occur from use of reserve pits at each well pad during construction. During power plant operation, extraction and reinjection of geothermal water could impact flows and water quality at hot and warm springs and seeps. Since most of the extracted groundwater would be returned to the geothermal source aquifer via injection wells, the volume of groundwater in these aquifers is not expected to be reduced substantially over the life of the operation. During pumping, however, some groundwater flow paths in the deeper aquifers could be modified.

Long-term pumping of geothermal reservoirs and reductions in temperatures prior to reinjection could reduce pressures within the deeper geothermal system. The magnitude of upward vertical hydraulic gradients could be reduced as a result of depressurization of the system.

Ormat would purchase water rights from an existing canal water right holder for the necessary amount of cooling water. Wastewater would be disposed via

an on-site septic system. BMPs and measures in the POU would be implemented to reduce impacts on water quality and quantity. In addition, mitigation of potential impacts could be addressed by development of monitoring plans for these water resources.

Vulcan Project

Impacts on water quality and quantity from the Proposed Action and Alternative would be similar to those described for the Ormat Project. The Vulcan Project would require more water for electricity generation and cooling because Vulcan would construct up to four power plants. BMPs and mitigation measures would be similar to those described for the Ormat Project.

Floodplains, Wetlands, and Riparian Zones

SPPC Project

The Proposed Action and Alternatives cross wet meadows. Construction of a transmission line in these areas could have direct impacts on wetland areas, including permanent removal of wetland vegetation. BMPs and measures in the POD would be implemented to reduce impacts on wetlands. Additional mitigation and monitoring measures would be implemented to further reduce impacts.

Ormat Project

The Proposed Action and Alternative could affect seasonal wetlands, including wet meadows and playas, causing impacts similar to those described above for the SPPC Project. BMPs, measures in the POU, would be implemented to reduce impacts. In addition, mitigation of potential impacts could be addressed by development of monitoring plans for water resources.

Vulcan Project

Impacts on playas from the Vulcan Proposed Action and Alternative would be similar to those described under the Ormat Project. A greater acreage of playa would be affected by the Vulcan Project. BMPs, measures in the POD/POU, and mitigation measures would be similar to those described for the Ormat Project.

Vegetation

SPPC Project

Impacts on vegetation from the Proposed Action and Alternatives would include temporary and permanent loss of vegetation communities from construction, operation, and maintenance of the project (e.g., transmission lines, access roads, substation, switching stations, and associated facilities). BMPs and measures included in the POD would help to reduce impacts. For the Proposed Action and Alternatives 1 and 2, most impacts would occur on the agriculture and developed vegetation community. The fewest permanent impacts would be caused by the Proposed Action and Alternative 2, which would disturb

approximately 352 acres of vegetation. The Macari Fiber Optic Alternative would disturb one acre of greasewood flat vegetation.

Ormat Project

Impacts on vegetation from the Proposed Action and Alternative would be similar to those described for the SPPC Project. Loss of vegetation communities would be associated with construction of the switching station, pipelines, well pads, access roads, and transmission line. Most impacts would occur in the greasewood flat vegetation community, although the Carson Lake Binary Power Plant and Substation would be located on disturbed land, dominated by invasive species. The Proposed Action would permanently disturb 197 acres of vegetation, and the Alternative would have permanent impacts on 195 acres.

Vulcan Project

Impacts on vegetation from the Proposed Action and Alternative would be similar to those described for the SPPC Project. Loss of vegetation communities would be associated with construction of four possible power plants, switching stations, pipelines, well pads, access roads, and a transmission line. Most impacts would occur in the mixed salt desert scrub community. The Proposed Action would permanently disturb 750 acres of vegetation, and the Alternative would disturb 826 acres.

Invasive, Nonnative Species

Salt Wells Energy Projects

For all Proposed Actions and Alternatives, soil disturbance and plant removal during construction activities could lead to the introduction and spread of invasive, nonnative species, including noxious weeds. Any ground disturbance could create favorable conditions for invasive, nonnative species to be introduced, to spread, or to become well established. However, vegetation clearing or ground-disturbing activities would be restricted to the minimum amount necessary to lessen potential impacts. Additionally, BMPs and measures included in the POD/POU would reduce the spread or introduction of invasive, nonnative species.

Wildlife

SPPC Project

The SPPC Proposed Action or Alternatives could cause death or injury to wildlife; disturb species due to lighting, noise, and human presence; degrade, fragment, or convert wildlife habitats; or provide habitat for predators. BMPs and measures included in the POD would reduce impacts on wildlife.

Ormat Project

Impacts on wildlife from the Proposed Action or Alternative would be similar to those described above for the SPPC Project. Impacts within the Ormat Project Area would be more concentrated; despite covering a smaller acreage, these

impacts would occur closer together geographically. Impacts from the transmission line would be less than those for the SPPC Project, since the Ormat transmission line is shorter. However, Ormat's proposed and alternative pipelines could alter movement for some wildlife species. BMPs and measures included in the POU would reduce impacts on wildlife.

Vulcan Project

Impacts on wildlife from the Proposed Action or Alternative would be similar to those described for the SPPC Project. The size of the project (4 possible power plants, 8 miles of transmission lines, 19 miles of pipeline, and up to 26 well pads) would permanently and temporarily impact a large amount of habitat. BMPs and environmental protection measures included in the POD/POU would reduce impacts on wildlife.

Migratory Birds

SPPC Project

Construction and operation of the SPPC Project under the Proposed Action and Alternatives may impact migratory birds and their habitat through disturbance and habitat fragmentation. This may affect migratory patterns and habitat use by migratory birds, and result in permanent degradation of habitat quantity and quality. Other direct impacts could result from project components, such as the 22-mile-long transmission line, that may change patterns of avian movement to and from Carson Lake and Pasture, increase risk of collision with power lines, and increase predation by providing more perching opportunities. Potentially occurring BLM-designated sensitive bird species include golden eagle, Swainson's hawk, loggerhead shrike, long-billed curlew, burrowing owl, and short-eared owl. Other potentially occurring bird species include US Fish and Wildlife Service (USFWS) Birds of Conservation Concern and Game Birds Below Desired Condition. BMPs and measures included in the POD would reduce impacts on migratory birds.

Ormat Project

Impacts on migratory birds from the Proposed Action or Alternative would be similar to those described above for the SPPC Project. Impacts from operation of the Ormat transmission line would be fewer, since it would only be 200 feet long. Furthermore, there would be fewer impacts on migratory birds which utilize agricultural areas, since this habitat type would not be affected by the Ormat Project. Potentially occurring BLM-designated sensitive bird species include golden eagle, prairie falcon, Swainson's hawk, loggerhead shrike, long-billed curlew, snowy plover, and short-eared owl. Other potentially occurring bird species include USFWS Birds of Conservation Concern and USFWS Game Birds Below Desired Condition. BMPs and measures included in the POU would reduce impacts on migratory birds.

Vulcan Project

Impacts on migratory birds from the Proposed Action or Alternative would be similar to those described for the SPPC Project. The likelihood for impacts would be greater for the Vulcan Project due to the larger acreage that would be affected and the larger number of migratory birds that were observed within the Vulcan Project Area. Potentially occurring BLM-designated sensitive bird species include golden eagle, prairie falcon, Swainson's hawk, loggerhead shrike, long-billed curlew, snowy plover, and burrowing owl. Other potentially occurring bird species include USFWS Birds of Conservation Concern and USFWS Game Birds Below Desired Condition. Golden eagle is known to nest near Vulcan's proposed and alternative facilities, and mitigation measures would be implemented to reduce impacts on this species. BMPs and measures included in the POD/POU would reduce impacts on other migratory birds.

BLM-Designated Sensitive Species (Animals and Plants)

SPPC Project

Impacts from the Proposed Action or Alternatives on BLM-designated sensitive species would be similar to those described for wildlife and migratory birds. Birds are the only BLM-designated sensitive species that could be impacted within the SPPC Project Area and impacts on these species are described in **Section 1.5.11**. BMPs and measures included in the POD would reduce impacts on BLM-designated sensitive species.

Ormat Project

Impacts on BLM-designated sensitive species as a result of the Proposed Action or Alternative would be similar to those described for the SPPC Project. Potentially impacted BLM-designated sensitive species include BLM-designated sensitive bird species, described in **Section 1.5.11**, BLM-designated sensitive bat species, and pallid wood nymph. BMPs and measures included in the POU would reduce impacts on BLM-designated sensitive species. An additional mitigation measure would be implemented to ensure that there would be no impacts on pallid wood nymph.

Vulcan Project

Impacts on BLM-designated sensitive species from the Proposed Action or Alternative would be similar to those described for the SPPC Project. Potentially impacted BLM-designated species include BLM-designated sensitive bird species, described in **Section 1.5.11**, BLM-designated sensitive bat species, and pallid wood nymph. BMPs and measures included in the POD/POU would reduce impacts on BLM-designated species.

Cultural Resources

Salt Wells Energy Projects

Archaeological and architectural history Class III inventories and National Register of Historic Places (NRHP) evaluations are ongoing. Preliminary findings indicate historic properties from previous investigations and from the ongoing work may be adversely impacted during any ground disturbing construction activity in the Salt Wells Energy Projects Area. Use of historic property avoidance and development of treatment plans, as specified in **Appendix D**, Programmatic Agreement for the Salt Wells Energy Projects, the Programmatic Agreement between the BLM, Reclamation, the State Historic Preservation Office, and SPPC, Ormat, and Vulcan for unavoidable significant cultural resources, would assure mitigation or avoidance occur on all historic properties receiving potential adverse ground disturbing effects.

Native American Religious Concerns

Salt Wells Energy Projects

The Native American consultation process is ongoing. During consultation for the Proposed Actions and Alternatives, the following concerns were identified: cultural resources, including historic properties; continued access and use of traditional use sites; and other resources that may be affected by the current project.

Access to or the use of traditional use sites may be temporarily impacted during the construction phase of the projects. No direct permanent impacts on access to or the use of traditional use sites within the project area have been identified.

Paleontological Resources

Salt Wells Energy Projects

It is unlikely that the Proposed Actions or Alternatives would affect geologic units that have the potential to contain paleontological resources. If paleontological resources are present within the Projects Area, impacts on those resources are more likely to occur where ground disturbance takes place and the work site has not experienced substantial prior disturbance. If paleontological localities are identified in the Projects Area, mitigation and monitoring measures would be implemented to reduce impacts.

Visual Resources

SPPC Project

Under the Proposed Action and Alternatives, visual impacts would be most apparent where the transmission line would follow roads since the roads are the primary source of traffic in the SPPC Project Area. Visual impacts from the transmission line would vary by alternative depending on the length of the line

and the locations relative to sensitive receptors. The two 60-kV electric line folds would consist of four new poles in the existing alignment, so it would not be visible to the casual observer from the road or the nearby elementary school. The four new single-pole angle structures across Sheckler Road would be visible from the road but would be close enough to the existing poles that there would not be much of a change in the visual character of the area. The poles are more than 0.5 mile away and would not be visible or would be barely visible from the school due to a vegetated buffer along the edge of the school property.

The two proposed switching stations would be built immediately adjacent to existing structures. The substation would be larger than the two switching stations and would thus cover more land area. The switching stations and substation would be visible from the existing structures in the immediate area. BMPs and mitigation measures would be implemented to reduce visual impacts.

Ormat Project

The Proposed Action and Alternative would have visual impacts on public land. Viewsheds from Grimes Point Lookout and Macari Lane, though affected, would meet VRM Class III standards. The proposed power plant and associated structures, well pads, and pipelines would be a noticeable change to the visual features and character of the rural area. The power plant, in particular, would be a visible and very noticeable change. The Grimes Point Archaeological Site is a sensitive receptor, and the power plant area would be visible and may be disruptive to recreational visitors and sightseers. The pipeline corridor and well pads would be most apparent from roads and a noticeable change to the area. The overall visual impact would vary in different areas. There would be a visual impact on views from Grimes Point Lookout and on BLM land east of Macari Lane. However, the Proposed Action and Alternative would meet the VRM Class III objectives.

Vulcan Project

Viewsheds from Highway 50 and the Pony Express National Historic Trail would be affected by the Vulcan Proposed Action and Alternative 1. The four proposed power plants and associated structures, well pads, and pipelines would be a noticeable change to the visual features and character of the mostly undeveloped area. Power Plant Sites 1 and 4, in particular, are visible from the highway and would be noticeable change. The pipeline corridor and well pads would also be a noticeable change to the area, and would be somewhat visible from Highway 50. The Pony Express National Historic Trail is a sensitive receptor and the binary or flash power plant, associated structures, and alternative transmission line would be visible and may be disruptive to recreational visitors and sightseers. The overall visual impact of the Proposed Action would vary. There would be visual impacts from the Pony Express National Historic Trail and some points along Highway 50. However, the Proposed Action and Alternative would meet the VRM Class III objectives.

Livestock Grazing

SPPC Project

The SPPC Proposed Action and Alternatives 1 and 2 overlap with two BLM grazing allotments. The Macari Fiber Optic Alternative does not overlap with any BLM grazing allotments. The Greenwave Substation would be located on private land and would not impact public livestock grazing. Most impacts would be temporary and associated with construction. These impacts would include temporary loss of forage, harassment and displacement of cattle, and alteration of range improvements to accommodate construction traffic. Mitigation measures would be implemented to reduce impacts on livestock grazing.

Ormat Project

The Ormat Proposed Action overlaps with three pastures on Reclamation lands, and the Alternative overlaps with two pastures on Reclamation lands. The Proposed Action and Alternative do not overlap with any BLM grazing allotments. Impacts and mitigation measures would be similar to those identified for the SPPC Project. In addition, the possible reduction in water quantity due to reduction in groundwater levels or pressures in springs or seasonal wetlands could affect livestock grazing on the Rock Springs Allotment, causing a greater concentration of cattle in other areas.

Vulcan Project

The Vulcan Proposed Action and Alternative overlap with two BLM grazing allotments and one pasture on Reclamation lands. Impacts and mitigation measures would be similar to those identified for the Ormat Project.

Recreation

SPPC Project

Under the Proposed Action and Alternatives, temporary access and centerline roads would be constructed and could result in increased off-highway vehicle (OHV) use of the areas until the roads are reclaimed. Construction could also result in temporary access restrictions for recreational users on Reclamation- or BLM-administered lands. The Proposed Action and Alternatives could potentially conflict with the Valley Off-Road Racing Association (VORRA) race route; mitigation measures would be implemented to prevent these conflicts. The SPPC Proposed Action and Alternatives would not result in direct impacts on recreation at the Pony Express National Historic Trail, the Grimes Point Archaeological Site, or Hidden Cave.

Ormat Project

Impacts from the Proposed Action and Alternative would be similar to those described for the SPPC Proposed Action. However, the Ormat Project would not conflict with the VORRA race route. Due to its proximity to Carson Lake

and Pasture, mitigation measures would be implemented to reduce impacts on recreationists in that area.

Vulcan Project

Impacts and mitigation measures for the Proposed Action and Alternative would be similar to those described for the SPPC Proposed Action. In addition, due to its proximity to Carson Lake and Pasture, mitigation measures would be implemented to reduce impacts on recreationists in that area.

Special Designations (Including Areas of Critical Environmental Concern and Wilderness)

Salt Wells Energy Projects

There are no special designation areas within or adjacent to the Salt Wells Energy Projects Area; therefore, there would be no impacts from the Proposed Actions or the Alternatives.

National Scenic and Historic Trails

SPPC Project

Impacts on National Scenic and Historic Trails are not anticipated from the Proposed Action or Alternatives.

Ormat Project

Impacts on National Scenic and Historic Trails are not anticipated from the Proposed Action or Alternative.

Vulcan Project

Under the Proposed Action and Alternative, Power Plant Site 5, as well as associated structures, would be visible from a portion of the Pony Express National Historic Trail, causing visual impacts. Mitigation measures would be implemented to reduce impacts. The Alternative would also cross the Pony Express National Historic Trail, causing temporary construction-related effects and permanent visual effects. Mitigation measures would be implemented to reduce impacts.

Noise

SPPC Project

The construction and maintenance of the transmission lines and substations as proposed under the Proposed Action and Alternatives would involve noise-making activities from blasting and equipment used for drilling, earth moving, and hauling. Construction noise could affect sensitive receptors, but impacts are expected to be temporary and infrequent. The number of and distance to sensitive receptors would vary according to the siting of each alternative. BMPs would be implemented to reduce noise impacts.

Operation of the SPPC project components would result in noise from the transmission lines and towers, noise from activities for routine inspection and maintenance of the new facilities, and noise from the switching station and substation facilities. Noise from routine maintenance is considered to be low and intermittent and would not represent an impact on any sensitive receptors.

Residents of properties near the substation could be impacted by operational noise of the transformers. The layout of the substation and the noise impacts on nearby residences would be addressed during the Churchill County permitting process for the facility.

Impacts from corona, insular, and eolian noise from the transmission line are expected to be minimal, especially considering the existing noise levels from NAS Fallon.

Ormat Project

Expected sources of noise associated with the Proposed Action and Alternative include construction activities (earth-moving equipment for road, well pad, and sump pit construction), drilling operations, well testing, and power plant operation. The Ormat Project would potentially impact one sensitive receptor, a nearby residence. Construction noise at this residence is projected to be no greater than 62.5 A-weighted decibels (dBA), and noise from power plant operation is projected to be no greater than 50.7 dBA at the residence. Mitigation measures would be implemented to reduce noise impacts.

Vulcan Project

There are no noise-sensitive receptors near the Vulcan Project Area. No direct noise impacts on humans are anticipated from the Proposed Action or Alternative.

Public Health and Safety and Fire Management

SPPC Project

It is anticipated that that the electromagnetic fields (EMFs) for the Proposed Action and Alternatives would be less than the most stringent state standards for transmission line EMFs at the edge of the ROW, and that EMFs associated with the substation and switching station equipment would be low at locations beyond the property.

Use of hazardous materials during project construction, operation, and maintenance would pose potential health and safety hazards to construction and maintenance workers and nearby residents. Furthermore, construction, operation, and maintenance can affect general public safety along the transmission line routes, in staging areas, and at the proposed substation and switching station sites. BMPs and Environmental Protection Measures would be implemented to reduce impacts on public health and safety.

Ormat Project

Impacts on public health and safety from the Proposed Action or Alternative would be similar to those described for the SPPC Project. However, impacts caused by EMF would be less of a concern for the Ormat Project, as the transmission line is only 200 feet long. BMPs and Environmental Protection Measures would be implemented to reduce impacts on public health and safety.

Vulcan Project

Direct impacts on public health and safety from the Proposed Action or Alternative would be similar to those described for the SPPC Project. However, impacts caused by EMF would be less of a concern for the Vulcan Project, as the 230-kV interconnection line, switching station, and power plants are not located near residences or developed areas. BMPs and Environmental Protection Measures would be implemented to reduce impacts on public health and safety.

Fire Management

Salt Wells Energy Projects

Construction, operation, and maintenance of facilities associated with the Salt Wells Energy Project, such as transmission lines, switching stations, well pads, power plants, and substations for the Proposed Actions or Alternatives, could increase the potential for a fire in the Salt Wells Energy Projects Area. Increased access to public lands could indirectly raise the risk of ignition of wildfires from smoking, camping, and other activities on public lands. BMPs and Environmental Protection Measures would be implemented to reduce the likelihood of fire impacts.

Wastes, Hazardous or Solid

SPPC Project

No hazardous materials were known to be stored within the SPPC Survey Area; therefore, the Proposed Action and Alternatives would not expose workers to any preexisting hazardous materials and wastes not associated with the Proposed Action or Alternatives during construction, operation, and maintenance.

Project construction and operation phases would involve hazardous material use. The transport, use, or disposal of such hazardous materials could affect workers, the public, and the environment through accidental spills or emissions. BMPs and Environmental Protection Measures would be implemented to reduce impacts from hazardous or solid wastes.

Ormat Project

Impacts would be similar to those described for the SPPC Project. In addition, the geothermal power plant would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes. A detailed POU, as part of the reclamation plan, would be

developed in consultation with the US Navy, BLM, Reclamation, and other stakeholders before the plant is built and operated.

Vulcan Project
Impacts would be similar to those described for the Ormat Project.

Social and Economic Values

SPPC Project
The Proposed Action and Alternatives may cause slight increases in population and economic activity within Churchill County during project construction.

The development of the SPPC Project would necessitate the acquisition of easements over private property for the development of the transmission line. SPPC would provide financial compensation to private property owners when acquiring a property easement. The properties that would be affected would vary by alternative (Table 4-19). The SPPC Project could also result in slightly decreased property values for nearby lands.

Ormat Project
The Proposed Action and Alternative may cause slight increases in population and economic activity within Churchill County during project construction.

The proposed power plant, substation and switching station would all occur on private land owned by Ormat. Proposed pipelines and wells would be located on public land. Therefore, there would be no impacts on land value associated with the Proposed Action or Alternative.

Vulcan Project
Impacts from the Proposed Action and Alternative would be similar to the Ormat Project. However, since the Vulcan Project would involve construction of more facilities, it would cause a greater increase in population and economic activity within Churchill County during project construction.

Environmental Justice

Salt Wells Energy Projects
There are no known minority populations fitting the definition for environmental justice concerns within the Salt Wells Energy Projects Area. In addition, there is not a meaningfully greater low-income population in the Projects Area than for the county as a whole. Therefore, there would be no direct or indirect impacts anticipated as a result of the Proposed Actions or Alternatives.

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TABLE OF CONTENTS

Chapter Page

EXECUTIVE SUMMARY ES-1

1. INTRODUCTION 1-1

1.1 Introduction 1-1
1.2 Project Objectives and History 1-2
1.3 Purpose of and Need for Action 1-8
1.4 Geothermal Lease Rights, Limitations, and Stages of Development 1-9
1.5 BLM Decisions Resulting from This EIS 1-10
1.6 Reclamation Decisions Resulting from This EIS 1-10
1.7 Authorizing Actions 1-10
Conformance Statement 1-11
Relationship to BLM and Non-BLM Policies, Plans, and Programs 1-11
1.8 Public Involvement 1-15

2. DESCRIPTION OF THE PROPOSED ACTIONS AND ALTERNATIVES 2-1

2.1 Introduction 2-1
2.2 Proposed Actions 2-1
Sierra Pacific Power Company Proposed Action – Fallon 230-kV Source Project 2-1
Sierra Pacific Power Company - No Action 2-19
Ormat Technologies Proposed Action– Carson Lake Geothermal Project 2-19
Ormat Technologies – No Action 2-32
Vulcan Proposed Action– Salt Wells Geothermal Development Project 2-32
Vulcan Power Company - No Action 2-52
2.3 Alternatives 2-52
Sierra Pacific Power Company – Fallon 230-kV Source Project 2-52
Ormat Technologies 2-56
Vulcan Power Company 2-56
2.4 Alternatives Considered but Eliminated from Further Analysis 2-56
Sierra Pacific Power Company – Fallon 230-kV Source Project 2-56
Ormat Technologies – Carson Lake Geothermal Project 2-63
Vulcan Power Company – Salt Wells Geothermal Development Project 2-63

3. AFFECTED ENVIRONMENT 3-1

3.1 Introduction 3-1
Scoping and Issues Identification 3-1
Setting 3-1
Supplemental Authorities 3-2
Resources or Uses Other Than Supplemental Authorities 3-2
3.2 Land Use Authorizations, Airspace, and Access 3-2
Regional Overview 3-2
SPPC Project Area 3-11
Ormat Project Area 3-12
Vulcan Project Area 3-13
3.3 Air Quality 3-13
Regional Overview 3-13
SPPC Project Area 3-16

Chapter Page

Ormat Project Area 3-16
Vulcan Project Area 3-16
3.4 Minerals/Geology 3-16
Regional Overview 3-16
SPPC Project Area 3-19
Ormat Project Area 3-20
Vulcan Project Area 3-21
3.5 Soils 3-23
Regional Overview 3-23
SPPC Project Area 3-23
Ormat Project Area 3-31
Vulcan Project Area 3-32
3.6 Farm Lands (Prime or Unique) 3-36
Regional Overview 3-36
SPPC Project Area 3-36
Ormat Project Area 3-43
Vulcan Project Area 3-43
3.7 Water Quality and Quantity 3-44
Regional Overview 3-44
SPPC Project Area 3-72
Ormat Project Area 3-72
Vulcan Project Area 3-73
3.8 Floodplains, Wetlands and Riparian Zones 3-73
Regulatory Background 3-73
Regional Overview 3-73
SPPC Project Area 3-74
Ormat Project Area 3-77
Vulcan Project Area 3-78
3.9 Vegetation 3-79
Methods 3-79
Regional Overview 3-80
SPPC Project Area 3-88
Ormat Project Area 3-88
Vulcan Project Area 3-89
3.10 Invasive, Nonnative Species 3-91
Regulatory Background 3-91
Methods 3-91
Regional Overview 3-91
SPPC Project Area 3-92
Ormat Project Area 3-92
Vulcan Project Area 3-92
3.11 Wildlife 3-92
Methods 3-92
Regional Overview 3-92
SPPC Project Area 3-94
Ormat Project Area 3-94
Vulcan Project Area 3-94

TABLE OF CONTENTS *(continued)*

Chapter Page

3.12 Migratory Birds....3-94
Regulatory Background....3-94
Methods....3-96
Regional Overview....3-96
SPPC Project Area....3-103
Ormat Project Area....3-103
Vulcan Project Area....3-103
3.13 BLM-Designated Sensitive Species (Animals and Plants)....3-104
Regulatory Background....3-104
Methods....3-105
Regional Overview....3-105
SPPC Project Area....3-111
Ormat Project Area....3-111
Vulcan Project Area....3-111
3.14 Cultural Resources....3-112
Prehistoric Background....3-113
Ethnographic Overview....3-116
Historic Background....3-117
Regional Overview....3-120
SPPC Project Area....3-137
Ormat Project Area....3-138
Vulcan Project Area....3-139
3.15 Native American Religious Concerns....3-140
Regional Overview....3-140
3.16 Paleontological Resources....3-144
Regulatory Framework....3-145
Federal Regulations....3-145
Paleontological Potential....3-146
Regional Overview....3-147
SPPC Project Area....3-148
Ormat Project Area....3-148
Vulcan Project Area....3-149
3.17 Visual Resources....3-150
Regional Overview....3-150
SPPC Project Area....3-151
Ormat Project Area....3-151
Vulcan Project Area....3-152
3.18 Livestock Grazing....3-152
Regional Overview....3-152
SPPC Project Area....3-152
Ormat Project Area....3-155
Vulcan Project Area....3-155
3.19 Recreation....3-156
Regional Overview....3-156
SPPC Project Area....3-158
Ormat Project Area....3-161
Vulcan Project Area....3-161

3.20 National Scenic and Historic Trails 3-161
Regulatory Overview 3-161
Regional Overview 3-162
SPPC Project Area 3-162
Ormat Project Area 3-162
Vulcan Project Area 3-162
3.21 Noise 3-162
Regional Overview 3-164
SPPC Project Area 3-164
Ormat Project Area 3-165
Vulcan Project Area 3-165
3.22 Public Health and Safety 3-166
Regional Overview 3-166
SPPC Project Area 3-167
Ormat Project Area 3-167
Vulcan Project Area 3-167
3.23 Fire Management 3-167
Regional Overview 3-167
SPPC Project Area 3-167
Ormat Project Area 3-167
Vulcan Project Area 3-167
3.24 Wastes, Hazardous or Solid 3-167
Regional Overview 3-167
SPPC Project Area 3-168
Ormat Project Area 3-168
Vulcan Project Area 3-168
3.25 Social and Economic Values 3-168
Regional Overview 3-168
SPPC Project Area 3-171
Ormat Project Area 3-172
Vulcan Project Area 3-172
3.26 Environmental Justice 3-172

4. ENVIRONMENTAL CONSEQUENCES 4-1

4.1 Introduction 4-1
4.2 Land Use Authorizations, Airspace, and Access 4-2
Summary 4-2
SPPC Project Area 4-2
Ormat Project Area 4-5
Vulcan Project Area 4-7
4.3 Air Quality 4-8
Summary 4-8
SPPC Project Area 4-9
Ormat Project Area 4-12
Vulcan Project Area 4-17
4.4 Minerals/Geology 4-23
Summary 4-23

Chapter Page

SPPC Project Area....4-23
Ormat Project Area....4-25
Vulcan Project Area....4-27
4.5 Soils....4-28
Summary....4-28
SPPC Project Area....4-29
Ormat Project Area....4-32
Vulcan Project Area....4-34
4.6 Farm Lands (Prime or Unique)....4-36
Summary....4-36
SPPC Project Area....4-37
Ormat Project Area....4-40
Vulcan Project Area....4-41
4.7 Water Quality and Quantity....4-41
Summary....4-41
SPPC Project Area....4-43
Ormat Project Area....4-45
Vulcan Project Area....4-49
4.8 Floodplains, Wetlands and Riparian Zones....4-54
Summary....4-54
SPPC Project Area....4-55
Ormat Project Area....4-58
Vulcan Project Area....4-60
4.9 Vegetation....4-62
Summary....4-62
SPPC Project Area....4-63
Ormat Project Area....4-67
Vulcan Project Area....4-69
4.10 Invasive, Nonnative Species....4-72
Summary....4-72
SPPC Project Area....4-72
Ormat Project Area....4-75
Vulcan Project Area....4-77
4.11 Wildlife....4-78
Summary....4-78
SPPC Project Area....4-79
Ormat Project Area....4-83
Vulcan Project Area....4-85
4.12 Migratory Birds....4-87
Summary....4-87
SPPC Project Area....4-88
Ormat Project Area....4-93
Vulcan Project Area....4-96
4.13 BLM-Designated Sensitive Species (Animals and Plants)....4-100
Summary....4-100
SPPC Project Area....4-101
Ormat Project Area....4-103

Chapter Page

Vulcan Project Area 4-105
4.14 Cultural Resources 4-107
Summary 4-107
SPPC Project Area 4-108
Ormat Project Area 4-112
Vulcan Project Area 4-113
4.15 Native American Religious Concerns 4-114
Summary 4-114
SPPC Project Area 4-115
Ormat Project Area 4-117
Vulcan Project Area 4-118
4.16 Paleontological Resources 4-119
Summary 4-119
SPPC Project Area 4-120
Ormat Project Area 4-124
Vulcan Project Area 4-127
4.17 Visual Resources 4-130
Summary 4-130
SPPC Project Area 4-131
Ormat Project Area 4-136
Vulcan Project Area 4-140
4.18 Livestock Grazing 4-143
Summary 4-143
SPPC Project Area 4-144
Ormat Project Area 4-147
Vulcan Project Area 4-148
4.19 Recreation 4-150
Summary 4-150
SPPC Project Area 4-150
Ormat Project Area 4-153
Vulcan Project Area 4-154
4.20 National Scenic and Historic Trails 4-156
Summary 4-156
SPPC Project Area 4-157
Ormat Project Area 4-159
Vulcan Project Area 4-160
4.21 Noise 4-161
Summary 4-161
SPPC Project Area 4-163
Ormat Project Area 4-168
Vulcan Project Area 4-171
4.22 Public Health and Safety 4-171
Summary 4-171
SPPC Project Area 4-172
Ormat Project Area 4-175
Vulcan Project Area 4-176

4.23 Fire Management 4-177
Summary 4-177
SPPC Project Area 4-177
Ormat Project Area 4-179
Vulcan Project Area 4-181
4.24 Wastes, Hazardous or Solid 4-182
Summary 4-182
SPPC Project Area 4-182
Ormat Project Area 4-185
Vulcan Project Area 4-186
4.25 Social and Economic Values 4-188
Summary 4-188
SPPC Project Area 4-189
Ormat Project Area 4-193
Vulcan Project Area 4-195
4.26 Environmental Justice 4-200
Summary 4-200
SPPC Project Area 4-201
Ormat Project Area 4-201
Vulcan Project Area 4-202
4.27 The Relationship Between Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity 4-202
4.28 Irreversible and Irretrievable Commitment of Resources 4-203

5. CUMULATIVE IMPACTS 5-1

5.1 Introduction 5-1
What is the Process of Assessing Cumulative Impacts? 5-1
5.2 Land Use Authorizations, Airspace, and Access 5-13
Region of Influence 5-13
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan actions) 5-13
Cumulative Impacts 5-14
5.3 Air Quality 5-14
Region of Influence 5-14
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-14
Cumulative Impacts 5-15
5.4 Minerals/Geology 5-16
Region of Influence 5-16
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-16
Cumulative Impacts 5-16
5.5 Soils 5-17
Region of Influence 5-17
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-17
Cumulative Impacts 5-18
5.6 Farm Lands (Prime or Unique) 5-19
Region of Influence 5-19
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-19
Cumulative Impacts 5-19

5.7 Water Quality and Quantity 5-20
Region of Influence 5-20
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-20
Cumulative Impacts 5-20
5.8 Floodplains, Wetlands, and Riparian Zones 5-22
Region of Influence 5-22
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-22
Cumulative Impacts 5-23
5.9 Vegetation 5-23
Region of Influence 5-23
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-23
Cumulative Impacts 5-24
5.10 Invasive, Nonnative Species 5-25
Region of Influence 5-25
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-25
Cumulative Impacts 5-25
5.11 Wildlife 5-25
Region of Influence 5-25
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-26
Cumulative Impacts 5-26
5.12 Migratory Birds 5-26
Region of Influence 5-26
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-26
Cumulative Impacts 5-27
5.13 BLM-Designated Sensitive Species (Animals and Plants) 5-27
Region of Influence 5-27
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-27
Cumulative Impacts 5-28
5.14 Cultural Resources 5-28
Region of Influence 5-28
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-28
Cumulative Impacts 5-28
5.15 Native American Religious Concerns 5-29
Region of Influence 5-29
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-29
Cumulative Impacts 5-29
5.16 Paleontological Resources 5-29
Region of Influence 5-29
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-29
Cumulative Impacts 5-30
5.17 Visual Resources 5-30
Region of Influence 5-30
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-30
Cumulative Impacts 5-30
5.18 Livestock Grazing 5-31
Region of Influence 5-31
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-31

TABLE OF CONTENTS *(continued)*

Chapter Page

Cumulative Impacts 5-32
5.19 Recreation 5-32
Region of Influence 5-32
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-33
Cumulative Impacts 5-34
5.20 National Scenic and Historic Trails 5-34
Region of Influence 5-34
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-34
Cumulative Impacts 5-34
5.21 Noise 5-35
Region of Influence 5-35
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-35
Cumulative Impacts 5-35
5.22 Public Health and Safety 5-35
Region of Influence 5-35
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-35
Cumulative Impacts 5-36
5.23 Fire Management 5-36
Region of Influence 5-36
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-36
Cumulative Impacts 5-36
5.24 Wastes, Hazardous or Solid 5-37
Region of Influence 5-37
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-37
Cumulative Impacts 5-37
5.25 Social and Economic Values 5-38
Region of Influence 5-38
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-38
Cumulative Impacts 5-39
5.26 Environmental Justice 5-40
Region of Influence 5-40
Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions) 5-40
Cumulative Impacts 5-40

6. REFERENCES 6-1

7. CONSULTATION, COORDINATION, AND PREPARATION 7-1

8. GLOSSARY 8-1

FIGURES

Page

1-1 Salt Wells Energy Projects Area 1-3
1-2 Transmission Line Alternatives 1-5
2-1 Sierra Pacific Power Company Proposed Action, South 2-3

FIGURES *(continued)* Page

2-2 Sierra Pacific Power Company Proposed Action, North....2-5
2-3 H-Frame Tangent Structure Typical Drawing....2-9
2-4 Three-Pole Dead-End Heavy Angle Structure Typical Drawing....2-10
2-5 Steel Single-Pole Self-Supporting Angle Structure....2-11
2-6 Single-Pole Staggered Tangent Structure Typical Drawing....2-12
2-7 Ormat Proposed and Alternative Project Facilities....2-21
2-8 Land Status of Ormat Project Area....2-25
2-9 Vulcan Proposed Action and Alternative....2-37
2-10 Land Status of Vulcan Project Area....2-39
2-11 Vulcan Proposed Power Plant and Substation 1....2-41
2-12 Vulcan Proposed Power Plants and Substations 2 and 3....2-42
2-13 Vulcan Proposed Power Plant and Substation 4....2-43
2-14 Vulcan Proposed Power Plant and Substation 5....2-44
2-15 Sierra Pacific Power Company Alternative 1....2-53
2-16 Sierra Pacific Power Company Alternative 2....2-57
2-17 Sierra Pacific Power Company Macari Fiber Optic Alternative....2-59
3-1 Land Use Authorizations, Airspace and Access....3-7
3-2 Geologic Resources and Authorized Leases....3-17
3-3 Soil Wind Erodibility Group, SPPC Northern....3-25
3-4 Soil Wind Erodibility Group, SPPC Central....3-27
3-5 Soil Wind Erodibility Group, SPPC Southern....3-29
3-6 Soil Wind Erodibility Group, Ormat....3-33
3-7 Soil Wind Erodibility Group, Vulcan....3-37
3-8 Farmlands....3-39
3-9 Prime Farmlands....3-41
3-10 Springs, Seeps, and Surface Water Features....3-45
3-11 Groundwater Flow in Basin Fill Aquifer....3-49
3-12 Conceptual Hydrologic Block Model Diagram....3-55
3-13 Cross Section and Well Locations....3-57
3-14 Hydrogeologic Cross-Section A-A'....3-59
3-15 Hydrogeologic Cross-Section B-B'....3-60
3-16 Geothermal Gradients for Selected Boreholes....3-67
3-17 Wetlands and Water Bodies....3-75
3-18 Habitat Types, Overall View....3-81
3-19 Habitat Types, Northern View....3-83
3-20 Habitat Types, Southern View....3-85
3-21 Cultural and Visual Resources....3-121
3-22 Grazing....3-153
3-23 Recreation....3-159
5-1 Salt Wells Energy Projects, Cumulative Actions....5-7
5-2 Salt Wells Energy Projects, Ormat Cumulative Actions....5-9
5-3 Salt Wells Energy Projects, Vulcan Cumulative Actions....5-11

TABLES

Page

1-1 Potential Required Permits and Regulatory Responsibilities 1-12
1-2 Issues and Concerns Raised During the Salt Wells Energy Projects EIS Scoping Process 1-16
2-1 Proposed Fallon 230-kV Source Project Facilities 2-2
2-2 Carson Lake Geothermal Development Proposed Project Facilities 2-20
2-3 Proposed Well Pads 2-29
2-4 Vulcan Salt Wells Proposed Project Facilities 2-33
2-5 Vulcan's Proposed Salt Wells Project Estimated Water Consumption 2-35
2-6 Proposed Well Pad Sites 2-49
3-1 Supplemental Authorities 3-3
3-2 Resources or Uses Other Than Supplemental Authorities 3-4
3-3 Land Ownership and Management in Churchill County 3-5
3-4 ROW Distance on Private Land and Federally Administered Land 3-11
3-5 Locatable Mineral Resources in the SPPC Project Area 3-20
3-6 Locatable Mineral Resources in the Ormat Project Area 3-21
3-7 Locatable Mineral Resources in the Vulcan Project Area 3-22
3-8 Acres of Potential Prime Farmland – SPPC Survey Area 3-43
3-9 Acres of Potential Prime Farmland – Ormat Proposed Action 3-44
3-10 Summary of Water Quality Data for the Carson River 3-51
3-11 Thermal Seep and Spring Water Quality Data 3-52
3-12 Attributes and Locations of Springs and Seeps 3-52
3-13 Groundwater Quality Data for Shallow Basin-Fill Aquifer 3-61
3-14 Groundwater Quality Data for Shallow Piezometers Near Wetland Areas 3-62
3-15 Groundwater Quality Data for Geothermal Sources 3-63
3-16 Groundwater Quality Data for Selected Wells Within and Near the Salt Wells Energy Projects Area 3-65
3-17 Vegetation Communities in the SPPC Survey Area 3-89
3-18 Vegetation Communities in the Ormat Project Area 3-89
3-19 Vegetation Communities in the Vulcan Project Area 3-90
3-20 Habitat Types in the Project Area 3-93
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 3-97
3-22 BLM-Designated Sensitive Species Potentially Occurring in the Projects Area 3-106
3-23 Salt Wells Energy Projects Archaeological Site Summary 3-124
3-24 Salt Wells Energy Projects Area Architectural Summary 3-134
3-25 BLM Grazing Allotments Within the SPPC Project Area 3-155
3-26 BLM Grazing Allotments and Reclamation Pastures Within the Ormat Project Area 3-155
3-27 BLM Grazing Allotments and Reclamation Pastures Within the Vulcan Project Area 3-156
3-28 Full-time and Part-time Employment by Industry 3-170
3-29 Minority Population Characteristics 3-173
4-1 Screening Level Analysis of SPPC Construction Emissions (tons) 4-9
4-2 Screening Level Analysis of Ormat Construction Emissions (tons per construction phase) 4-13
4-3 Ormat Production Well Drilling Emissions Per Well 4-14
4-4 Screening Level Analysis of Vulcan Construction Emissions (tons per construction phase) 4-19
4-5 Vulcan Production Well Drilling Emissions Per Well 4-20

4-6 Potential Prime Farmlands Impacted Acreage SPPC Survey Area 4-38
4-7 Comparison of Perennial Wetland Impacts by SPPC Alternative 4-55
4-8 Comparison of Wetland Impacts by Ormat Alternative 4-58
4-9 Comparison of Wetland Impacts by Vulcan Alternative 4-60
4-10 Comparison of Temporary Disturbance to Vegetation by SPPC Alternative[1] 4-63
4-11 Comparison of Permanent Disturbance to Vegetation by SPPC Alternative[1] 4-64
4-12 Comparison of Vegetation Disturbance by Ormat Alternative[1] 4-68
4-13 Comparison of Vegetation Disturbance by Vulcan Alternative[1] 4-70
4-14 Temporary and Permanent Impact Acreages for Each Proposed Project 4-73
4-15 Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the SPPC Proposed Action and Alternatives 4-145
4-16 Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Ormat Proposed Action and Alternative* 4-147
4-17 Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Vulcan Proposed Action and Alternative 4-149
4-18 Projected Noise Contributions at Residence from Project Phases 4-168
4-19 Number of Parcels and Total Acreage (not managed by BLM) Potentially Requiring Easement Acquisition by Zoning Category[1] 4-190
4-20 Temporary Construction Staffing - Direct Employment 4-197
4-21 Permanent Staffing - Direct Employment 4-198
5-1 Past, Present and Reasonably Foreseeable Future Actions 5-3
5-2 Ormat Carson Lake/Salt Wells Previously Permitted Well Pads 5-6
5-3 Vulcan Power Permitted Salt Wells Well Pad Sites 5-6
5-4 Potential Direct and Indirect Impacts on Water Quality and Quantity 5-21
5-5 Impacts on Vegetation Communities Associated with the Whole of the Actions 5-24
5-6 Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Whole of the Actions (SPPC, Ormat, and Vulcan) 5-32
5-7 Approximate Cumulative Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands 5-33

APPENDICES

A Typical Geothermal Resource Development and Transmission Tools
B Lease Stipulations and Conditions of Approval
C Interagency Agreement Between the Bureau of Reclamation and the Bureau of Land Management
D Programmatic Agreement for the Salt Wells Energy Projects
E Environmental Protection Measures and Best Management Practices
F Land Use Authorizations in the Salt Wells Energy Projects Area
G Soils
H Supplemental Biological Resources
J Visual Simulations

ACRONYMS AND ABBREVIATIONS

	Full Phrase
ac-ft	acre-foot
amsl	above mean sea level
APE	area of potential effect
APZ	Accident Potential Zone
AUM	Animal Unit Month
bgs	below ground surface
BLM	United States Department of the Interior, Bureau of Land Management
BMP	best management practice
BOPE	blow-out prevention equipment
BP	before present
°C	degrees Celsius
Ca	calcium
CAA	Clean Air Act
CCDO	United States Department of the Interior, Bureau of Land Management, Carson City District Office
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
Cl	chlorine
cm	centimeter
CO	carbon monoxide
CO_2	carbon dioxide
CRMP	Consolidated Resource Management Plan
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel
DEIS	Draft Environmental Impact Statement
DNA	determination of NEPA adequacy
DOD	United States Department of Defense
DOI	United States Department of the Interior
EA	environmental assessment
EIS	environmental impact statement
EMF	electric and magnetic field
EPA	United States Environmental Protection Agency
EPAct	Energy Policy Act of 2005
ESA	Endangered Species Act
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FLPMA	Federal Land Policy and Management Act of 1976
FPPA	Farmlands Protection Policy Act

GDP	geothermal drilling permit
GHz	gigahertz
gpm	gallons per minute
HCO_3	bicarbonate
H_2S	hydrogen sulfide
HSU	Hydrostratigraphic Unit
Hz	Hertz
IBA	Important Bird Area
IM	Instruction Memorandum
K	potassium
KOP	Key Observation Point
kV	kilovolt
Kw	Whole Soil Erodibility Factor
LAeq	equivalent average sound level
Mg	magnesium
mg/L	milligrams per liter
MOU	memorandum of understanding
MW	megawatt
Na	sodium
NAAQS	National Ambient Air Quality Standards
NAERC	North American Electric Reliability Company
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	Naval Air Station
NDEP	Nevada Division of Environmental Protection
NDOM	Nevada Division of Minerals
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife
NDWR	Nevada Division of Water Resources
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NLCS	Nevada Lands Conservancy
NNHP	Nevada Natural Heritage Program
NNL	National Natural Landmark
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
OHV	off-highway vehicle

Ormat	Ormat Technologies Inc.
Pb	lead
PEIS	programmatic environmental impact statement
PFYC	Potential Fossil Yield Classification
PG	professional geologist
$PM_{2.5}$	Particulate matter much smaller than 2.5 microns in effective diameter
PM_{10}	Particulate matter much smaller than 10 microns in effective diameter
POD	Plan of Development
POU	Plan of Utilization
PRPA	Paleontological Resources Preservation Act
PSD	Prevention of Significant Deterioration
PUD	planned unit development
Reclamation	United States Department of the Interior, Bureau of Reclamation
RFD	reasonably foreseeable development
ROI	region of influence
RMP	resource management plan
ROD	record of decision
ROW	right-of-way
SC	Specific Conductance
SCADA	supervisory control and data acquisition
SFO	United States Department of the Interior, Bureau of Land Management, Carson City District Office, Stillwater Field Office
SHPO	State Historic Preservation Office
SiO_2	silica
SO_2	sulfur dioxide
SO_4	sulfate
SPCC	Spill Prevention Contingency and Countermeasure
SPPC	Sierra Pacific Power Company
SWPPP	Storm Water Pollution Prevention Plan
SWReGAP	Southwest Regional Gap Analysis
TCID	Truckee-Carson Irrigation District
TCP	Traditional Cultural Property
TDS	total dissolved solids
TSS	total suspended solids
µS	microSiemens
US	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USFS	United States Department of Agriculture, Forest Service
USFWS	United States Department of the Interior, Fish and Wildlife Service
USGS	United States Geological Survey
VORRA	Valley Off-Road Racing Association

VRM	Visual Resource Management
Vulcan	Vulcan Power Company
WEG	Wind Erodibility Group

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

This environmental impact statement (EIS) documents and summarizes the environmental analysis of three separate projects proposed by Sierra Pacific Power Company (SPPC), Ormat Technologies, Inc. (Ormat), and Vulcan Power Company (Vulcan) in the Salt Wells area of Nevada. Together, the three projects are referred to as the Salt Wells Energy Projects (Proposed Actions).

In 2009, the United States (US) Department of the Interior (DOI), Bureau of Land Management (BLM) Stillwater Field Office (SFO) received an application for an electric transmission right-of-way (ROW) from SPPC and two separate geothermal utilization plans or Plans of Utilization (POU) and applications for facility construction permits from Ormat and Vulcan. The POUs documented steps to generate electricity from geothermal resources in Salt Wells, Nevada. The term *geothermal* comes from the Greek *geo* meaning "earth" and *thermal* meaning "heat." As such, geothermal energy is energy derived from the natural heat of the earth. **Appendix A**, Typical Geothermal Resource Development and Transmission Tools, provides background information on geothermal resources and the tools needed to develop and transmit electricity derived from these resources.

The Projects Area encompassed by the three proposals covers approximately 24,152 acres in the Salt Wells area of Nevada, which includes an area just southwest of Fallon to approximately 24 miles southeast of Fallon. **Figure 1-1**, Salt Wells Energy Projects Area, shows where the proposed projects are located within the Salt Wells area.

Combined, the three proposals could result in up to five 30- to 60-megawatt (MW) geothermal power plants with up to 71 associated wells (39 for the proposed actions and the remainder previously authorized), pipelines and associated facilities, and a 22-mile, up to 125-foot-wide ROW for a new transmission line, with substations and switching stations.

The proposed facilities would be sited on a combination of private property, federal land managed by the BLM, and Newlands Project lands managed by the US Bureau of Reclamation (Reclamation); such operations must comply with BLM regulations for Geothermal Leasing, Title 43 Code of Federal Regulations

(CFR), Part 3200, the Geothermal Steam Act, as amended, regulations for activities on public land, 43 CFR Part 2800, Rights-of-Way Program, and the Federal Land Policy and Management Act of 1976 (FLPMA). Applicable Reclamation regulations are at 43 CFR Part 400.

Reclamation is responsible for lands within the Newlands Project. Reclamation holds land for the Newlands Project under three authorities: withdrawn land, acquired land and 1890 easements on private land. Crossings of withdrawn lands and acquired lands will be authorized with a license issued by Reclamation. Licenses for land use require use fees. Portions of the Newlands Project that are not located on federal lands are authorized by the 1890 Canal Act easements. Utility crossings of Newlands Project facilities on private lands require engineering compliance before use authorization can be issued. The 1890 easement crossings are issued with a concurrence letter with no use fee required by Reclamation. **Figure 1-2,** Transmission Line Alternatives and the Newlands Project, shows the Newlands Project Features and potential crossings associated with the SPPC Proposed Action and Alternatives.

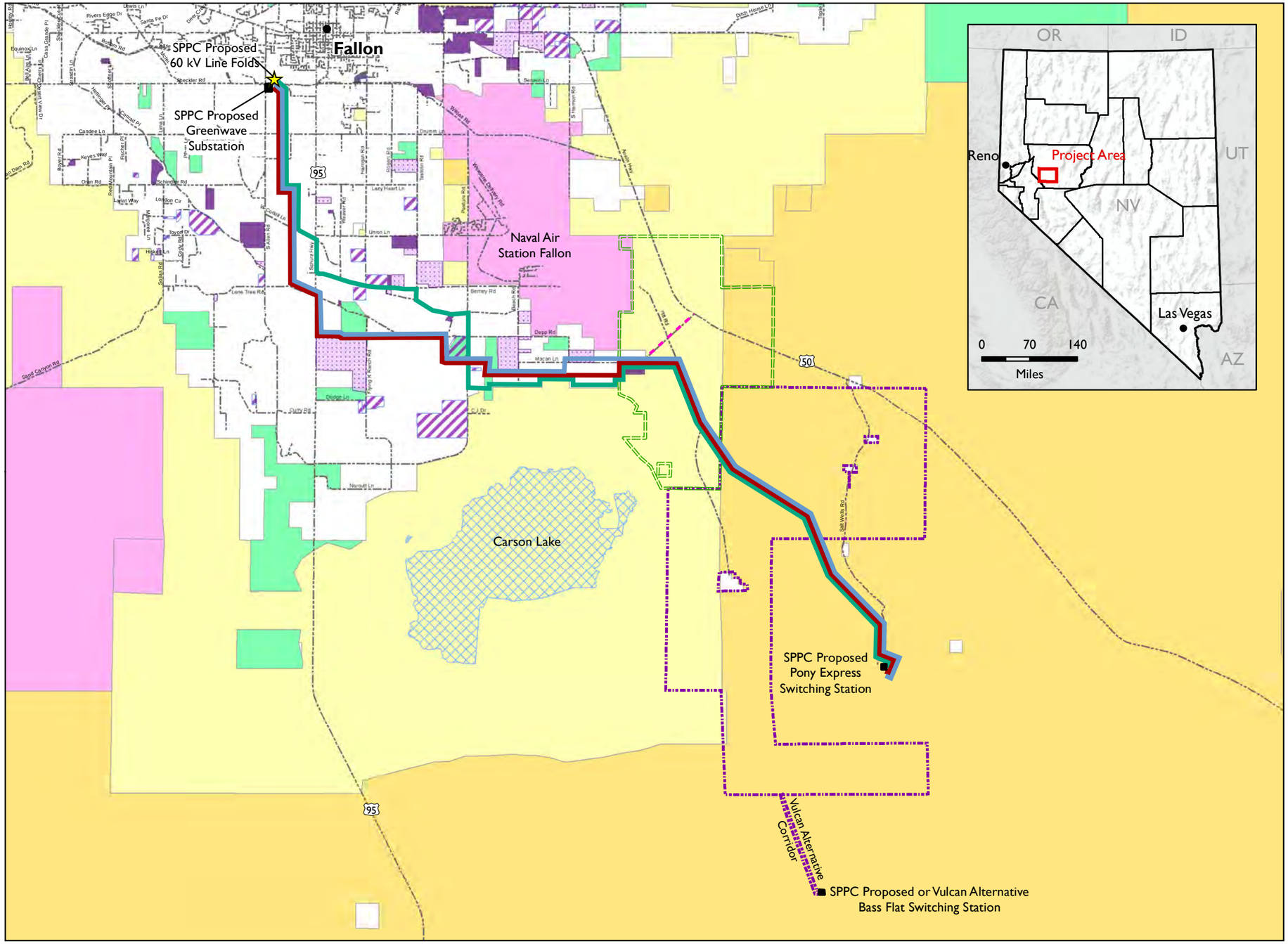
Due to potential for the Proposed Actions to result in significant environmental impacts, BLM determined that an EIS would be necessary, as required by the National Environmental Policy Act of 1969 (NEPA). This document follows regulations promulgated by the Council on Environmental Quality (CEQ) for implementing procedural provisions of NEPA (40 CFR 1500-1508) and BLM's NEPA Handbook (H-1790-1).

The BLM determined that because of similar timing, geographic area, and type of action, the three proposals will be analyzed in one EIS. The BLM will issue a separate Record of Decision (ROD) at the end of the process for each proposed projects that will also be signed by Reclamation for its own use authorization in the form of a ROW pursuant to its own regulations at 43 CFR 429.

1.2 PROJECT OBJECTIVES AND HISTORY

The applicant's objectives are to develop the infrastructure necessary to produce and transmit geothermal energy to consumers and provide reliable electric capacity to the Fallon area. Additionally, the projects would help meet the requirements of the Nevada Renewable Portfolio Standard, a state law that requires 25 percent of electricity be produced from renewable sources by 2025.

The SPPC Project Area covers approximately 1,194 acres and includes construction of a new substation, 22 miles of single-circuit 230-kilovolt (kV) transmission line, two 230-kV switching stations, a fiber optic cable along the length of the transmission line, and two 60-kV electric line folds connecting the proposed new substation to the existing Fallon Substation. The ROW for the transmission line would be 125 feet for H-frame structures and 60 feet for single-pole structures.



Salt Wells Energy Projects Area

Churchill County, Nevada

SW_SPPC_150buf_dissolve_palt1n2

SPPC Project Area
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative Macari Fiber Optic Line
- Proposed 60 kV Line Folds

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Existing Conservation Easement
- Approved, Pending Conservation Easement
- Proposed Conservation Easement
- Open Water

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

NATIONAL SYSTEM OF PUBLIC LANDS

0 1 2
Miles

January 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.

Figure 1-1

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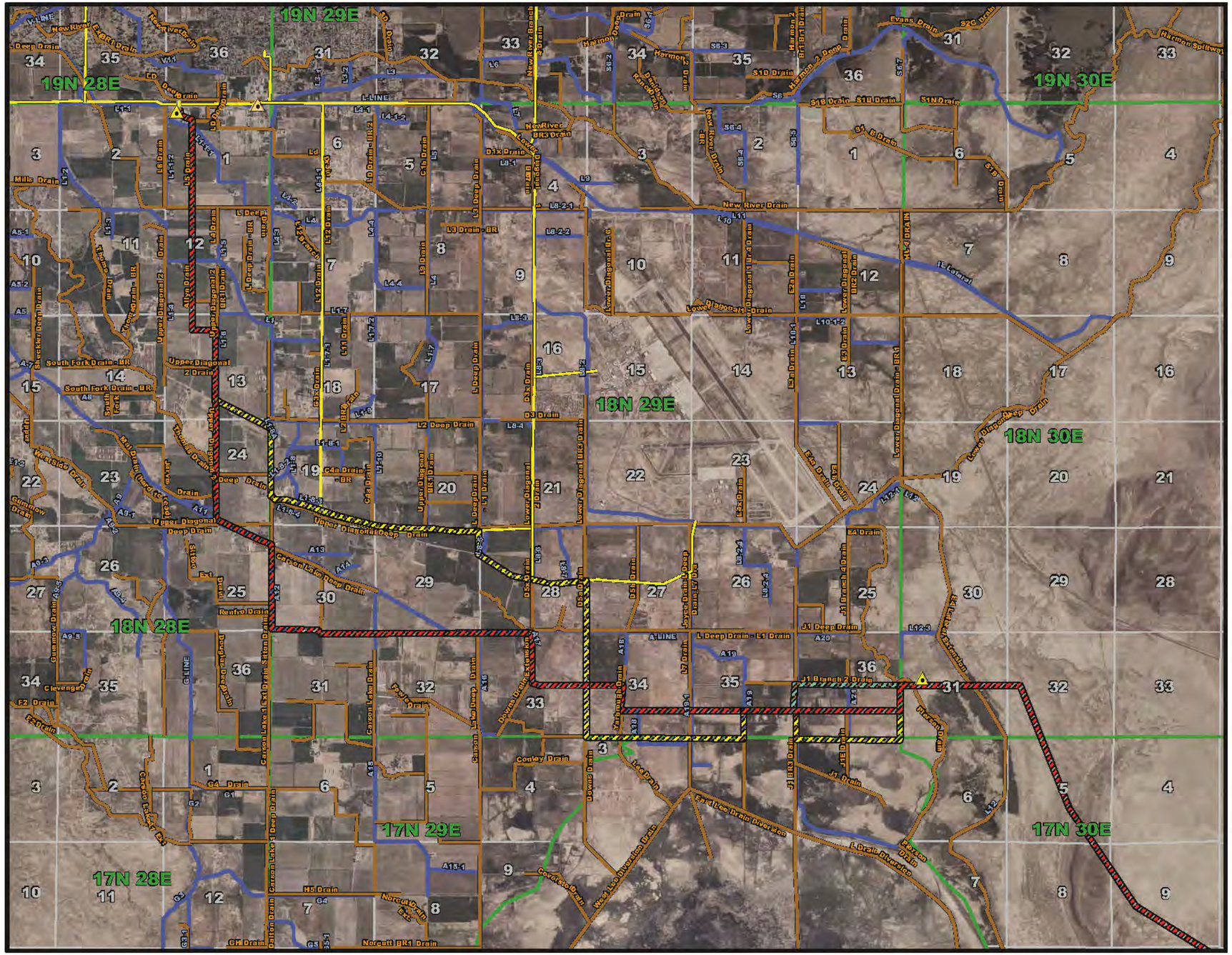

TRANSMISSION LINE ALTERNATIVES

- Newlands Project -
Reclamation Features Overlay
Churchill County, Nevada

LEGEND

- 230 kV Transmission Line Proposed Action
- 230 kV Transmission Line Alternative 1
- 230 kV Transmission Line Alternative 2
- Proposed 60 kV Line Fold
- Proposed Switching Station/Substation
- Existing Fallon Substation
- Existing Transmission Line

NEWLANDS PROJECT FEATURES

- Delivery Feature
- Drainage Feature

N

0 0.5 1 2 3
Miles

RECLAMATION
Managing Water in the West

Lahontan Basin Area Office
705 N. Plaza Street
Carson City, NV 89701

THIS FIGURE WAS PROVIDED BY THE BUREAU OF RECLAMATION AND IS BASED ON DRAFT DATA

Figure 1-2

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The Ormat Project includes the construction and operation of a 40-MW (gross) binary combined air- and wet-cooled geothermal power plant, up to 13 new well pads (which could accommodate multiple wells) in addition to the 12 well pads previously approved, pipelines, a substation, switching station, connection to the proposed SPPC 230-kV transmission line, and access roads on approximately 6,948 acres of land. Approximately 197 acres within this area would remain permanently disturbed. BLM has completed an Environmental Assessment (EA) for Ormat's Carson Lake Geothermal Exploration Project (EA–NV–030–07–006) (BLM 2008) and a Sundry Notice and has previously approved 12 separate wells estimated to be necessary for Ormat's project. The conditions of approval and stipulations specified for the EA are included in **Appendix B**, Lease Stipulations and Conditions of Approval.

Several proposed well sites are located on federal geothermal leases in the Carson Lake and Pasture area, currently open to leasing under the BLM Carson City District Office (CCDO) Consolidated Resource Management Plan (CRMP) (2001) (as amended by the 2008 RMP amendments to Geothermal Leasing in the Western US Programmatic EIS [PEIS]) and whose surface is managed by Reclamation, although these lands have been proposed to be transferred to the Nevada Department of Wildlife (NDOW). All lands within the Salt Wells Energy Projects Area are already under lease.

Vulcan is proposing up to four power plants and associated substations at five possible locations. In addition, a 230-kV interconnection transmission line would be constructed to connect the power plant(s) to Vulcan's proposed Bunejug Switching Station. Vulcan would also construct up to 26 new well pads and associated wells, roads, and pipelines. Vulcan's Project Area encompasses approximately 15,622 acres of land of which approximately 750 acres would be permanently disturbed.

BLM has previously completed two EAs for exploration drilling in Salt Wells (EA–NV–030–07–05 of February 2007 and DOI– BLM–NV–C010–2009–0006–EA of April 2009) for twenty exploration wells and associated access roads (see **Appendix B**, Lease Stipulations and Conditions of Approval).

This EIS describes the components of, reasonable alternatives to, and environmental consequences of constructing, maintaining, and operating the proposed ROWs, proposed geothermal power plants, and their associated facilities. **Chapter 1**, Introduction, describes the purpose of and need for action, authorizing actions, and public participation in the EIS process. **Chapter 2**, Description of the Proposed Actions and Alternatives, describes the Proposed Actions, Alternatives to the Proposed Actions, and alternatives considered but eliminated from further analysis. **Chapter 3**, Affected Environment, describes the existing social and environmental conditions in the project area. **Chapter 4**, Environmental Consequences, details potential direct and indirect impacts associated with the Proposed Actions and Alternatives, and

possible mitigation measures that could be selected to minimize impacts. Potential cumulative impacts of the Proposed Actions and Alternatives as related to other projects in the region are discussed in **Chapter 5**, Cumulative Impacts. References cited in the EIS are provided in **Chapter 6**, References. **Chapter 7**, Consultation, Coordination, and Preparation, identifies the consultation and coordination with state and federal agencies that occurred during preparation of this EIS, along with a list of preparers, and authorized users that were notified. A glossary of terms and acronyms is in **Chapter 8**, Glossary.

1.3 PURPOSE OF AND NEED FOR ACTION

BLM manages the federal lands in accordance with land use plans under the FLPMA on principles of multiple use and sustained yield. A geothermal lease is for the heat resource of the earth where there is federal mineral estate. Unless specifically owned in fee, the federal government does not own the hot water commonly associated with the heat; this falls under state water laws. Geothermal developers must obtain the appropriate water rights and state permits, in addition to the federal lease for the resource.

The BLM has the delegated authority to issue geothermal leases on federal lands. The BLM currently administers about 480 geothermal leases that covered over 700,000 acres at the end of fiscal year 2007. Of those leases, 57 are producing geothermal energy, 54 producing resource for electrical generation, and 3 for direct use (BLM and USFS 2008). It is the policy of the federal government, consistent with Section 2 of the Mining and Mineral Policy Act of 1970 and Sections 102(a)(7), (8), and (12) of the FLPMA (43 US Code [USC] 1701 *et seq.*), to encourage the development of mineral resources, including geothermal resources, on federal lands. The Geothermal Steam Act of 1970 (30 USC Section 1001, *et seq.*), which was amended and supplemented by the Energy Policy Act (EPAct) of 2005, provides statutory guidance for geothermal leasing by the BLM. New federal geothermal development regulations (43 CFR Parts 3000, 3200, and 3280 – Geothermal Resource Leasing and Geothermal Resources Unit Agreements) were made effective June 1, 2007 (72 Fed Reg. 24358, May 2, 2007), as a result of a directive provided in the EPAct of 2005. These statutes and regulations delineate lands that are available and unavailable for leasing.

The BLM is responsible for the development of energy resources on public lands in an environmentally sound manner (43 USC 1701). The BLM's purpose for this project is to direct and control the use of public lands for the orderly development of commercial-scale geothermal power generation facilities, associated infrastructure, and a transmission line in a manner that will allow other existing uses to continue, protect the natural resources, minimize resource conflicts and prevent unnecessary or undue degradation to the public lands (see 40 CFR 2801.2).

In accordance with the Geothermal Steam Act, as amended and 43 CFR Part 3200, BLM needs to consider whether to approve any or all of the three related applications for utilization of geothermal resources, which include construction, operation, and maintenance of the Proposed Actions. Title V of the FLPMA, implemented by 43 CFR Part 2800 and Part 3200, authorizes the Secretary of the Interior (through the BLM) to grant ROWs over, upon, under, or through public lands for the purposes of generating and transmitting electric energy. Because this is an externally generated proposal, BLM must respond to and consider whether to approve, approve with conditions, or deny the applications filed by the applicants. In addition, Reclamation will use this analysis and ROD to decide whether to approve a use authorization in the form of a ROW for the transmission line under its own regulations at 43 CFR Part 400.

Secretarial Order 3285, Amendment 1 (February 22, 2010) states that "encouraging the production, development, and delivery of renewable energy is one of the Department's highest priorities. Agencies and bureaus within the Department will work collaboratively with each other, and with other federal agencies, departments, states, local communities, and private landowners to encourage the timely and responsible development of renewable energy and associated transmission while protecting and enhancing the nation's water, wildlife, and other natural resources."

The EPAct of 2005 (Public Law 109-58) encourages the development of renewable and alternative energy resources, including geothermal energy, as part of an overall strategy to develop a diverse portfolio of domestic energy supplies. Section 211 of the Act calls for the Secretary of the Interior to have approved non-hydropower renewable energy projects located on public lands, where appropriate, with a generation capacity of at least 10,000 MW of electricity by 2015.

Additionally, the BLM's implementation strategy titled, *BLM Implementation of the National Energy Policy*, and other federal policies, including the Geothermal Steam Act of 1970, amended and supplemented by the EPAct of 2005; the Mining and Mineral Policy Act of 1970; the FLPMA; and the National Materials and Mineral Policy, Research and Development Act of 1980, direct the federal government to foster and encourage private enterprise to develop alternative energy resources with appropriate environmental constraints. If approved, the Salt Wells Energy Projects would provide new renewable energy sources and contribute to meeting these goals.

1.4 GEOTHERMAL LEASE RIGHTS, LIMITATIONS, AND STAGES OF DEVELOPMENT

The four stages of geothermal resource development within a lease are exploration, drilling operations, utilization, and reclamation and abandonment. Each stage requires a permit from the BLM. Leasing geothermal resources by the BLM vests with the lessee a non-exclusive right to future exploration and an exclusive right to produce and use the geothermal resources within the lease

area, subject to existing laws, regulations, formal orders, and the terms, conditions and stipulations in or attached to the lease form or included as conditions of approval to permits. Lease issuance alone does not authorize any ground-disturbing activities to explore for or develop geothermal resources without site specific approval for the intended operation. Such approval could include additional environmental reviews and permits. Also at each stage, the BLM can issue site-specific conditions-of-approval to protect resource values. The specific activities associated with each phase are detailed in Chapter 2.

A lease is issued for a primary term of 10 years and may be extended for two five-year periods. Each of these extensions is available provided the lessee meets the work commitment requirements or lessee made payment in lieu of minimum work requirements of each year. At any time a lease may receive a 5-year drilling extension. Once commercial production is established, the lease may receive a production extension of up to 35 years and a renewal period of up to 55 years. The lease must continue to produce to remain in effect. BLM may grant a suspension of operations and production on a lease when justified by the operator (see 43 CFR 3207).

Geothermal exploration and production on federal land conducted through leases is subject to terms and stipulations to comply with all applicable federal and state laws pertaining to various considerations for tribal interests, sanitation, water quality, wildlife, safety, cultural resources, and reclamation.

1.5 BLM Decisions Resulting from This EIS

Regulations at 43 CFR 2800 and 43 CFR 3200 would be included in the ROD including approval of a utilization plan, facility construction permit, geothermal drilling permit (GDP), site license, ROW authorizations. However the Notice to Proceed under the ROW would be granted later in the process and would be based on a revised, more site specific plan of development (POD) or POU or Sundry Notice for actions covered under this draft EIS (DEIS) analysis.

1.6 Reclamation Decisions Resulting from This EIS

Reclamation regulations at 43 CFR 429 would be included in the ROD, including approval of use authorizations. However, licenses and concurrence letters authorizing the specific crossings would be granted later in the process and would be based on a revised, site specific POD for actions covered under this DEIS analysis.

1.7 Authorizing Actions

Actions proposed on BLM-administered lands must comply with FLPMA, whose statutes require the BLM to analyze the Proposed Actions to ensure the following:

- Adequate provisions are included to prevent undue or unnecessary degradation of public lands;

- Measures are included to provide for reasonable reclamation of disturbed areas; and
- Proposed Actions would comply with other applicable federal, state, and local laws and regulations.

BLM's authority to grant a ROW is limited to that portion of the route that is on public land. Because most of Sierra's proposed ROW covers non-BLM land, the Proposed Actions would be subject to permit approvals from the affected local jurisdictions, including Churchill County.

Other federal, state, and local agencies have jurisdiction (including inspection responsibilities) over certain aspects of the Proposed Actions. **Table 1-1**, Potential Regulatory Responsibilities, lists additional federal, state, and local permits, policies, and actions that may be required and lists the agencies that may use the information presented in the EIS to make decisions about issuing permits or approvals.

Conformance Statement

The Proposed Actions and Alternatives described below are in conformance with the terms and conditions in the CRMP page ROW 1: National Policy, Section 1 and for Lands and Realty and Minerals, as amended by the 2008 Geothermal PEIS, and are consistent with the NEPA analysis supporting these decisions. Specifically page MIN1, Decision 1: the desired outcome for minerals and energy management is to "encourage development of energy and mineral resources in a timely manner to meet national, regional, and local needs consistent with the objectives for other public land uses" (BLM 2001a).

Relationship to BLM and Non-BLM Policies, Plans, and Programs

These actions are consistent with federal laws and regulations; other plans, programs, and policies of affiliated Tribes; and other federal agencies, state, and local government, to the extent practical within federal law, regulation, and policy. Specific approvals, permits, and regulatory requirements would be required for constructing, operating, and maintaining the proposed geothermal exploratory wells.

The PEIS, conducted by BLM and the US Department of Agriculture, Forest Service (USFS), amended 114 BLM Resource Management Plans (RMP), including the CRMP, to allocate lands

According to the PEIS the state of Nevada is expected to commercially develop 1,473 MW and 2,880 MVW of electricity from geothermal resources by the years 2015 and 2025, respectively. The CCDO is expected to contribute 536 and 971 MW, respectively, of this total potential. Federal lands in Salt Wells were estimated to develop approximately 120 to 140 MW of electricity from geothermal resources by 2025 (BLM and USFS 2008). Available resource information and the projections in the RFD provide background for development of geothermal resources in Salt Wells, Nevada.

Table 1-1
Potential Required Permits and Regulatory Responsibilities

Regulatory Agency	Action
BLM	• Section 106 compliance with the National Historic Preservation Act (NHPA) • Cultural Resource Permit pursuant to the Native American Graves Protection and Repatriation Act (NAGPRA) • Cultural Resource Permit pursuant to the American Indian Religious Freedom Act • Cultural resource use permits: 1) survey/recordation permit, (2) survey and limited testing permit, and (3) excavation and/or removal permit • EIS and ROD pursuant to NEPA • Facility Construction Permit • Geothermal Drilling Permit (GDP) • Geothermal Sundry Notice • Commercial Use Permit • ROW Grant – transportation and utility systems and facilities on federal lands • Site License Agreement • Temporary Use Permits for construction-related activities • Utilization Plan
Reclamation	• Commercial Use Licenses and Letters of Concurrence. • ROD for non-lease actions on Reclamation action on Reclamation withdrawn acquired and 1890 reservation easement lands. Memorandum of Understanding between BLM and Reclamation (see **Appendix C**, Interagency Agreement Between the Bureau of Reclamation and the Bureau of Land Management) allows BLM to make geothermal surface use approvals on Reclamation-managed lands.
Federal Aviation Administration (FAA)	• FAA Notice of Proposed Construction Permit (FAA Form 7460-1)
Federal Energy Regulatory Commission	• Notice of Self Certification as a Qualifying Small Power Producing Facility
US Army Corps of Engineers (USACE)	• Nationwide Permit 14, 404/401 Permit pursuant to the Clean Water Act (CWA)
US Fish and Wildlife Service (USFWS)	• Section 7 Compliance per the Endangered Species Act (ESA)

Table 1-1
Potential Required Permits and Regulatory Responsibilities

Regulatory Agency	Action
Nevada Bureau of Water Pollution Control	• Stormwater general permits for construction, National Pollutant Discharge Elimination System (NPDES) • Temporary rolling stock permit
Nevada Bureau of Water Quality Planning	• Section 401 Water Quality Certification pursuant to the CWA
Nevada Chemical Accident Prevention Program	• Permit to Construct • Permit to Operate
NDOW	• State-listed endangered species review
Nevada Department of Conservation and Natural Resources, Division of Water Resources	• Application for Permit to Appropriate the Public Waters of the State of Nevada • Request for a Waiver for Temporary Use of Groundwater for Oil & Gas or Geothermal Exploration
Nevada Department of Transportation (NDOT)	• Occupancy or Encroachment Permits
NDEP	• Air Quality Operating Permit
NDEP-Bureau of Air Pollution Control	• Permit to Construct • Surface Area Disturbance Permit
NDEP- Bureau of Water Pollution Control	• Commercial Septic Discharge Permit • Underground Injection Control Permit • Use of Water to Explore for Minerals • Water Appropriation Permit
Nevada Division of Industrial Relations	• Pressure Vessel Inspection and Permitting
Nevada Division of Minerals (NDOM)	• Geothermal Project Area Permit • Geothermal Drilling Permit • Geothermal Injection Well Permit
Nevada State Historic Preservation Office (SHPO)	• Programmatic Agreement for NHPA compliance between BLM, Reclamation, SHPO, and the project proponents. The Programmatic Agreement is included in Appendix D, Programmatic Agreement for the Salt Wells Energy Projects.
Public Utilities Commission of Nevada	• Utility Environmental Protection Act Permit

Table 1-1
Potential Required Permits and Regulatory Responsibilities

Regulatory Agency	Action
Churchill County	• Application and permit for county road encroachment • Building Permit (substation) • Grading Permit • Special Use Permit • Surface Area Disturbance Permit (dust control plan)

Churchill County Master Plan

The 2005 Churchill County Master Plan, page 13-15, directs the County to support development and use of renewable energy sources such as geothermal, coordinate with Federal agencies promoting renewable resource development, and optimize economic benefit and environmental protection for Churchill County (Churchill County 2005).

The plan classifies geothermal as one of the four main industry sectors within the county and states, "Recognize that the development of Nevada's mineral resources is desirable and necessary to the nation, the state and Churchill County. 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:

1. There should be reasonable access to lands where the mineral estate is in federal ownership.

2. The expansion and development of geothermal resources should be promoted on lands under federal land management.

3. Recognize geothermal production as an important component of a national energy policy.

4. Support a permitting process that is consistent and eliminates unwarranted delays in site development.

5. Mining Law reform should support a national minerals policy that promotes a strong domestic mining industry in Nevada.

Regarding energy transmission, the plan states, "Corridors for the future transmission of energy, communications and transportation need to be planned for in harmony with other uses on public lands. Preference should be given to existing corridors. Corridors should have multiple uses kept to as few a number and length as possible."

1.8 PUBLIC INVOLVEMENT

NEPA requires an early and open process for determining issues that should be addressed and analyzed in the EIS to help decision-makers decide to implement the Proposed Actions or an alternative. The EIS process, as mandated by NEPA, is designed to involve and inform the public and federal, state, and local agencies as to the environmental consequences of a federal agency's actions and to provide the lead agency with important information and analyses to promote better decision making. To formally solicit public input, the BLM has conducted the following activities:

- The BLM invited nine agencies to participate in the EIS process as cooperating agencies and requested them to make a decision and to notify the BLM by August 30, 2009. The agencies that accepted are Reclamation, Churchill County, City of Fallon, Naval Air Station (NAS) Fallon, Nevada Division of Minerals, and NDOW. Representatives of these agencies signed a memorandum of understanding (MOU) to clarify all participants' responsibilities and to specify conditions, schedules, and procedures to be followed in developing and preparing the EIS.
- The public scoping period began on September 11, 2009, with the publication of the Notice of Intent (NOI) in the Federal Register and continued through November 10, 2009 (Scoping Period). A project Web site was launched prior to the beginning of the scoping period and was maintained and expanded throughout scoping. **Table 1-2,** Issues and Concerns Raised During the Salt Wells Energy Projects EIS Scoping Process, summarizes comments raised during the scoping process.
- A public scoping meeting, hosted by Churchill County, was held on October 21, 2009, at the County Administration Complex in Fallon, Nevada. The meeting provided an opportunity for members of the public, local government, tribes, utilities, and other interest groups to learn about the EIS, to provide input into the development of the EIS, and to voice their concerns related to potential environmental impacts so that they may be addressed in the EIS.
- The BLM presented the project to the Churchill County Commissioner's on October 21, 2009, and answered questions from both the commissioners and the public regarding various aspects of the three proposals.
- The BLM met with the State Historic Preservation Office (SHPO) to discuss Class I Survey Methodology and Historical review on April 2, 2010.
- The BLM met with a representative of the Fallon-Paiute-Shoshone Tribe on April 13, 2010.

Table 1-2
Issues and Concerns Raised During the Salt Wells Energy Projects EIS Scoping Process

Comments	Location in Document Where Addressed
Effect of this project on the price, availability, and consistency of energy supplied to the Fallon area.	Chapter 1– Purpose and Need
If power generated by this project would be made available to the local Fallon community, if needed, before being sold to outside interests	Chapter 4– Social and Economic Values
Whether drilling required for this project may increase the frequency and/or the intensity of earthquakes	Chapter 4– Minerals/Geology
Effects of lighting on Dark Sky attributes of the area	Chapter 4– Visual Resources
Building materials, colors, and site placement should be compatible with the natural environment	Chapter 4– Visual Resources; Appendix E– Environmental Protection Measures and Best Management Practices
Ensure that appropriate water rights are obtained before construction to avoid costly delays	Chapter 2– Description of the Proposed Actions and Alternatives; Chapter 4– Water Quantity and Quality
Put in place a monitoring plan that allows baseline water quality to be compared to future results during and after completion of the project	Chapter 4– Water Quantity and Quality
The operator should be prepared to mitigate any negative effects on water quality	Chapter 4– Water Quantity and Quality
Effects on the quality and quantity of surface and underground water sources, with particular concern for the area in and around the project and Carson Lake	Chapter 4– Water Quantity and Quality
Effects of pumping on the intermediate aquifer	Chapter 4– Water Quantity and Quality
Ormat should also perform a hydrologic study of their proposed area and address impacts on NAS Fallon and private landowners	Chapter 4– Water Quantity and Quality
Relationship between how springs and surface waters may be related to the "deep" geothermal production zone and how shallow aquifer waters are related to that same "deep" zone	Chapter 4– Water Quantity and Quality

Table 1-2
Issues and Concerns Raised During the Salt Wells Energy Projects EIS Scoping Process

Comments	Location in Document Where Addressed
State jurisdiction over geothermal resource drainage	Chapter 4– Land Use Authorizations, Airspace and Access; Chapter 4– Geology/ Minerals
Impacts on equity between neighboring geothermal resources	Chapter 4– Social and Economic Values; Chapter 5– Social and Economic Values
Ormat and Vulcan should create a resource development plan to determine what targets (depth and location) are anticipated for production and injection in order to make determinations regarding potential impacts	A construction and Operation Plan would be submitted following approval, however until further exploration is performed on the resource it is difficult to determine exact production and injection well numbers and depths
Effects of power lines on instrument procedures at NAS Fallon	Chapter 4– Land Use Authorizations, Airspace and Access; Chapter 4– Public Health and Safety

- The BLM attended a field visit with a USFWS representative to discuss raptors on August 20, 2010.
- The BLM met with tribal staff on August 25, 2010.
- The BLM met with the Cooperating Agencies during Alternative Development on the following dates:
- November 9, 2009 (Field Trip to Project Areas)
- November 10, 2010 (at BLM in Carson City)
- January 13, 2010 (at Churchill County, Fallon)
- February 24, 2010 (at Reclamation in Carson City)
- May 7, 2010 (at BLM in Carson City)
- June 16, 2010 (at BLM in Carson City)
- June 23, 2010 (Field Trip to Project Areas with Reclamation)
- August 24, 2010 (at BLM in Carson City)
- September 10, 2010 (meeting with NDOW at BLM in Carson City)
- October 19, 2010 (at BLM in Carson City)

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CHAPTER 2
DESCRIPTION OF THE PROPOSED ACTIONS AND ALTERNATIVES

2.1 INTRODUCTION

SPPC filed an application with the BLM SFO to obtain a ROW across public land. In addition, both Ormat and Vulcan have submitted POUs to develop geothermal resources on public lands. Together, the three proposals are referred to as the Salt Wells Energy Projects (Proposed Actions). As described in Chapter 1, BLM previously approved associated activities for the Vulcan and Ormat projects. These activities are discussed in more detail in **Chapter 5**, Cumulative Impacts.

Alternatives considered in this EIS are based on issues identified by BLM and cooperating agencies, as well as comments received during the public scoping process. Alternatives are intended to reduce or minimize potential impacts associated with the Proposed Actions, while still meeting the purpose of and need for the Proposed Actions.

2.2 PROPOSED ACTIONS

Sierra Pacific Power Company Proposed Action – Fallon 230-kV Source Project

SPPC proposes to build two switching stations, one 230-kV transmission line, two 60-kV electric line folds, and one substation, as follows:

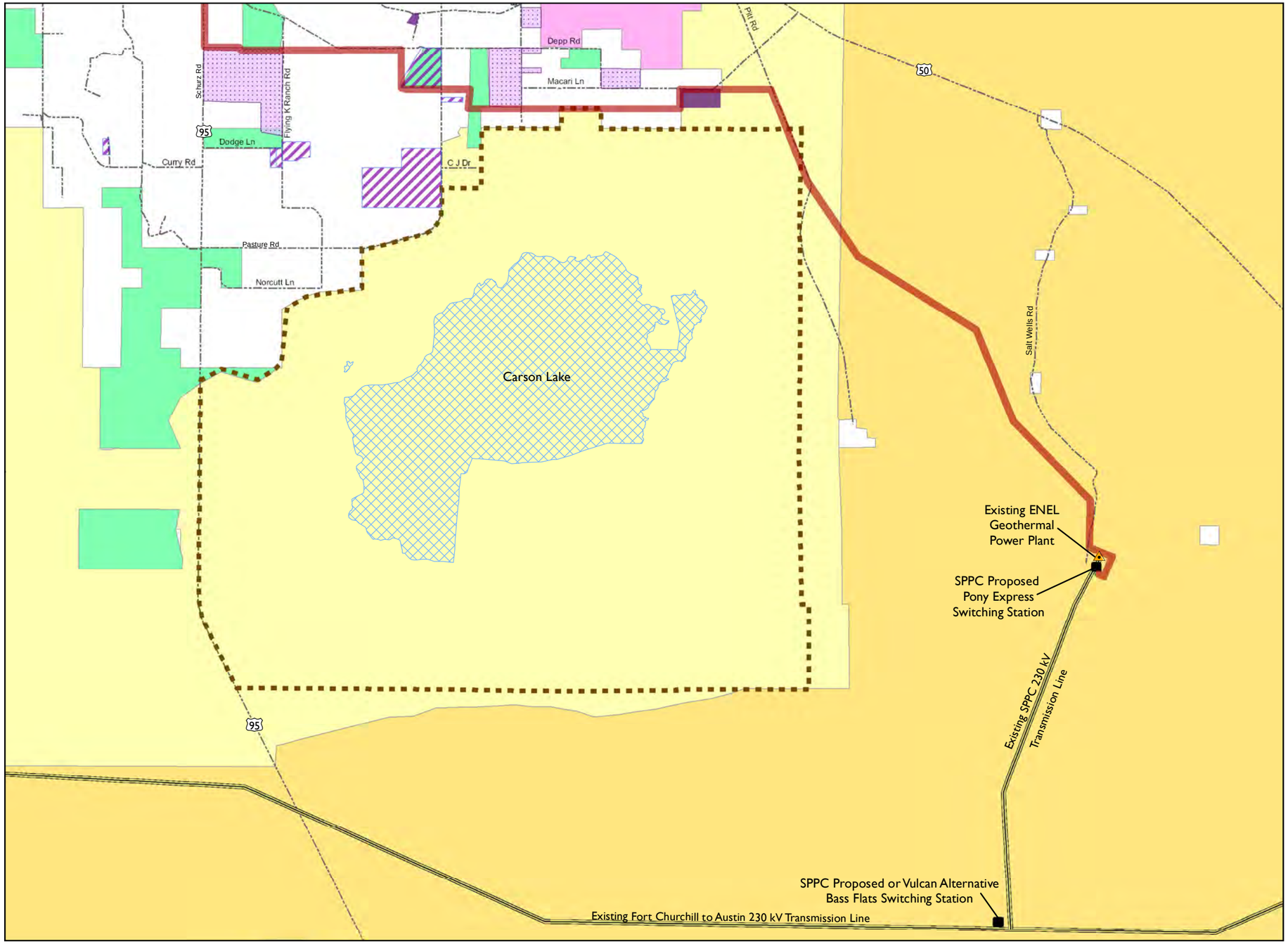
- Construction of a new Bass Flat Switching Station at the junction of the existing Fort Churchill to Austin 230-kV transmission line and the ENEL 230-kV transmission line;
- Construction of a new Pony Express Switching Station adjacent to the existing ENEL Geothermal Power Plant;
- Construction of a new Greenwave Substation;
- Construction of a 230-kV transmission line from the proposed Pony Express Switching Station to the Greenwave Substation; and
- Installation of two 60-kV electric line folds on four single-pole structures connecting the proposed Greenwave Substation to the

existing 60-kV transmission lines which are connected to the existing Fallon Substation north of Sheckler Road.

The major components of SPPC's Fallon 230-kV Source Project are described in **Table 2-1**, Proposed Fallon 230-kV Source Project Facilities, and depicted on **Figure 2-1**, Sierra Pacific Power Company's Fallon 230-kV Source Project Proposed Action–South, and **Figure 2-2**, Sierra Pacific Power Company's Fallon 230-kV Source Project Proposed Action–North. Figures 2-1 and 2-2 also show the land ownership status for all lands within the project area. SPPC would implement the best management practices (BMPs), as defined by the Nevada State Conservation Commission (1994), which include accepted measures identified in in the POD and outlined in **Appendix E**, Environmental Protection Measures and Best Management Practices, during construction and operation of the project.

Table 2-1
Proposed Fallon 230-kV Source Project Facilities

Project Component	Location/Description	Temporary Disturbance	Permanent Disturbance
Proposed Bass Flat Switching Station	Approximately 20 miles southeast of Fallon.	500 x 500 feet (+/- 5.75 acres)	500 x 500 feet (+/- 5.75 acres)
Proposed Pony Express Switching Station	On public land adjacent to ENEL's Salt Wells Geothermal Power Plant (approximately 16 miles southeast of Fallon, Nevada).	500 x 500 feet (+/- 5.75 acres)	500 x 500 feet (+/- 5.75 acres)
Proposed Greenwave Substation	South side of Sheckler Road in Fallon, Nevada.	11.5 acres	11.5 acres
Proposed 230-kV Transmission Line	Between the Proposed Greenwave Substation and the Proposed Pony Express Switching Station.	Length: 21.7 miles Width: 300-foot ROW Total Disturbance: 789 acres	Length: 21.7 miles Width: 125-foot ROW for H-frame pole and 60-foot ROW for single pole. Total Disturbance (assuming all H-frame pole buildout): 329 acres
Proposed 60-kV Electric Line Folds	Installation of two 60-kV electric line folds on four single-pole structures from the proposed Greenwave Substation to the existing 60-kV transmission lines across the street.	Length: 250 feet Width: 100-foot ROW Total Disturbance: 0.6 acres	Length: 250 feet Width: 100-foot ROW Total Disturbance: 0.6 acres
Total Estimated Disturbance:		**813 acres**	**352 acres**



Sierra Pacific Power Company Proposed Action, South

Churchill County, Nevada

SPPC Facilities

- Proposed 230 kV Transmission Line Corridor

Other Features

- Proposed Switching Station
- Existing Power Plant
- Existing 230kV Transmission Line
- CLP Title Transfer
- Existing Conservation Easement
- Approved, Pending Conservation Easement
- Proposed Conservation Easement
- Open Water

Land Ownership

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

Souce: BLM 2010, Churchill County 2010, SPPC 2010

NATIONAL SYSTEM OF PUBLIC LANDS

0 0.75 1.5

Miles

January 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.

Figure 2-1

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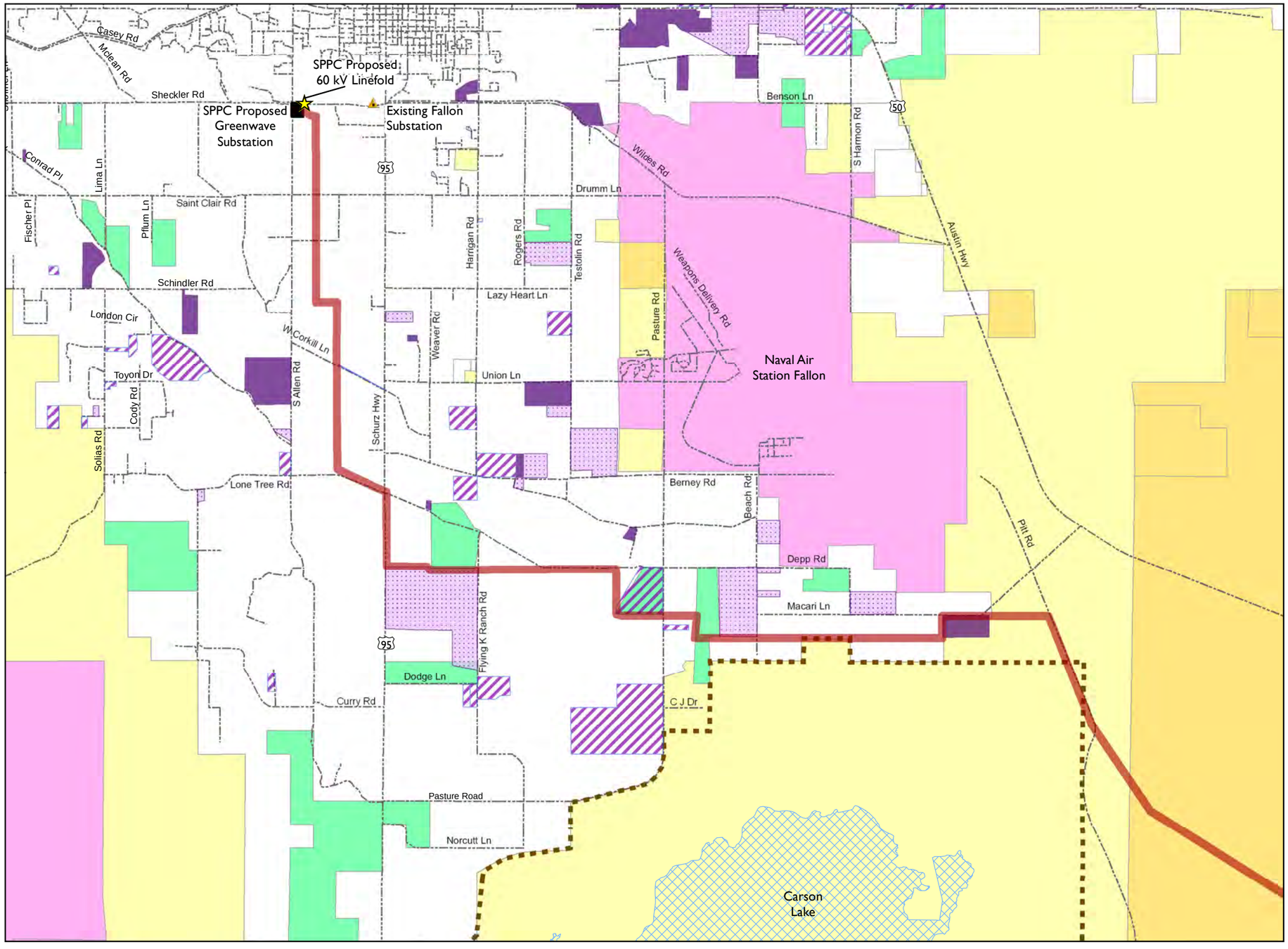

Sierra Pacific Power Company Proposed Action, North

Churchill County, Nevada

SPPC Facilities
- Proposed 230 kV Transmission Line Corridor
- Proposed 60 kV Linefold

Other Features
- Proposed Substation
- Existing Substation
- CLP Title Transfer
- Existing Conservation Easement
- Approved, Pending Conservation Easement
- Proposed Conservation Easement
- Open Water

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 2010, Churchill County 2010, SPPC 2010

NATIONAL SYSTEM OF PUBLIC LANDS

0 0.5 1
Miles

January 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.

Figure 2-2

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Proposed Bass Flat Switching Station

The purpose of a switching station is to tie three or more transmission lines together at a single point, and separate and protect each line segment with circuit breakers. Like a substation, a switching station would contain switches, circuit breakers, electrical bus work, and a control building. It does not however have a transformer. All of the lines entering and exiting a switching station are at the same voltage.

The Bass Flat Switching Station would involve the construction of an expandable 5-breaker, breaker and a half switching station on an approximate 5.75-acre parcel. The site would be immediately northwest of the line tap point where the existing 230-kV transmission line from the ENEL Geothermal Power Plant ties into the existing 230-kV transmission line between Fort Churchill and Austin. The existing line tap configuration is not adequate to serve the Fallon area or the new power plants proposed by Vulcan or Ormat. The new switching station would provide circuit breakers and remote switching capabilities (via a microwave and fiber optic system discussed under Communications) that would allow safe and reliable operation of the transmission tie to ENEL, Vulcan, Ormat, and Fallon, as well as the existing 230-kV system between Fort Churchill and the eastern parts of Nevada. The Bass Flat Switching Station would have a 110-foot microwave tower to allow for communication to the SPPC Microwave site at Eagle Ridge. SPPC would use existing roads for access during construction, operations, and maintenance. Any road improvements (blading, adding gravel, etc.) or additional disturbances not currently anticipated would be discussed in the revised POD as identified and discussed under the Construction subsection of the proposed 230-kV transmission line.

Work at the switching station site would begin by clearing existing vegetation and organic matter from the site. The site would then be graded to a level pad (approximately 5 to 6 acres) for installation of the equipment. Once the pad is prepared, the site would be secured with chain-link fencing. Structure footings and underground utilities, including an electrical conduit and additions to the grounding grid, would be installed followed by aboveground equipment. Once the equipment is installed, the site would be graded and medium gray gravel, two inches wide or less, would be spread over the site to a depth of approximately four inches. Temporarily disturbed areas surrounding the switching station would be revegetated.

Proposed Pony Express Switching Station

The Pony Express Switching Station would be located adjacent to ENEL's Salt Wells Geothermal Power Plant on an approximate 5.75-acre parcel. The switching station would allow the existing 230-kV transmission line to the geothermal plant to be re-terminated and the proposed 230-kV transmission line to continue northwest to the proposed Greenwave Substation in Fallon. Construction methods would be the same as those identified under the proposed Bass Flat Switching Station. SPPC would use existing roads for access.

Any additional disturbance for access would be discussed in the POD.

Proposed Greenwave Substation

The proposed Greenwave Substation would involve the construction of a substation within an 11.5-acre area using the same methods as identified in the description of the proposed Bass Flat Switching Station. The purpose of a substation is to convert energy from the high voltage transmission lines to lower voltage transmission or distribution lines. A substation would contain one or more high voltage line terminals and one or more lower voltage line terminals, separated by a transformer. It would also contain associated high and low voltage electrical equipment, including switches, circuit breakers, electrical bus work, and a control building.

Proposed 230-kV Transmission Line

The proposed 230-kV transmission line would be constructed from the proposed Pony Express Switching Station to the Greenwave Substation. In between these two power facilities, the transmission line may be connected to the Vulcan Bunejug Switching Station and/or the Ormat Macari Switching Station, which are both discussed under the respective proposed projects. From the proposed location of the Macari Switching Station, the proposed 230-kV transmission line route would travel west for approximately one-half mile, south one-half mile and west approximately five miles before jogging north one-half mile and continuing west for approximately two miles. The line would cross Pasture Road and then head north one mile and west between Pasture and Testolin Roads. The route would continue west to Highway 95, turn north and cross west at an angle along Depp Road to mid-way between Highway 95 and Allen Road, and turn north again to the Greenwave Substation.

The proposed 230-kV transmission line would be a single-circuit transmission line consisting of steel or wood H-frame tangent structures, steel or wood three-pole dead-end heavy angle structures, steel single-pole heavy angle dead-end structures, and steel single-pole staggered tangent structures. The total width of the permanent ROW would be 125 feet for H–frame structures and 60 feet for single-pole structures. H–frame structures would be from the Pony Express Switching Station to the Macari Switching Station. H-frame structures are used in open rural areas where longer spans can be achieved and wider ROWs are easy to obtain. Single-pole configuration is used in urban areas where greater ROW restrictions exist and the line routes follow roads, ditches, and property lines. H-frame structures would typically be 60 to 75 feet above ground level, depending on terrain. Single-pole structures would typically be 80 to 85 feet above ground level to allow for vertical stacking of the transmission conductors and additional distribution underbuild circuits. Typical drawings of 230-kV transmission structures are provided as **Figures 2-3** through **2-6**. The 230-kV transmission line would use a 795 MCM aluminum conductor, which is

Figure 2-3 H-Frame Tangent Structure Typical Drawing

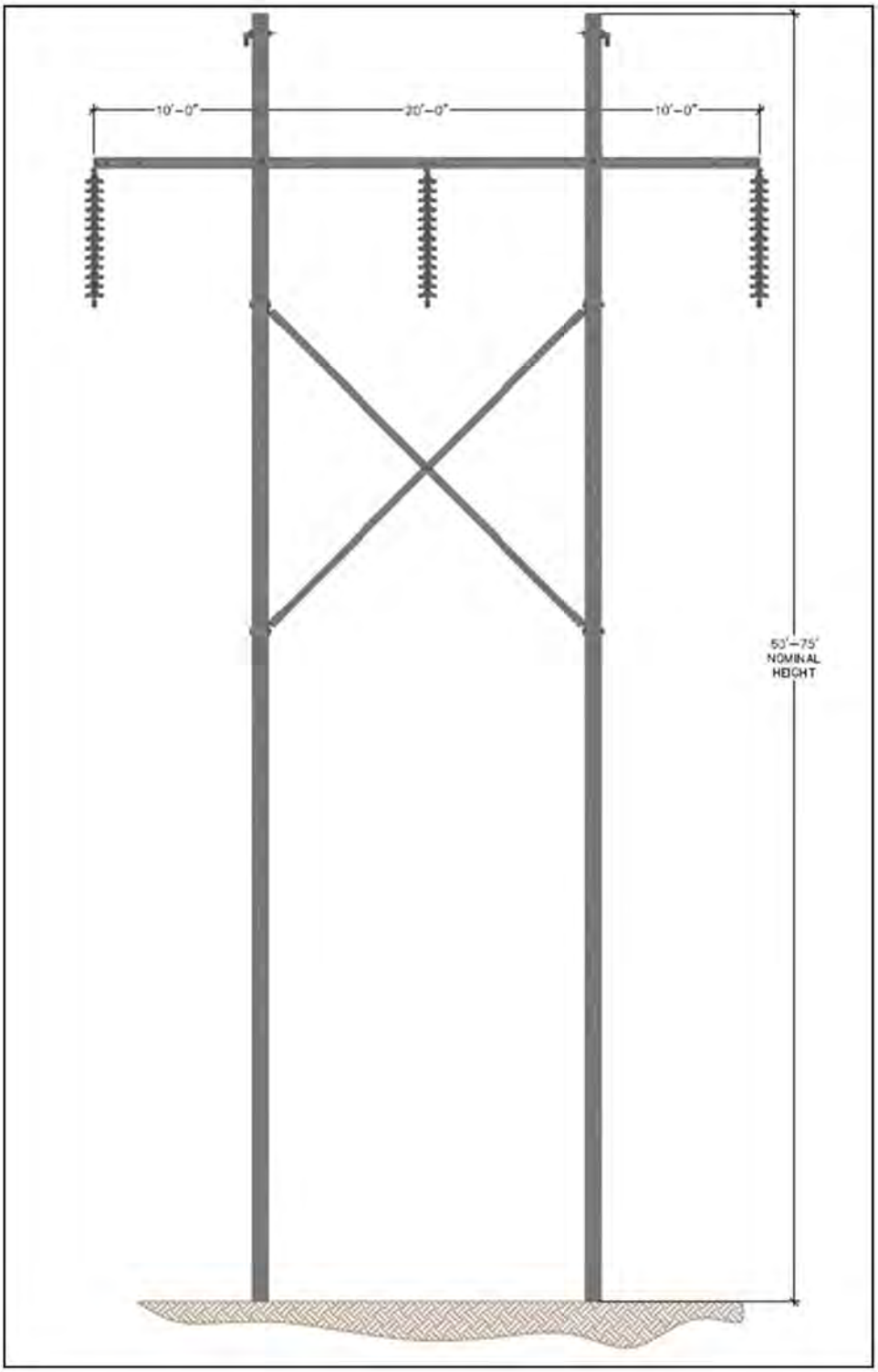


Figure 2-4 Three-Pole Dead-End Heavy Angle Structure Typical Drawing

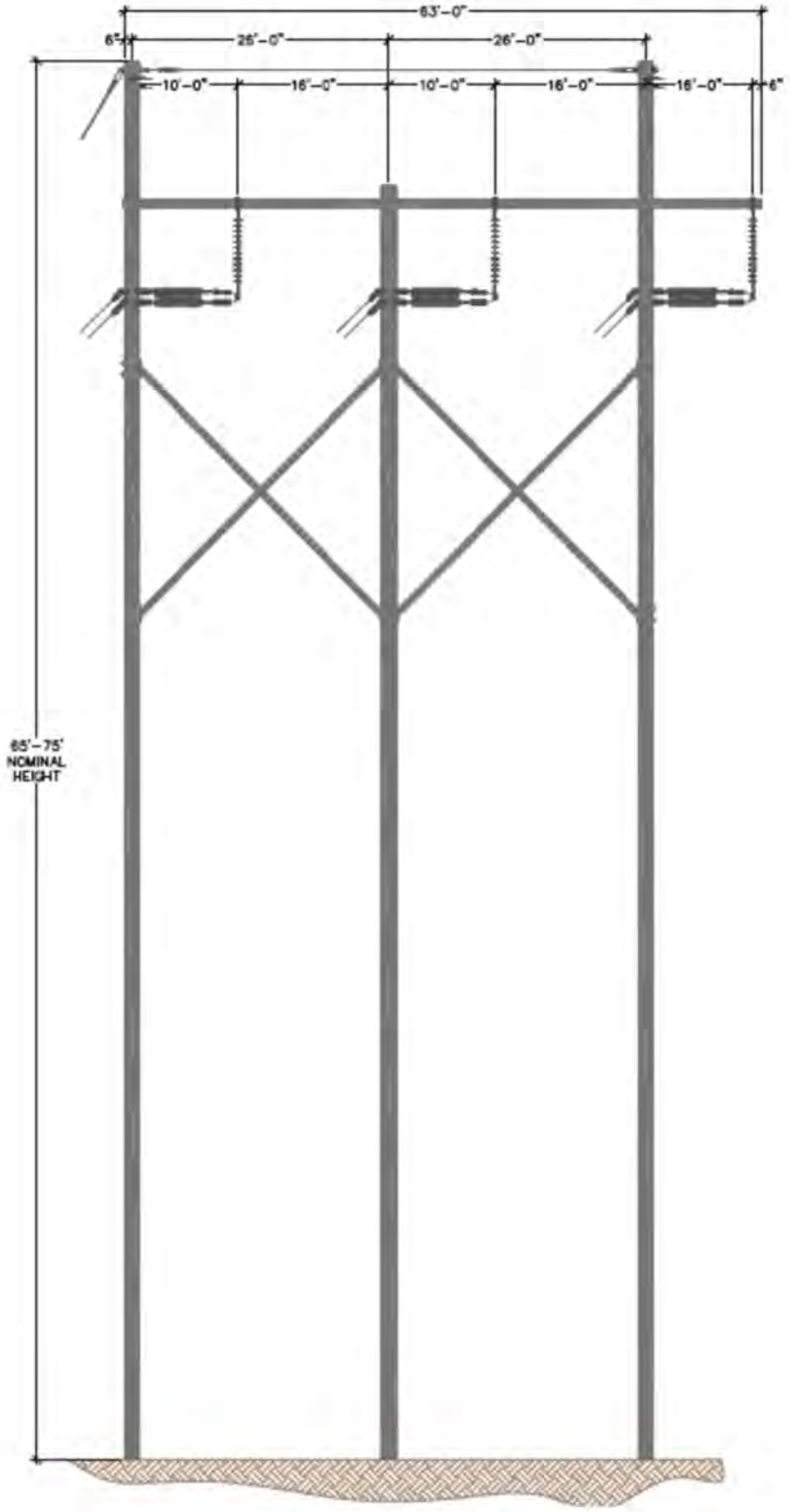


Figure 2-5 Steel Single-Pole Self-Supporting Angle Structure

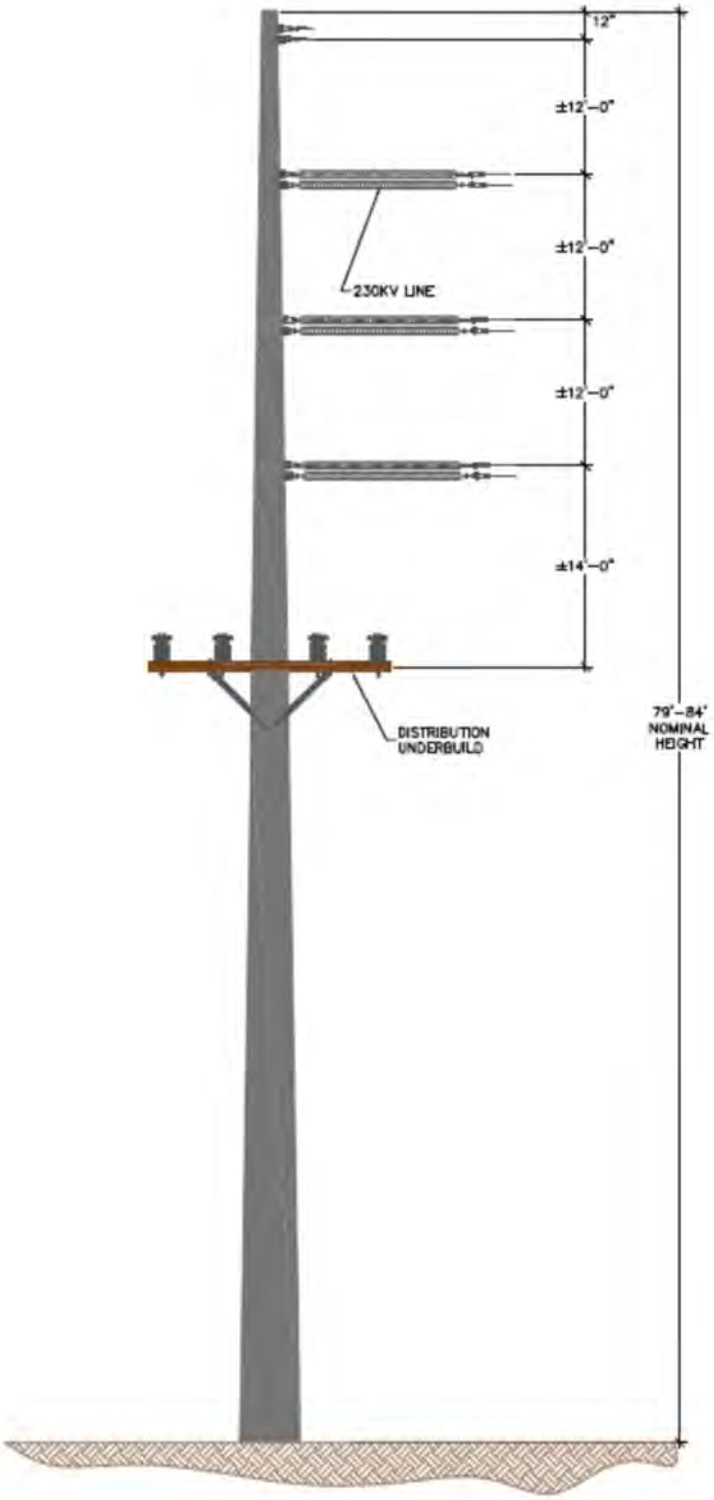
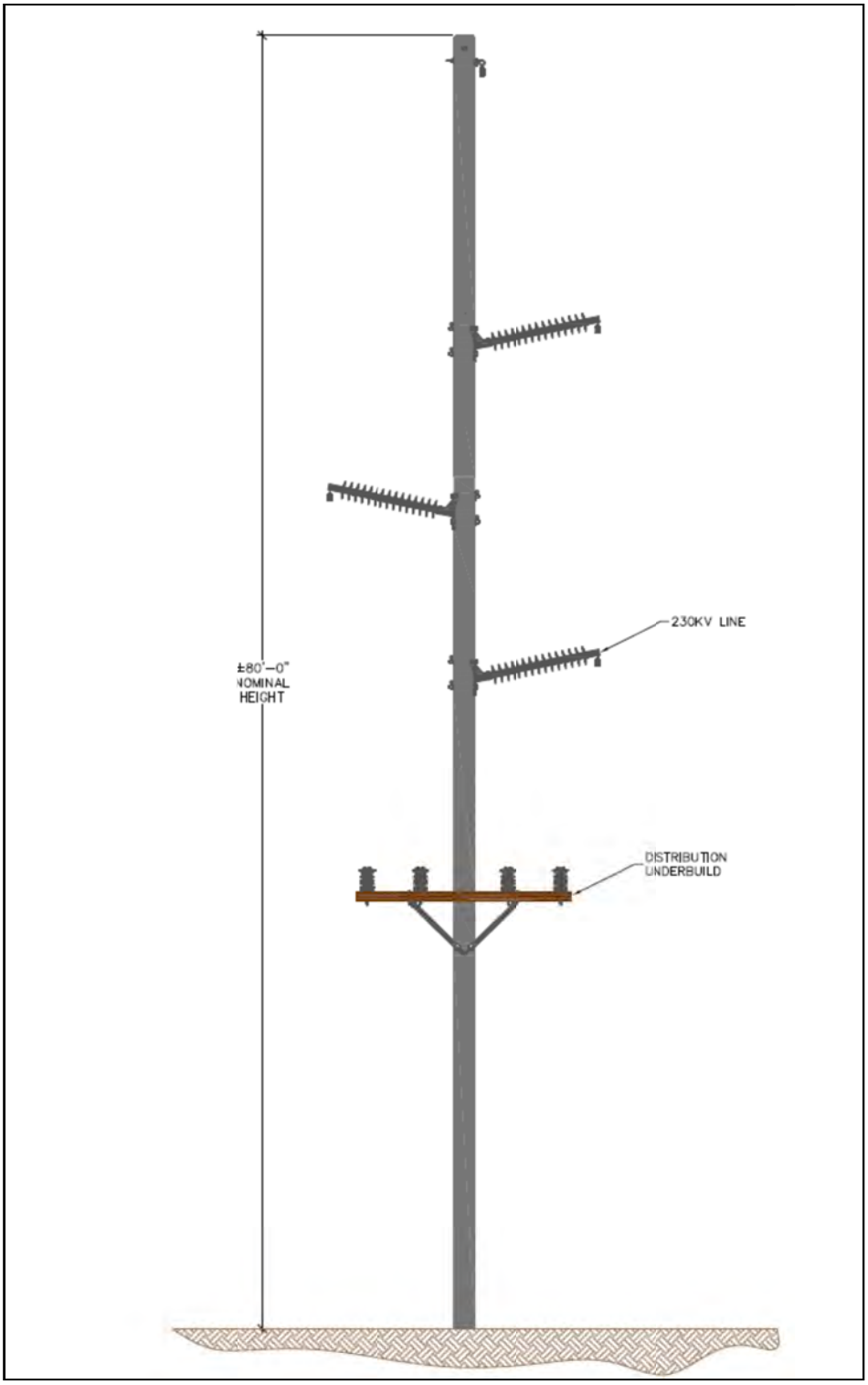


Figure 2-6 Single-Pole Staggered Tangent Structure Typical Drawing



1.06 inches in diameter. The typical distance between structures would be approximately 1,000 feet for two- and three-pole structures and approximately 400 feet for single-pole structures. The minimum ground clearance for the 230-kV transmission line would be 26 feet.

The proposed 230-kV system improvements were designed to accommodate 135 MW of generation with projections of up to 100 MW of additional generation in the area. If the proposed generation levels are reduced or eliminated, the remaining generation could be connected at 120 kV or even 60 kV into the Fallon area, Studies completed to date have only analyzed the maximum generation levels proposed by the developers. Sensitivity studies to determine the various generation levels relative to the different interconnection voltages have not been completed.

Transmission Line Construction

The construction workforce for the transmission line would consist of approximately 25 to 50 personnel. Project construction would also require additional support personnel contracted by SPPC, including construction inspectors, surveyors, project managers, and environmental inspectors.

In order to accommodate construction activities, SPPC would require a temporary 300-foot-wide ROW for the 230-kV transmission line. To accommodate construction equipment and activities, temporary work pads, which would be approximately 1.5 acres for three-pole angle structures, 0.75 acre for H-frame structures and single-pole angle structures, and 0.30 acre for single-pole staggered tangent structures, would be necessary at each transmission structure site.

The project would be constructed using BMPs and in accordance to all relevant codes (e.g., National Electric Safety Code and Uniform Building Code). Qualified specialists would be employed during the construction to address special site conditions, such as geotechnical engineers to plan and design for slope stability and seismic events.

Prior to construction, a revised POD would be developed and submitted to BLM and Reclamation for approval. The POD would outline the specifics of how the proposed project would be constructed, operated, and maintained and would include monitoring measures to ensure all commitments are fulfilled. SPPC would implement the applicable mitigation measures and best management practices identified in **Appendix E**, Environmental Protection Measures and Best Management Practices, during construction and operation of the project. In addition, several separate plans would be developed to address specific issues, potentially including the following: 1) general spill prevention control, 2) fire, emergency preparedness, and response, 3) blasting, transportation management, flagging, and fencing, 4) weed management, 5) stream, wetland, well, spring, and canal protection, 6) reclamation and habitat restoration, 7) wildlife protection, and 8) soil conservation and erosion/dust

control. The POD would also outline the exact access road, staging area, and stringing area locations. Any additional resource studies would be completed and approved by the BLM prior to issuing a short-term ROW for construction purposes and the Notice to Proceed. Implementing appropriate procedures and mitigation measures outlined in this EIS would be included in the POD. The following sections discuss the approximate construction methods to be used for the transmission line project.

Stringing Sites. These sites are necessary to install the conductor for the 230-kV and 60-kV transmission lines. Conductor stringing sites would be located at approximately 2- to 3-mile intervals, would be 500 feet in length and up to 300 feet wide, and would connect 15 to 50 poles. Stringing areas located at angle points may extend beyond the standard 300-foot survey corridor and would each have a radius of approximately 600 feet. The stringing area locations would be addressed in the POD, and any additional resource studies would be completed and approved by the BLM prior to issuing the Notice to Proceed and by Reclamation prior to issuance of licenses and letters of concurrence.

Staging Areas. Approximately three staging areas, which would each be a minimum of 5 acres, would be established during construction to stage equipment and materials. The locations would be addressed in the POD, and any additional resource studies would be completed and accepted by the BLM prior to BLM issuing their Notice to Proceed.

Placement of the proposed structures and installation of the transmission lines would be conducted as follows:

Mobilization and Staging. A crew of 25 to 50 workers would mobilize to the site approximately 1 to 2 weeks prior to the start of work. During this time, they would transport equipment and construction materials to designated construction staging areas.

Preconstruction Surveying and Staking. The initial activity prior to construction is the engineering survey and staking of project facilities. This would include marking the locations of structures, anchor sites, staging and material yards (if known), wire setup sites, access roads, switching station and the substation. In addition, signs, flags, and/or fencing would be used to delineate project features, such as access and sensitive resource areas.

Once the project area is staked, any supplemental cultural surveys, preconstruction plant and wildlife surveys, as required, would be completed prior to the commencement of ground clearing as outlined in the POD. Additional staking may be required just prior to construction to refresh previously installed stakes and flagging and/or delineate any sensitive resource areas identified during the preconstruction field surveys.

Access Road Construction. Construction personnel would use numerous existing access roads to transport materials and equipment to and from the switching station, substations, transmission line corridor, staging areas, and for fiber optic installation. The following types of access roads would be used during construction:

- Existing paved roads;
- Existing dirt/gravel roads that require improvements (e.g., widening, blading, importation of materials to accommodate construction equipment);
- Temporary spur roads; and
- Centerline travel route.

SPPC would use existing access roads to the maximum extent feasible. Intermittent blading with bulldozers, graders, or equivalent machinery would be used to improve existing dirt and gravel roads for use by construction machinery. Additionally, road work outside of the permanent ROW, including creating spur roads from existing roads, may be required under a short-term ROW once the final route has been selected and project design has been completed. Any additional disturbance outside the permanent ROW would be addressed in the POD. The POD would stipulate additional resource surveys that may be required by BLM in order for SPPC to obtain a Notice to Proceed for activities not previously analyzed. All areas temporarily disturbed during construction activities would be reclaimed following project development.

To accommodate temporary centerline travel routes along the transmission line ROW, a temporary 10-foot-wide centerline travel road would be used. In areas where vegetation removal is necessary, vegetation would be cleared, primarily by a mower or hydroaxe, leaving the root systems intact to allow for soil stabilization and possible regrowth. Intermittent blading of the ROW may be necessary to ensure that rubber-tired equipment can traverse the terrain. Any excess soil would be retained for reclamation post construction.

ROW Preparation. In order to establish work areas (i.e., staging and stringing areas) where poles and conductors would be stored and/or installed, vegetation clearing, topsoil removal and protection, and grading within the ROW may be necessary. In all locations, vegetation removal would be minimized to the maximum extent possible. In order to stage equipment and conduct work, the structure work areas and stringing sites would require a relatively flat surface; therefore, the areas may be graded and gravel and/or soil may be imported to achieve the necessary elevation. The imported gravel and/or soil would be removed upon completion of construction, and the topsoil would be replaced.

Structure Placement. Materials such as transmission poles, insulators, hardware, and guy wire anchors would be delivered from the staging areas to each

transmission structure site. Assembly crews would attach insulators, travelers, and hardware to form a complete structural unit. H-frame structures would consist of two direct-buried poles connected by an "X-brace," with a horizontal cross-arm member mounted above the brace to support the electrical transmission lines. Three-pole structures would consist of three direct-buried poles supported by guy wires with 40- to 60-foot guy leads and soil anchors. Single-pole structures would consist of a direct-buried steel pole, with angles supported by guy wires and soil anchors. Self-supporting steel poles would be placed on concrete foundations within the City of Fallon or where guy wires would cause conflicts with existing land uses. Erection crews would place the assembled structures into excavated holes using a large mobile crane. The poles for the H-frames, three-pole angle structures, and single-pole tangents would be set in holes that are approximately three feet wide and ten feet deep, which are drilled by a truck-mounted auger or equivalent piece of equipment. These holes would be backfilled with native or imported materials or concrete. Guy wires to support the angle poles would be used to plumb the structures. As a safety precaution, guy wires would be made more visible if they cross over designated access roads. Signs, flagging, or other marking would be used to indicate the presence of guy wires. Where self-supporting steel angle poles are required, a concrete foundation would be poured, and the pole would be secured to the concrete foundation with anchor bolts. The size of the concrete foundation would depend on the loading at each individual structure and the type of soil encountered. Typical concrete foundations are expected to be 6 to 8 feet in diameter and 20 to 30 feet deep.

Conductor Placement. The installation of conductors and shield wires requires the following four-step process:

1. Install crossing structures (where necessary);
2. Install sock line (wire pull ropes);
3. Pull conductors and shield wires; and
4. Sag and connect conductors and shield wires.

Prior to installing the proposed overhead 230-kV conductor, temporary wooden pole crossing structures would be installed at road crossings and other locations where the proposed conductor could come in contact with existing electrical and communication facilities or vehicular and/or pedestrian traffic in the event the line accidentally falls during stringing operations. An auger would be used to excavate the holes where the crossing structures would be installed, and a crane would lift the structures into place. No concrete foundations would be required to set the crossing structures.

The temporary crossing structures would be removed following the completion of conductor-stringing operations, and the holes would be backfilled with excavated soil. As an alternative to crossing structures, flaggers may be used to

temporarily hold traffic for brief periods of time while the overhead line is installed at road crossings. Travelers would be attached to the insulators prior to pole setting. The travelers allow the conductor to be pulled between poles until the entire line is ready to be clipped in and pulled up to the final tension position. Conductor-stringing operations would begin by pulling a sock line (a small cable used to pull the conductor) onto the travelers from pole to pole using aerial manlifts or a construction vehicle traveling along access roads or the centerline travel route. Once the sock line is installed, it would be attached to reels of conductor or shield wire at the wire setup sites and pulled through in the reverse direction back through the travelers.

During the pulling process, enough tension would be maintained to keep the wires above ground, avoiding any damage to the conductors due to dragging. After the conductors and shield wires have been strung, they would be sagged to the proper tension and clipped into the insulators.

Site Cleanup and Demobilization. Surplus materials, equipment, and construction debris would be removed at the completion of construction activities. All man-made construction debris would be removed and disposed of appropriately at permitted landfill sites. Cleared vegetation would be shredded and distributed over the ROW as mulch and erosion control or would be disposed of off site, depending on landowner and agency agreements. Rocks and topsoil removed during access road grading and foundation excavation would be redistributed over the ROW to resemble adjacent site conditions.

Restoration and Reclamation. After construction has been completed, all existing roads would be left in a condition equal to or better than their preconstruction condition, as directed by the BLM or private landowner, as applicable. Additionally, all other areas disturbed by construction activities, including temporary access and spur roads, would be recontoured, decompacted, and seeded or left in place as directed by the BLM or private landowner. Excess soil removed during construction would be replaced.

BLM-approved seed mixes would be applied to these disturbed areas. SPPC would attempt to close or restrict vehicle access to areas that have been seeded until the reclamation success criteria have been achieved.

The staging areas would be restored to the condition they were in prior to the start of construction or as otherwise agreed upon by SPPC and the property owner. SPPC would not leave the site in a condition that would cause nuisance, dust, or weed infestation. If unspecified by the owner, reclamation would be in accordance with the POD.

After construction has been completed, SPPC would require a permanent ROW of 125 feet (62.5 feet on either side of the centerline) for the H-frame pole line and 60 feet (30 feet on either side of the centerline) for the single pole

line along the length of the 230-kV transmission line in order to conduct operations and maintenance activities.

60-kV Electric Line Folds

Two existing 60-kV transmission lines currently run east-west along Sheckler Road on their way to the Fallon Substation. These two lines pass in front of and would be "folded" into the new Greenwave Substation. The folds would be constructed on four new single-pole angle structures directly across the street from the new substation. The four 60-kV transmission lines would cross over Sheckler Road and would be conductored with twelve 397.5 MCM aluminum conductors, each 0.72 inch in diameter and tied to the existing power poles.

Construction of the electric line folds would take place within the existing 60-kV transmission line ROW, the Sheckler Road ROW, and on the Greenwave property. SPPC construction methods would be the same as identified for the 230-kV transmission line.

After construction has been completed, SPPC would require a permanent ROW of 100 feet (50 feet on either side of the centerline) for the 60-kV transmission lines in order to conduct operations and maintenance activities.

Communications

The 230-kV transmission system would require redundant and diverse communications paths for the control and protection of the line. The new 230-kV transmission line would be constructed with an integral fiber optic cable as part of the basic design that would provide the primary protection path.

The communication system would also have microwave systems to provide the secondary communication path for the line. The Bass Flat Switching Station would have a 110-foot microwave tower to allow communication with the SPPC Microwave site at Eagle Ridge. There would also be fiber optic connections made from the proposed Greenwave Substation to the SPPC fiber cable located along Highway 50. The connection to Greenwave Substation would be approximately 1.3 miles on existing pole lines along Allen Road.

Operation and Maintenance

SPPC proposes to have the transmission lines and associated facilities operational and in service by December 2013. Operations and maintenance would implement the appropriate procedures and mitigation measures as outlined in the POD. SPPC would conduct annual inspections of the transmission line. Annual inspections would be conducted using helicopters, all-terrain vehicles, and/or line trucks. The inspections would involve a visual review of the line along a path that is roughly parallel to the centerline and along existing dirt access roads.

In addition to the annual inspections, SPPC operations and maintenance personnel would conduct structure-climbing inspections every 10 years. These

inspections would include accessing each transmission structure site using four-wheel-drive vehicles on existing dirt access roads. At each structure site, SPPC personnel would climb the structure to inspect the integrity and condition of the hardware and insulators.

Trees that could interfere with the safe operation of the transmission line would be trimmed or removed as needed over the life of the project. Implementing appropriate procedures and mitigation measures outlined in this EIS would be included in the POD.

SPPC personnel would also require access to the line in the event of an emergency situation or if maintenance of a transmission structure is necessary. Under these circumstances, the transmission line would be accessed by line trucks using existing dirt access roads and/or centerline travel route or by helicopter.

Sierra Pacific Power Company - No Action

Under the No Action Alternative, the project would not be implemented. The No Action Alternative would not meet the stated purpose and need; however, it is carried forward for detailed analysis in accordance with CEQ guidance in order to provide a benchmark against which impacts from the action Alternatives can be evaluated (40 CFR 1502.11[d]).

Ormat Technologies Proposed Action– Carson Lake Geothermal Project

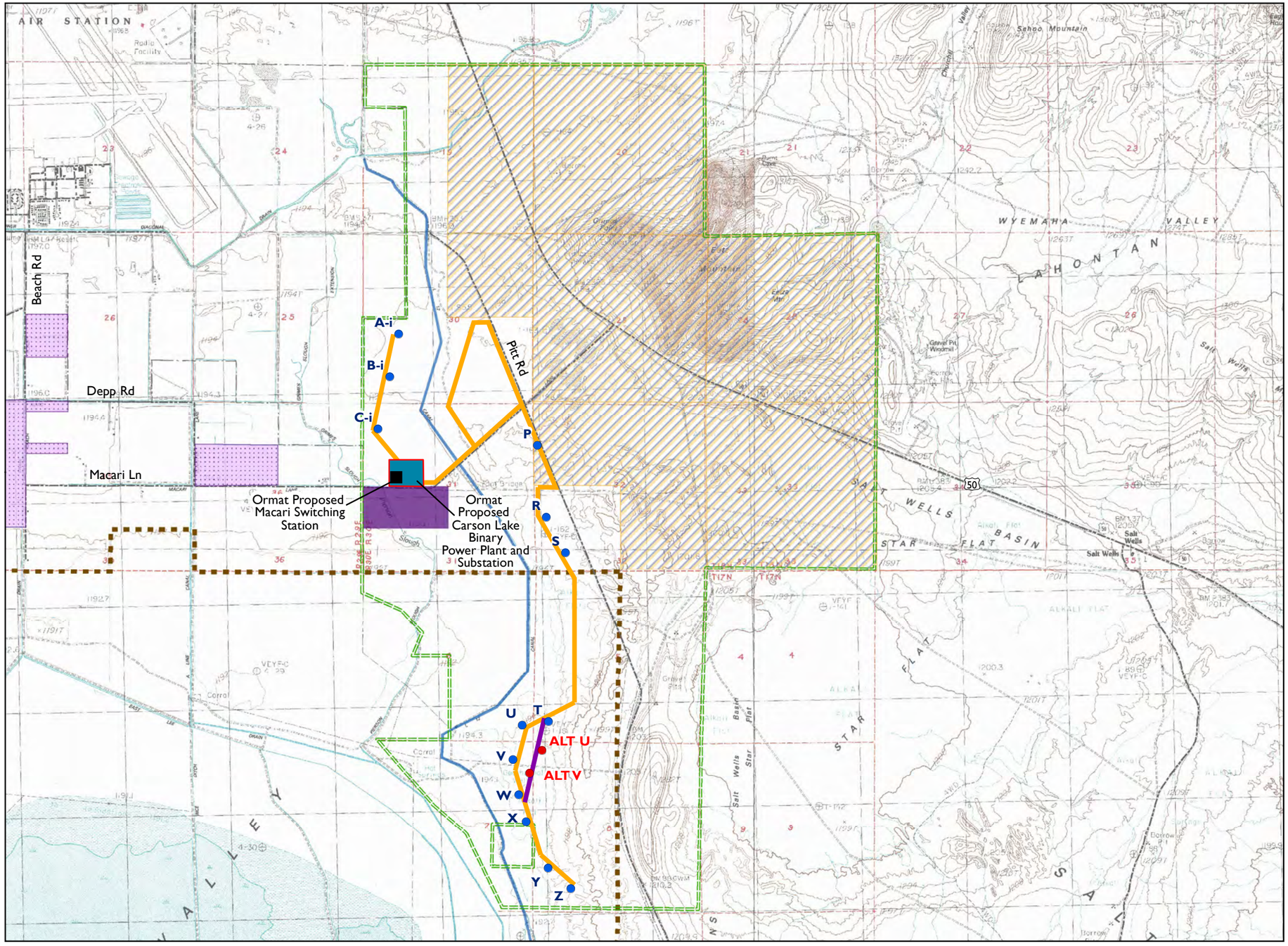
Summary

The Proposed Action includes development of the Carson Lake Binary Power Plant and Substation, the Macari Switching Station, a 230-kV transmission line between the Carson Lake Substation and the Macari Switching Station all within a private 80 acre parcel. Up to 13 well pads in addition to the 12 previously approved well pads (11 well pads were analyzed in the EA (EA-NV-030-07-006)f and authorized by BLM on July 25, 2008 and one well pad was approved under a DNA), associated pipelines, and roads would also be constructed. Ormat would adhere to the lease stipulations identified in **Appendix B**, Lease Stipulations and Conditions of Approval, during construction and operation of the project. Ormat would finalize the POU prior to construction of their power facilities. Implementing appropriate procedures as identified in **Appendix E**, Environmental Protection Measures and Best Management Practices, and mitigation measures outlined in this EIS would be included in the POU.

Table 2-2, Carson Lake Geothermal Development Proposed Project Facilities, outlines the proposed project components. **Appendix A**, Typical Geothermal Resource Development and Transmission Tools, explains the functions of these components in further detail. **Figure 2-7**, Ormat Power Company's Proposed and Alternative Project Facilities, shows the locations where each component would be located.

Table 2-2
Carson Lake Geothermal Development Proposed Project Facilities

Project Component	Description/Location	Temporary Disturbance	Permanent Disturbance
Carson Lake Binary Power Plant	The power plant would be a combination wet- and air-cooled power plant and would be located on private land owned by Ormat. The location where the power plant would be built is shown on Figure 2-7.	Approximately 30 acres	Approximately 20 acres
Carson Lake Binary Power Plant Substation	The substation would be located adjacent to the power plant as shown on Figure 2-7.	Approximately 0.5 acre within the footprint of the Carson Lake Binary Power Plant site.	Approximately 0.5 acre within the footprint of the Carson Lake Binary Power Plant site.
Macari Switching Station	Immediately west of the Carson Lake Binary Power Plant and Substation as shown on Figure 2-7.	Approximately 5.75 acres within the footprint of the Carson Lake Binary Power Plant site.	Approximately 5.75 acres within the footprint of the Carson Lake Binary Power Plant site.
Interconnect Transmission Line	Ormat would construct approximately 200 feet of transmission line to connect the Carson Lake Substation to the proposed Macari Switching Station.	Length: 200 feet Corridor Width: 300 feet Total Area of Disturbance (within Carson Lake Binary Power Plant site): ~ 0.6 acres	Length: 200 feet Corridor Width: 125 feet Total Area of Disturbance (within Carson Lake Binary Power Plant site): ~ 0.6 acres
Pipelines	The final pipeline corridor width would be 155 feet (100 feet wide to accommodate the expansion joints, 5 feet for pipeline, and 50 feet for road).	Length: 6.5 miles Corridor Construction width: 300 feet Total Area of Disturbance: 236.36 acres	Length: 6.5 miles Corridor width: 155 feet Total Area of Disturbance: 122 acres
Well Pads	Up to 13 new well pad locations would be built as shown on Figure 2-7. Well pads would accommodate multiple wells (i.e., production, injection, and/or observation wells).	13 well pads at 4.2 acres each: 54.6 acres	13 well pads at 4.2 acres each: 54.6 acres
Access Roads	Access roads would extend from existing unpaved roads to project components as shown in Figure 2-7.	Length: 4.6 miles Width: 50 feet Total Disturbance: Approximately 11 acres within the footprint of the pipeline corridor.	Length: 4.6 miles Width: 20 feet Total Disturbance: Approximately 11 acres within the footprint of the pipeline corridor.
Total Estimated Disturbance:		**332 acres**	**208 acres**



Ormat Proposed and Alternative Project Facilities

Churchill County, Nevada

Ormat Facilities
- Ormat Project Area Boundary
- Proposed Well Pad
- Alternative Well Pad
- Proposed Pipeline
- Alternative Pipeline
- Proposed Power Plant and Substation

Other Features
- Proposed Switching Station
- CLP Title Transfer
- Existing Conservation Easement
- Proposed Conservation Easement
- No Surface Occupancy
- Newlands Project Canal

Source: BLM 2010, Churchill County 2010, Omat 2010

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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 2-7

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Figure 2-8, Land Status of Ormat Project Area, shows the land ownership status for all lands within the project area.

Carson Lake Binary Power Plant

The proposed binary geothermal power plant facility would be designed to produce 40 MW of electricity. The combined air- and wet-cooled power plant systems and equipment would be designed and selected for a commercial life of 30 years. The power plant would be sited on private land, just southeast of NAS Fallon (Figure 2-7). The power plant would require 15 acres for the generator and the maintenance area. The entire construction area, including the Carson Lake Substation and the Macari Switching Station, would be 30 acres with at least 10 acres reclaimed for a total permanent disturbance of 20 acres. Table 2-2 provides details on the Carson Lake Binary Power Plant location and major components.

Plant Construction

After the initial project survey and power plant layout has been established, clearing and grubbing would take place, and topsoil would be stockpiled and revegetated after completion of the project to save for future reclamation of the site. Grading and fill activities necessary for the power plant and substation would run 3 to 4 weeks.

The power plant location is topographically flat and would necessitate fill to a depth of approximately 24 inches with six inches of gravel surfacing placed after final grading of the site. Grading design would be based on local topography as shown on topographic maps.

All equipment would be brought to the project site on trucks. The power plant construction site would be accessed from US Highway 50 via Macari Lane. The facility provides for fire monitors and hydrants located in strategic locations. These units are powered by a dedicated diesel generator and would utilize on-site water storage, geothermal fluid, and or water from the cooling tower water for fire suppression. The facility and substation would be fenced with chain link fencing and security wire along the top.

Plant Operations

Ormat is proposing pentane as the working fluid. Pentane is a low-toxic flammable product. The facility circulates approximately 30,000 gallons of pentane through the system with approximately one-fourth stored in a 10,000-gallon storage tank. The storage tank receives makeup pentane, and when conducting major maintenance activities, pentane from the circulating portion of the facility is transferred to the excess capacity in the storage tank.

The power plant would include a septic system for wastewater disposal. Sanitary water supplies would be purchased and delivered by a water delivery truck and stored on site. Potable water for drinking would be provided by a local bottle water purveyor.

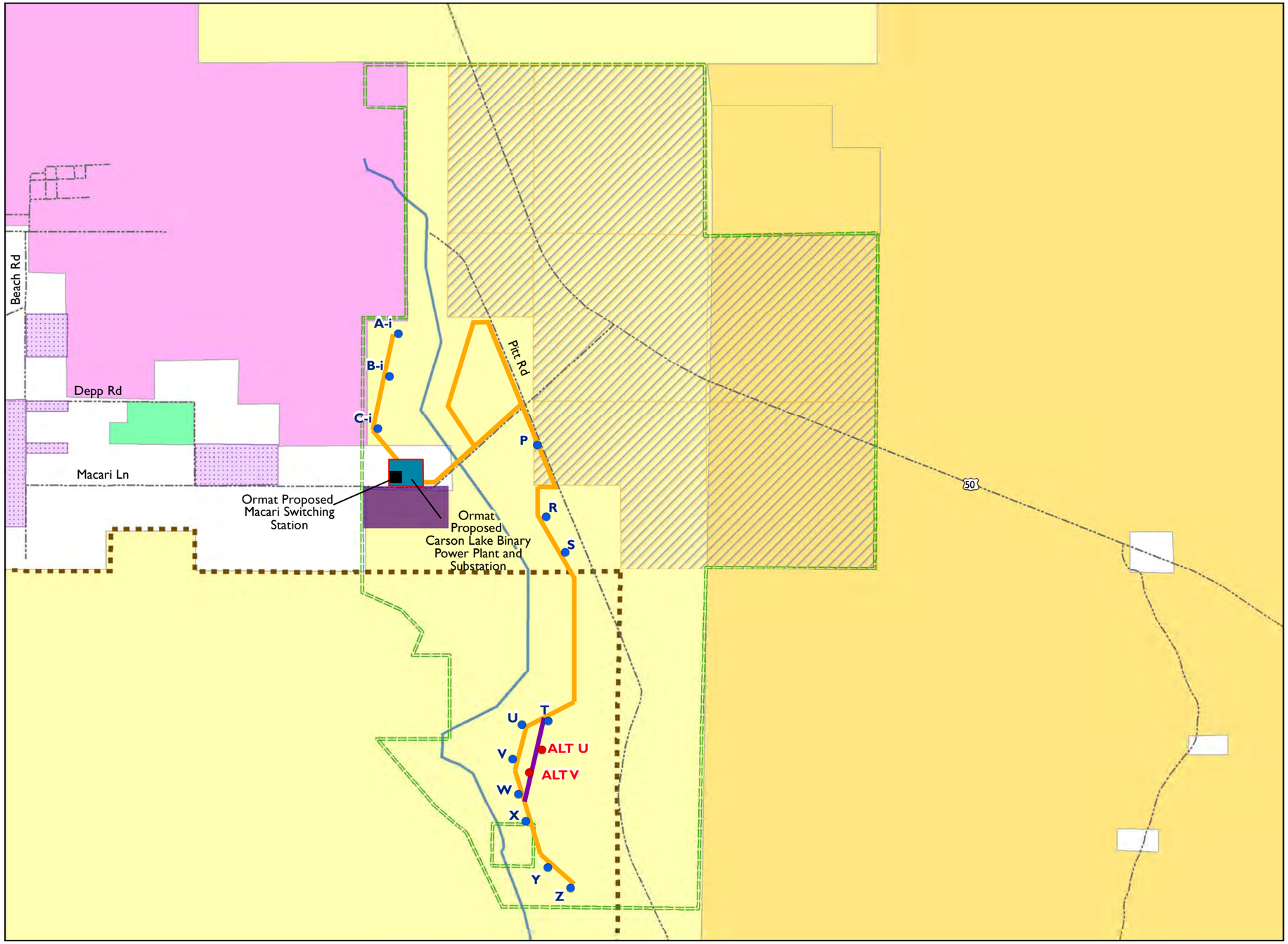
Cooling System

The efficiency of the power plant is largely determined by the dry bulb temperature of the ambient air, with the efficiency going down as the temperature goes up. The objective of water-assisted cooling is to reduce the dry bulb temperature and gain operating efficiency at peak energy demand intervals. Efficiencies gained for wet cooling typically provide generation increases of 25 percent. The proposed cooling systems would be a combination of a dry air cooling tower operating year round and two types of wet cooling operating more or less from May through October. The following describes the three types of cooling systems:

- Air-cooled condensers are large open-structure air-cooled heat exchangers. Large-finned tube radiators lie horizontal 20 feet above ground on steel beams. Large fans (13-foot diameter) on top of the tube assemblies draw ambient air at the dry bulb temperature up through the tubes, cooling and condensing the binary fluid flowing through the inside of the tubes. The total height for air-cooled structures is between 42 and 52 feet.
- The water-assisted air-cooled condensers system sprays water beneath the air-cooled condensers, and evaporative cooling allows air traveling to the air condensers to be cooled nearer to the wet bulb temperature, which is frequently 25 or more degrees lower, thereby increasing the efficiency and output of the facilities.
- Wet cooling consists of a traditional 45-foot tower as described in **Appendix A**, Typical Geothermal Resource Development and Transmission Tools. Operationally, portions of the hot vaporized pentane would be diverted through a water-cooled heat exchanger (condenser) where heat is transferred from the pentane to the water; the heated water is then forwarded to the cooling tower. The water is cooled in the cooling tower and is returned to the heat exchanger.

Cooling water consumption is anticipated to be 2,500 to 3,500 gallons per minute (gpm) through the operational season. Water rights would be purchased from an individual within the Truckee-Carson Irrigation District (TCID) and delivered to the site via the Reclamation irrigation canal paralleling the east property boundary. Design of the water withdrawal apparatus from the irrigation canal would be consistent with Reclamation construction and operation requirements. Ormat would need a separate authorization from the State Engineer to obtain the water rights necessary for use in the project.

A cooling tower plume typically occurs during times of high humidity when the water vapor is not readily absorbed to the atmosphere. Within the Carson Lake region, this usually occurs in the colder months when the air temperature drops



Land Status of Ormat Project Area

Churchill County, Nevada

Ormat Facilities
- Ormat Project Area Boundary
- Proposed Well Pad
- Alternative Well Pad
- Proposed Pipeline
- Alternative Pipeline
- Proposed Power Plant and Substation

Other Features
- Proposed Switching Station
- CLP Title Transfer
- Existing Conservation Easement
- Proposed Conservation Easement
- No Surface Occupancy
- Newlands Project Canal

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 2010, Churchill County 2010, Omat 2010

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Miles

January 2011
NAD 1983 HARN State Plane Nevada West
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Figure 2-8

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and the air humidity increases. Due to the proximity of NAS Fallon operations and visual sensitivities associated with Grimes Point Archaeological Site, Ormat would generally cease operations of wet cooling from November to May, minimizing operational times conducive to a large vapor plume.

Cooling tower "drift" (a type of moisture release) results from small quantities of water droplets of 10 microns or greater and small amounts of dust and dissolved and suspended solids that become airborne when the water droplets evaporate and are carried out with the exhaust air. The facility would employ drift eliminators to control particulate emissions to levels below levels required by the Nevada Department of Environmental Protection (NDEP), Bureau of Air Pollution Control.

Communications

In order to handle communications (command, control, voice, and Internet) at 18 gigahertz (GHz) Ethernet/T-1 speeds, Ormat would arrange to have installed an approximately 35-foot-tall microwave tower at the Carson Lake Binary Power Plant site.

Carson Lake Substation

Ormat would construct a substation on site to convert the lower voltage generated at the Carson Lake Binary Power Plant to a higher power voltage. This would then be connected to a proposed 230-kV transmission line between the substation and the proposed Macari Switching Station.

This electrical substation would be located within the 20-acre Carson Lake Binary Power Plant site and would have a footprint of approximately 300 by 200 feet. Surrounding the substation would be an 8-foot-tall chain-link fence with vehicle and personnel access gates. The surface of the substation would consist of crushed rock and would be bermed for spill containment.

The substation equipment would be installed on concrete foundation. The electrical generators at the power plant would be connected to the substation via a 13.8-kV transmission line.

Macari Switching Station

In order to connect the Ormat Carson Lake Binary Power Plant to the SPPC 230-kV transmission line, Ormat proposes to construct the Macari Switching Station. This switching station would be within the 20-acre Carson Lake Binary Power Plant site and would consist of a single radial circuit breaker. The approximate size of the switching station would be 500 feet by 500 feet (approximately 6 acres). The switching station would be constructed similar to the Bass Flat Switching Station as described under the SPPC Proposed Action, described previously.

Transmission Line

Ormat proposes to construct a 230-kV transmission line approximately 200 feet in length from the proposed Carson Lake Binary Power Plant Substation to the proposed Macari Switching Station. The transmission line would include a 230-kV transmission switch structure located between the two facilities. The line would be constructed using similar materials and methods as identified in the SPPC 230-kV transmission line proposal, described previously. In addition, a transmission line would be constructed from the Macari Switching Station to the SPPC 230-kV transmission line, which will run adjacent to the Macari site. Each structure would carry a single overhead ground wire/fiber optic cable for lightning protection and fiber-optic communications. A steel dead-end structure measuring 30 feet wide by 45 feet tall would provide a termination point for the overhead Ormat 230-kV interconnection line to the Macari Switching Station (see **Appendix A**, Typical Geothermal Resource Development and Transmission Tools).

Pipelines

The permanent gathering system for transporting hot geothermal fluid from the production wells to the power plant and from the power plant to the injection wells would use insulated pipelines located mostly on public lands. The collection pipeline system would vary in diameter from 20 to 30 inches. Piping would extend from the power plant to the well heads (Figure 2-7). The injection piping system would vary in diameter from 12 to 28 inches. Piping would extend from the power plant to the injection wells. The pipeline routes would generally follow the proposed well pad access roads, but could be located anywhere within the areas identified on Figure 2-7. The proposed construction pipeline corridor width is 300 feet to accommodate pipeline widths, expansion joints, and the access road. The final width would be 155 feet.

Construction of the pipelines may require grading of the pipeline corridor, which would allow permanent access to the pipelines for maintenance during operations. Any temporary construction access to the pipeline corridor would be reclaimed after completion of construction.

The construction phase of the pipeline would begin with excavations for the pre-fabricated pipeline supports; the pipeline would be supported every 30 feet by supports requiring a 10-square-foot footprint. Each support would be drilled with a truck-mounted auger or a similar piece of equipment. Pipe sections would be delivered and placed along the pipeline corridor and then would be lifted in place using a small crane and welded in place. When complete, the top of the pipeline would be approximately three feet above ground. Electric power and instrumentation cables would either be installed in steel conduit constructed on the pipe supports adjacent to the pipeline, or, in some locations, buried along the pipeline route. Pipelines that cross roads would be undergrounded in a "U" shaped conduit. The pipeline canal crossing along Macari Lane would be constructed to protect the canal embankment by avoiding

the toe on each side of the canal. The distance from the centerline of the canal to the toe of each side is approximately 75 feet; therefore, the span of the pipeline over the canal would be approximately 150 feet. Road crossings and irrigation canal crossings would comply with the Reclamation Design Engineering and Operation and Maintenance Guidelines for crossings (Reclamation 2008). The pipeline would also provide sufficient vertical clearance for Reclamation operations and maintenance of the canal.

Well Pads

Thirteen (13) new well pads are being proposed. Because of the type of power plant proposed in this project, multiple types of wells (i.e. production, injection, and observation wells) would be necessary to provide enough geothermal fluid to operate the generator at the power plant. For this reason, the newly proposed well pads would be 400 feet by 450 feet (4.2 acres) each to accommodate the aforementioned multiple wells (see **Appendix A**, Typical Geothermal Resource Development and Transmission Tools, for a typical well pad layout). Well pads would be constructed adjacent to pipeline access roads. **Table 2-3**, Proposed Well Pads, describes the 13 proposed well pads.

Table 2-3
Proposed Well Pads

Well Pad Number	Kettlemen Number	Lease Number	Township/ Range	Section
A-i	25-30	NVN 079105	T18N R30E	30
B-i	27-30	NVN 079105	T18N R30E	30
C-i	12-31	NVN 079104	T18N R30E	31
P	12-32	NVN 079104	T18N R30E	32
R	86-31	NVN 079104	T18N R30E	31
S	88-31	NVN 079104	T18N R30E	31
T	86-6	NVN 079106	T 17N R30E	6
U	88-6	NVN 079106	T 17N R30E	6
V	81-7	NVN 079106	T 17N R30E	7
W	83-7	NVN 079106	T 17N R30E	7
X	85-7	NVN 079106	T 17N R30E	7
Y	17-8	NVN 079106	T 17N R30E	8
Z	27-8	NVN 079106	T 17N R30E	8

Blow-out prevention equipment (BOPE) would be used to protect the human and natural environment during all exploration and production drilling phases. BOPE is further described in **Appendix A**. After completion and testing of each exploration well, Ormat would determine the best use of that well (i.e., to be used as a production, observation, or injection well). The drill rigs would be approximately 178 feet high. The drill rigs would be removed, as would much of the equipment that was necessary for well drilling. For the development phase, well pads requiring additional drilling would be equipped with a 10,000-gallon

water storage truck, mud and water mixing tanks, an aboveground diesel fuel storage tank, a metal equipment building, piping, valves, pipe rack, drillers/geologist trailers, and an unlined reserve pit. Well pads would not be fenced during construction; however, upon completion of drilling and until the site is reclaimed, the well pad and reserve pit would be fenced.

Each existing and/or proposed well pad site would maintain an unlined reserve pit. The reserve pits would be used for the containment and temporary storage of drill cuttings, waste drilling mud, and storm water runoff from the constructed pad. Geothermal fluid produced from the well during flow testing would also drain to the reserve pit. The reserve pit at each well pad would be approximately 100 feet long by 300 feet wide by up to 8 feet deep, and would have a capacity of up to 1.5 million gallons. The pits would be unlined because drilling mud flows into the reserve pit and seals the pit, preventing drilling fluids and other liquid run-off from percolating into local groundwater. The pit would be covered with netting and fenced.

Wells

Production Wells. After the exploration phase is completed, production wells could be drilled and constructed in the next phase of development. Wells that were constructed in the exploration phase that are capable of commercial production would be converted to production wells. No production or injection wells are planned on navy lands under the proposed action. Should the previously approved wells on the navy land be proposed for use in the future, additional NEPA analysis would be required. Proposed production wells would be drilled on 400-foot by 450-foot well pads, as previously described.

Production wells would be constructed to total depths of 1,500 to 10,000 feet. Wellhead dimensions are not expected to exceed a height of five feet above ground or be more than 36 inches in diameter.

During drilling operations, a minimum of 10,000 gallons of cool water and 12,000 pounds of inert, nontoxic, non-hazardous barite (barium sulfate), in addition to other drilling fluids would be stored at the well site for use in preventing well flow ("killing the well"), as necessary.

The well bore would be drilled using non-toxic, temperature-stable drilling mud composed of a bentonite clay-water or polymer-water mix for all wells. Variable concentrations of additives would be added to the drilling mud as needed to increase mud weight, and prevent mud loss. Additional drilling mud would be mixed and added to the mud system as needed to maintain the required quantities.

Compressed air may be added to the drilling mud, or used instead of drilling mud, to reduce the weight of the drilling fluids in the hole and assist in carrying the cuttings to the surface. The air, any drilling mud, rock cuttings, and any

reservoir fluids brought to the surface would be diverted through the separator/rock muffler to separate and discharge the air and water vapor to the air and the drilling mud and cuttings to the reserve pit.

Injection Wells. Ormat proposes to develop injection wells at Well Pads A-i, B-i, and C-i, as shown on Figure 2-7. However, additional injection wells may be located on proposed well pad sites or located as necessary to maintain geothermal reservoir pressures and temperatures. Injection wells would be drilled on 400-foot by 450-foot well pads, as previously described. Approximately four injection wells would be drilled. Injection wells are expected to be completed between a depth of 1,500 and 9,500 feet, depending on the results of exploration. Each injection well would each be drilled and cased to the depth selected by the project geologist.

Observation/Monitoring Wells. Wells not used for production or injection may be used for monitoring the geothermal reservoir. Well pads and access to any wells used as observation wells would be maintained from the exploration phase. No new work would be required.

Access Roads

Existing access roads would be used to the extent feasible. The Ormat Project Area would be accessed from Highway 50 via Macari Lane and Berney Road. Ormat would not use the historic, unaltered section of the Lincoln Highway or old Highway 50 (west of Highway 50, north of Macari Lane) to access the project site. A network of unpaved main access roads exists in the area; these roads would be used as principle travel routes to access roads to individual well pads. These existing unpaved principle access roads would require maintenance during exploration, development, and operation phases and may include the application of gravel to repair damage from traffic during periods of rainfall or snow. To control dust and stabilize the road surface, it may be necessary to apply BLM-approved dust abatement tackafiers.

Access to the power plant and substation would be within the Carson Lake Binary Power Plant footprint and located off of Macari Lane.

Access road construction would be similar to those methods described under the SPPC proposal, including clearing brush and bringing the surface to grade by grading the surface and adding gravel where required. Approximately 4.6 miles of access roads would be collocated along pipeline corridors and would be used as main thoroughfares to well pads and the power plant site. The overall construction width of any newly developed access road would be 50 feet with a post construction width of 20 feet. Proposed access roads to the power plant site, pipe routes, and well pads would have a construction width of 50 feet to accommodate passing and turnarounds. The access roads that remain after construction would be approximately 15 feet wide with 2.5-foot shoulders. Some passing turnout lanes may remain for future operations and maintenance. Vehicle turnarounds would be located on the well pads. The roads would have a

design speed of 10 to 30 miles per hour, built to carry highway loads. The access roads would be maintained by Ormat during construction and operation of the facilities as provided for in the POU.

Material for Construction Fill and Base

Material would be purchased for construction of well pads, access roads, and the power plant (such as construction fill, aggregates, concrete, and asphalt) from local sources. Ormat would not access BLM material sites nor establish on-site processing facilities for construction purposes.

Workforce

The power plant construction would likely require a maximum of 50 workers at peak but would average about 25 on site for the duration of the 8 to 12-month construction period.

Construction of the well field pipelines would require 35 workers over a period of approximately 9 months. Pipelines would be constructed after the wells are drilled and before the power plant begins operation.

Ormat Technologies – No Action

Under the No Action Alternative, the geothermal binary power plant and associated facilities would not be constructed. The No Action Alternative would not facilitate geothermal development or meet the stated purpose and need. The No Action Alternative is carried forward, however, for detailed analysis in accordance with CEQ guidance to provide a benchmark against which impacts from the action Alternatives can be evaluated (40 CFR 1502.11[d]).

Vulcan Proposed Action– Salt Wells Geothermal Development Project

Summary

Vulcan is proposing up to four power plants and associated substations at five possible locations. In addition, a 230-kV interconnection transmission line would be constructed to connect the power plant(s) to Vulcan's proposed Bunejug Switching Station. Vulcan would also construct up to 26 new well pads and associated wells, roads, and pipelines.

Vulcan's proposed project has similar components to those described under the Ormat project proposal. To eliminate redundant descriptions, the similar construction methods can be found under the Ormat project.

Table 2-4, Vulcan Salt Wells Proposed Project Facilities, describes the major components of Vulcan's Proposed Action. Vulcan would adhere to the lease stipulations identified in **Appendix B**, Lease Stipulations and Conditions of Approval, during construction and operation of the project. Vulcan would also finalize the POU/POD prior to construction of their power facilities. Implementing appropriate procedures, as identified in **Appendix E**, Environmental

Table 2-4
Vulcan Salt Wells Proposed Project Facilities

Project Component	Description/Location	Temporary Disturbance	Permanent Disturbance
Proposed Power Plants	Site 1: 2.3 miles south of US Highway 50 and accessed via the main road from the Salt Wells intersection Site 2: 2.9 miles south of US Highway 50 and accessed via the main road from the Salt Wells intersection Site 3: 4.1 miles south of US Highway 50 and accessed via Pit Road Site 4: 0.3 mile south of US Highway 50 and accessed via the main road from the Salt Wells intersection Site 5: 6.6 miles south of US Highway 50 and accessed via Pit Road	A maximum of 4 power plants would be constructed. Each power plant site would result in 23.5 acres of disturbance, including laydown areas. 23.5 acres (including a 5-acre laydown area) x 4 power plants = 94 acres	A maximum of four power plants would be constructed. Each power plant site would result in 23.5 acres of disturbance, including laydown areas. 23.5 acres (including a 5-acre laydown area) x 4 power plants = 94 acres
Proposed Power Plant Substations	One on each power plant site (see Proposed Power Plant Substations). See Figures 2-9 through 2-14	One on each power plant site. Each substation would occupy approximately 1.4 acres within each 23.5-acre power plant site. 1.4 acres x 4 power plants = 5.6 acres	One on each power plant site. Each substation would occupy approximately 1.4 acres within each 23.5-acre power plant site. 1.4 acres x 4 power plants = 5.6 acres
Proposed Bunejug Switching Station	Bunejug Switching Station See Figures 2-9 through 2-14.	5.75 acres	5.75 acres
Interconnect Transmission Lines	From selected power plants to the proposed Bunejug Switching Station.	Maximum buildout with the total length of the possible interconnect transmission lines of 7.9 miles. Temporary Corridor Width: 300 feet 7.9 miles (41,712 feet) x 300 feet = 12,513,600 square feet (287 acres) (temporary)	Maximum buildout with the total length of the possible interconnect transmission lines of 7.9 miles. Permanent Corridor Width: 125 feet 7.9 miles (41,712 feet) x 125 feet = 5,214,000 square feet (120 acres) (permanent)

Table 2-4
Vulcan Salt Wells Proposed Project Facilities

Project Component	Description/Location	Temporary Disturbance	Permanent Disturbance
Pipelines	The permanent pipeline corridor would be 155 feet (100-foot-wide joint, 5 feet for pipeline, and 50 feet for road). See Figures 2-9 through 2-14.	Maximum buildout with the total length of possible pipelines of 19.2 miles. 19.2 miles (101,375 feet) x construction width of 300 feet = 30,412,500 square feet (698 acres)	Maximum buildout with the total length of possible pipelines of 19.2 miles. 19.2 miles (101,375 feet) x 155 feet = 15,713,125 square feet (361 acres)
Well Pads	Up to 26 well pad locations would be built as shown in Figures 2-9 through 2-14 and described in Table 2-6.	Maximum buildout of 26 well pads at 4.2 acres each. 26 well pads x 4.2 acres = Approximately 109 acres	Maximum buildout of 26 well pads at 4.2 acres each. 26 well pads x 4.2 acres= Approximately 109 acres
Geothermal Wells	Production: Approximately 8 per binary power plant and 14 per flash power plant Injection: Approximately 4 per binary power plant and 7 per flash power plant Observation/Monitoring: None See Figures 2-9 through 2-14.	Included in well pad disturbance footprint above.	Included in well pad disturbance footprint above.
Water Wells	Five (5) wells would be required for construction and operation of each 30-MW power plant and its associated facilities (roads, well pads, pipelines, etc.). For maximum build-out (four 30-MW power plants), up to 20 wells could be required. Water wells would be located within a 1-mile radius of their respective power plant site or within an area near the existing well 58-9.	50-foot radius of disturbance around each water well head (0.2 acre) 1 mile of 20-foot-wide corridor for road and pipe (2.5 acres) per well 3 acres of disturbance per water well For maximum buildout, approximately 60 acres of disturbance.	50 foot radius of disturbance around each water well head (0.2 acre) 1 mile of 20-foot-wide corridor for road and pipe (2.5 acres) per well 3 acres of disturbance per water well For maximum buildout, approximately 60 acres of disturbance.
Well Pad Access Roads	See Figures 2-9 through 2-14.	Disturbance acres are included in the pipeline corridor area of disturbance.	Disturbance acres are included in the pipeline corridor area of disturbance.
Total Estimated Disturbance:		**1,260acres**	**756 acres**

Protection Measures and Best Management Practices, and mitigation measures outlined in this EIS would be included in the POU. **Figure 2-9**, Vulcan Power Company's Proposed and Alternative Project Components, shows the location of the Vulcan facilities.

Figure 2-10, Land Status of Vulcan Project Area, shows the land ownership status of all lands within the project area.

Power Plants

Vulcan proposes to develop up to three nominal 30-MW (net) binary geothermal power plants at Power Plant Sites 1, 2, and 4 and either 30-MW (net) binary or 60-MW (net) flash power plants at Power Plant Sites 3 and 5 (**Figures 2-11** through **2-14**, Vulcan Power Company Salt Wells Project – Proposed Sites and Wells) for a maximum output of 120 MW (net).

Proposed Binary Power *Plant*. Vulcan is proposing up to four 30-MW (net) geothermal binary power plants; one each at five potential locations (Figure 2-9) using a combination wet- and/or air-cooled technology. The cooling system technology would be similar to that proposed under Ormat's Carson Lake Binary Power Plant proposal. Vulcan may use wet- and/or air-cooled technology.

Each proposed binary power plant would occupy an 18.4-acre site situated within a 40-acre Survey Area. Each binary power plant site would produce approximately 30-MW (net) output from three 15-MW (gross) turbine-generator sets. Each power plant site would be fenced. The proposed 18.4-acre sites would be large enough to accommodate all the necessary facilities in the power-generating units.

Water Requirements. Vulcan would not require any surface water or purchased water for the Salt Wells geothermal power plants during normal operations. Groundwater wells and/or geothermal fluid from the geothermal reservoir would be used as the primary source for cooling water. **Table 2-5**, Vulcan's Proposed Salt Wells Project Estimated Water Consumption, summarizes the approximate water consumption for each type of power plant and the amount needed under total buildout scenarios.

Table 2-5
Vulcan's Proposed Salt Wells Project Estimated Water Consumption

Proposed Build Out	Consumptive Use (acre-feet/ year)
1-30 MW Binary Power Plant	3,300
1-60 MW Flash Power Plant	5,500
4-30 MW Binary Power Plants	13,200
2-30 MW Binary Power Plants and 1-60 MW Flash Power Plant	12,100

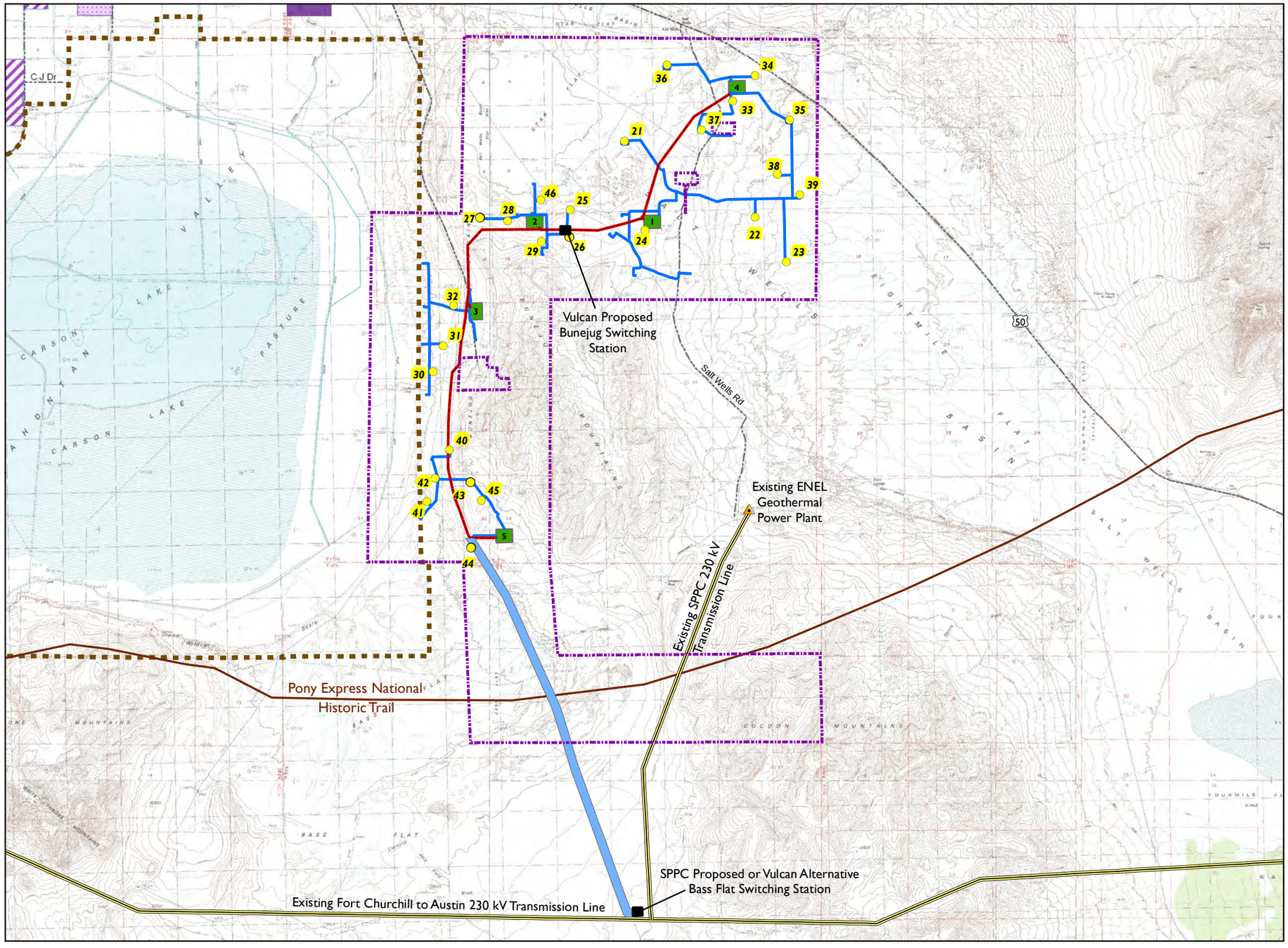
Drilling results from existing exploration Well 58-9, located in Section 9 of Township 17 North, Range 30 East (EA-NV-030-07-05) indicates a zone of cold water at a depth of approximately 750 feet. Vulcan proposes to drill additional groundwater wells in the area of Well 58-9. Vulcan is planning to drill and test other wells in the areas described previously in order to supplement that of Well 58-9 and satisfy the cooling water requirements for the first two 30-MW (net) binary power plants. Vulcan plans to use similar wells for the power plants on the west side of the Bunejug Mountains. The project areas on the west side of the mountains are in a larger sub basin with surface water resources and irrigated agriculture. Vulcan expects that this sub basin would be sufficient to support the proposed development at Sites 3 and 5. Vulcan would need a separate authorization from the State Engineer to obtain the water rights necessary for use in the project.

Plant Construction. Construction methods would be similar to those proposed under the Ormat proposal and can be found under the pertinent section.

Plant Operation. Typical binary power plant operations are similar to those identified in the description of the Ormat Carson Lake Binary Power Plant.

During operation, some of the circulating cooling water is lost to evaporation and must be replaced. On a hot dry summer day, it is estimated that approximately 2,500 gpm of the circulating cooling water would be lost to evaporation from the cooling towers (based on a 30-MW [net] binary power plant). During the nighttime hours of the summer and winter, it is expected that the evaporation loss would be significantly less. Although the major equipment is not yet selected, the average annual evaporation is expected to be approximately 2,000 gpm for each 30-MW (net) power plant, or less than 3,300 acre-feet (ac-ft) per year. The potential consumptive use per year is 3,300 ac-ft for each 30-MW (net) power plant. Additionally, a small amount of cooling water would be blown down from the cooling tower basin to maintain suitable water chemistry during commercial operation. This blow-down water would be injected into the reservoir. Evaporation loss and blow-down represent the total amount of replacement water that would be required. Vulcan proposes using groundwater wells and/or geothermal fluid from the geothermal reservoir to satisfy the replacement water demand.

With an estimate of 2,500 gpm for maximum evaporation loss per 30-MW facility, each water well would have a minimum production rate of 500 gpm; therefore, five wells would be required at a time of maximum evaporation loss and minimum water well production per 30-MW facility. Each water well would require a 50-foot radius of disturbance around each water well head (0.2 acre) and one mile of 20-foot-wide corridor for road and pipe (2.5 acres) per well for a total of 3 acres of disturbance per water well. For maximum buildout, four 30-



Vulcan Proposed Action and Alternative

Churchill County, Nevada

Vulcan Facilities

- Vulcan Project Area Boundary
- Proposed Well Pad
- Proposed Steamfield Pipeline and Associated Road
- Proposed 230 kV Interconnection Line
- Proposed Power Plant and Substation
- Alternative 230 kV Interconnection Line Corridor

Other Features

- Proposed Switching Station
- CLP Title Transfer
- Existing Power Plant
- Existing 230 kV Transmission Line
- Existing Conservation Easement
- Approved, Pending Conservation Easement
- Proposed Conservation Easement
- Pony Express National Historic Trail

Source: BLM 2010, Vulcan 2010

NATIONAL SYSTEM OF PUBLIC LANDS

0 0.5 1

Miles

January 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.

Figure 2-9

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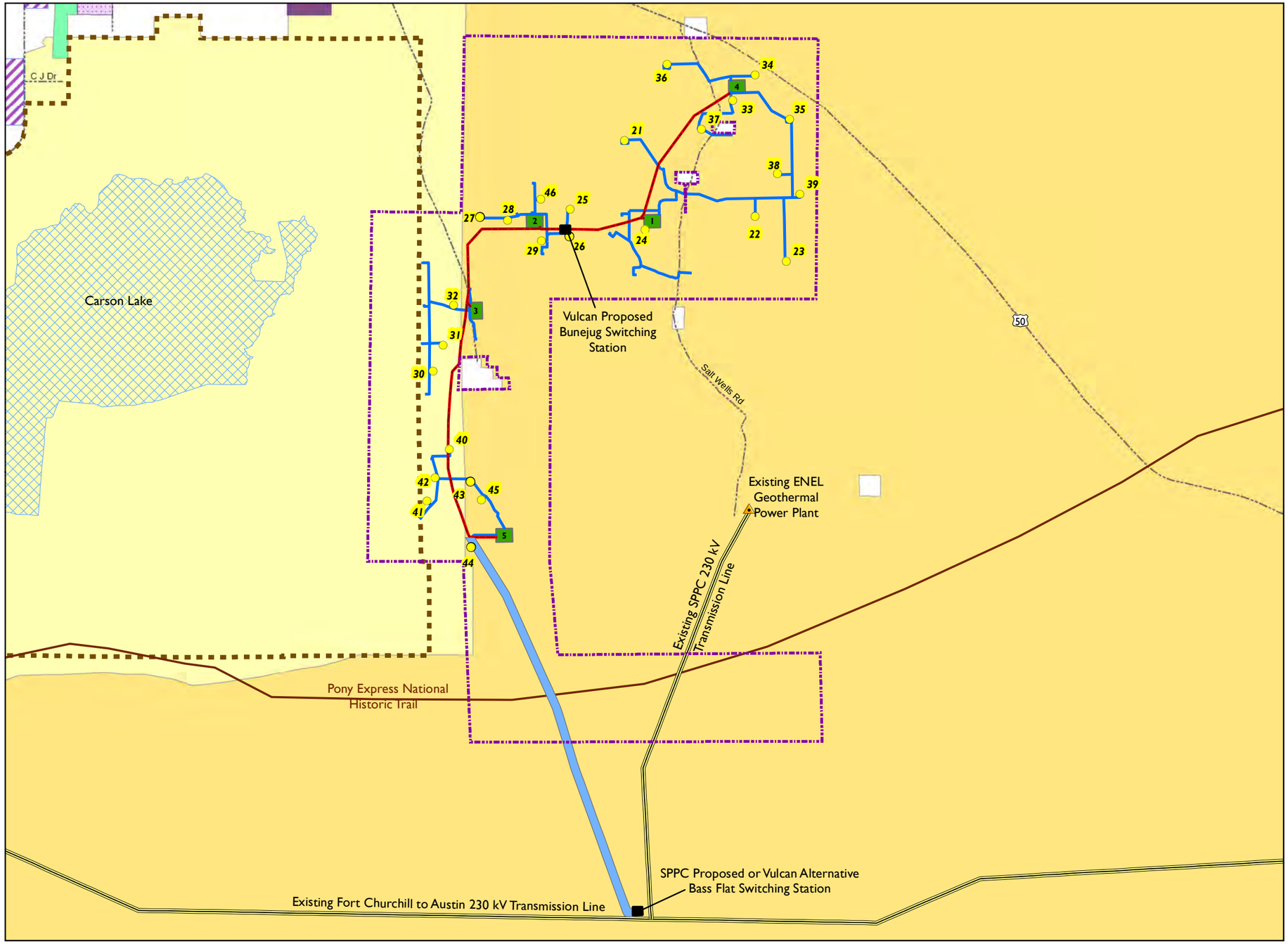

Land Status of Vulcan Project Area

Churchill County, Nevada

Vulcan Facilities
- Vulcan Project Area Boundary
- Proposed Well Pad
- Proposed Steamfield Pipeline and Associated Road
- Proposed 230 kV Interconnection Line
- Proposed Power Plant and Substation
- Alternative 230 kV Interconnection Line Corridor

Other Features
- Proposed Switching Station
- CLP Title Transfer
- Existing Power Plant
- Existing 230 kV Transmission Line
- Existing Conservation Easement
- Approved, Pending Conservation Easement
- Proposed Conservation Easement
- Open Water
- Pony Express National Historic Trail

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

Source: BLM 2010, Vulcan 2010

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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 2-10

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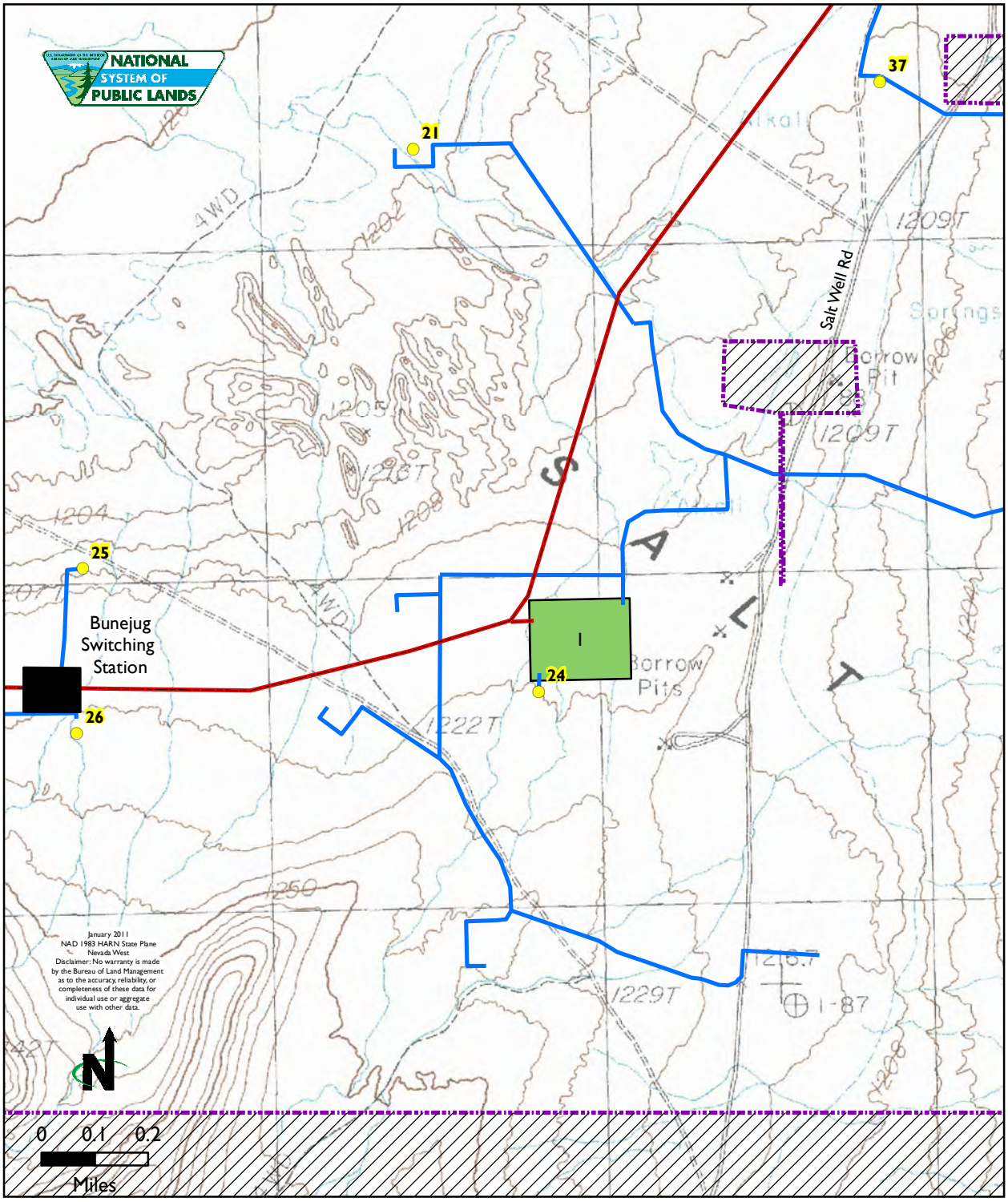
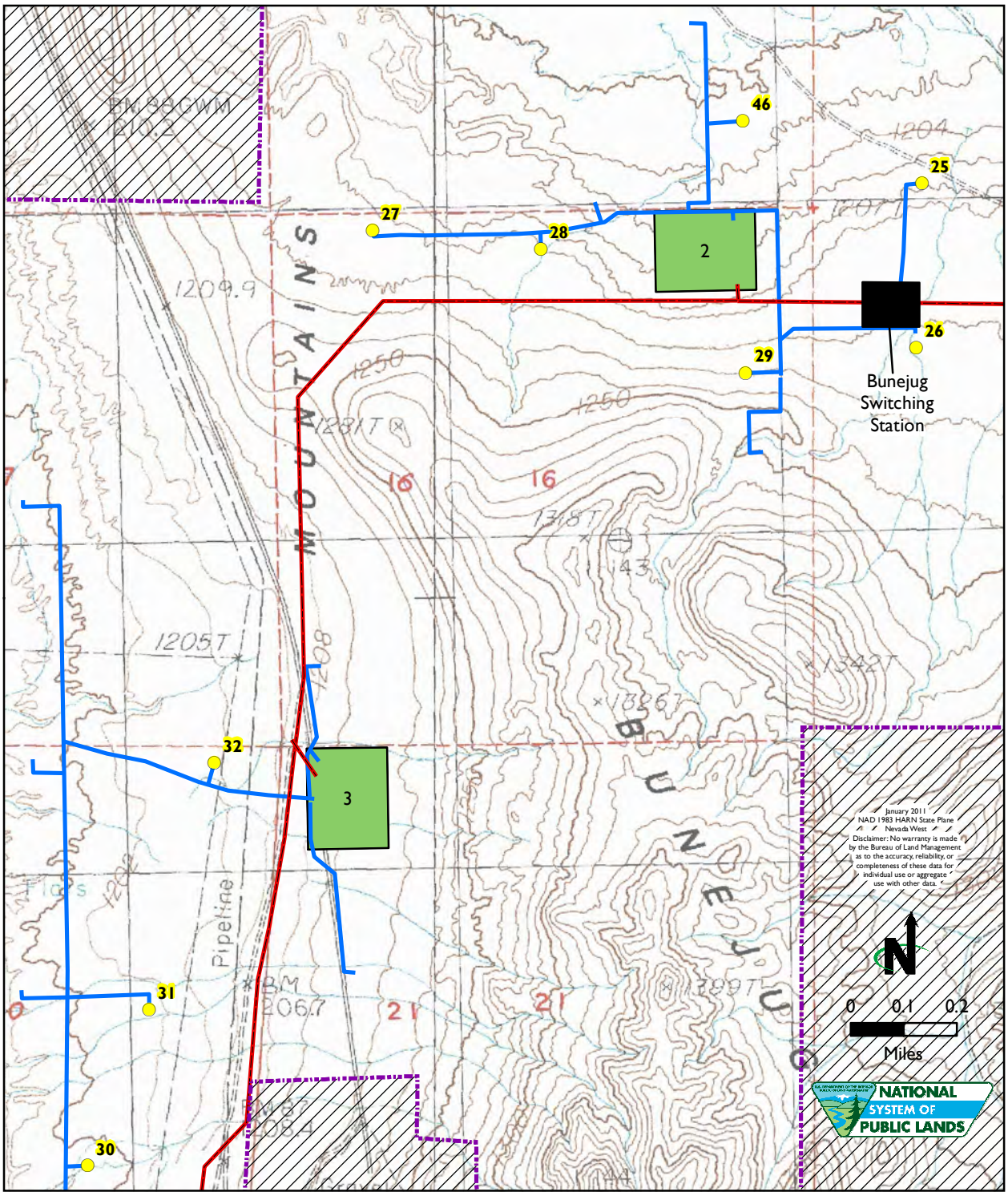


Vulcan Project Area Boundary
Excluded from Lease Area
Proposed Well Pad
Proposed Steamfield Pipeline and Associated Road
Proposed 230 kV Interconnection Line
Proposed Power Plant and Substation
Proposed Switching Station

Vulcan Proposed Power Plant and Substation 1

Churchill County, Nevada

Figure 2-11

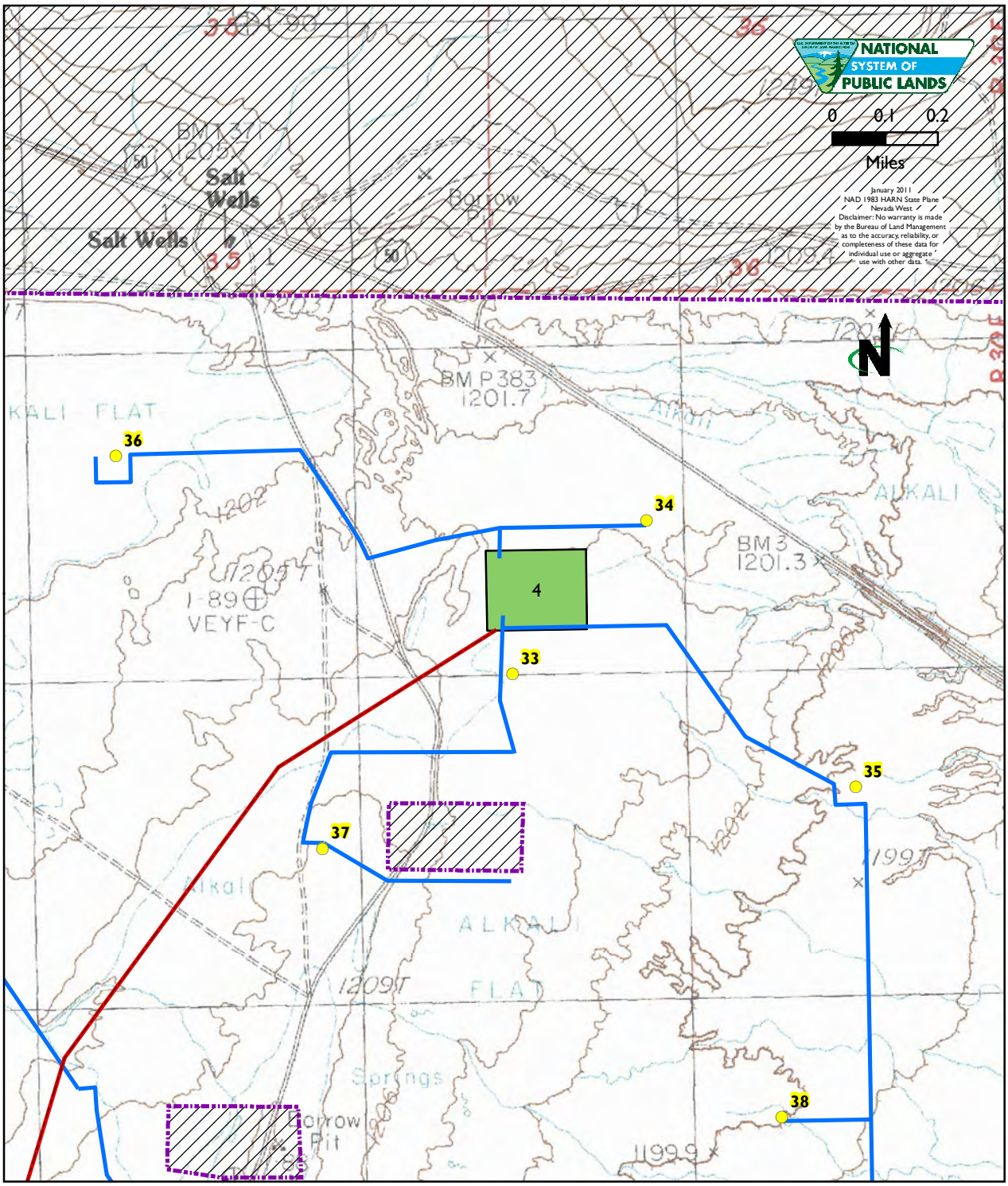


Vulcan Project Area Boundary
Excluded from Lease Area
Proposed Well Pad
Proposed Steamfield Pipeline and Associated Road
Proposed 230 kV Interconnection Line
Proposed Power Plant and Substation
Proposed Switching Station

Vulcan Proposed Power Plants and Substations 2 and 3

Churchill County, Nevada

Figure 2-12

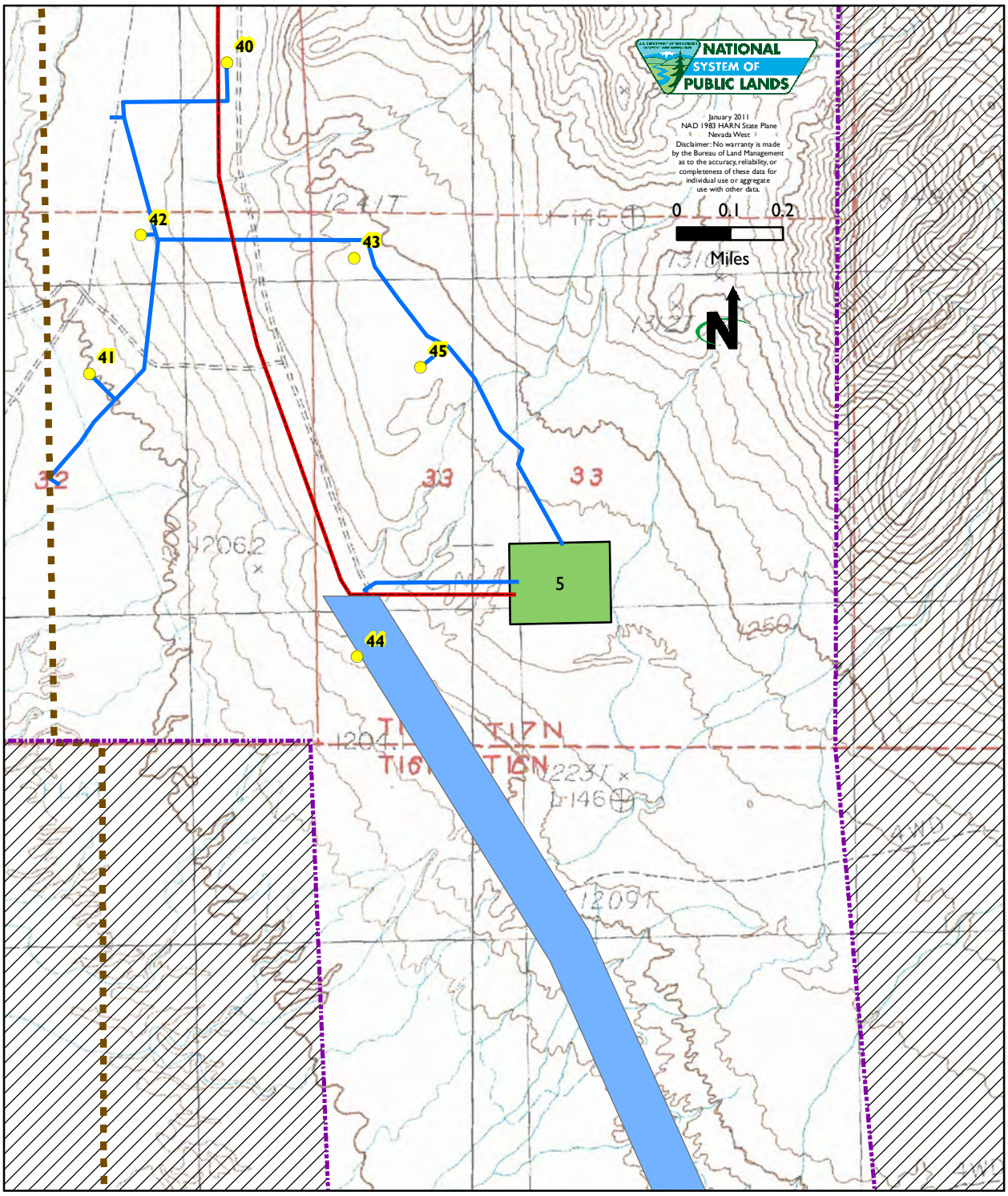


Vulcan Project Area Boundary
Excluded from Lease Area
Proposed Well Pad
Proposed Steamfield Pipeline and Associated Road
Proposed 230 kV Interconnection Line
Proposed Power Plant and Substation

Vulcan Proposed Power Plant and Substation 4

Churchill County, Nevada

Figure 2-13



Vulcan Project Area Boundary
Excluded from Lease Area
Proposed Well Pad
Proposed Steamfield Pipeline and Associated Road
Proposed 230 kV Interconnection Line
Proposed Power Plant and Substation
Alternative 230 kV Interconnection Line Corridor
CLP Title Transfer

Vulcan Proposed Power Plant and Substation 5

Churchill County, Nevada

Figure 2-14

MW power plants would require up to 20 wells and approximately 60 acres of disturbance. Preferably, water wells would be within a one-mile radius of their respective power plant site, and, to the extent feasible, the pipelines would be included within the geothermal fluid pipeline corridors and/or the interconnection line corridor. However, the known source, Well 58-9, could be used for any of the power plant sites, and the pipeline would be included within the geothermal fluid pipeline corridors and/or the interconnection line corridor, thereby minimizing the ultimate disturbance. Vulcan would finalize the POU/POD prior to construction of their power facilities. Appropriate procedures and mitigation measures outlined in this EIS would be included in the POU/POD.

The fire/service water storage tank would be arranged to provide dedicated water to the fire protection system and sufficient storage for use as plant service and non-potable domestic water (NFPA 2008). The tank capacity at each site would be approximately 300,000 gallons and would be erected early in the construction phase. The initial fill source of water and fire make-up water during operations is anticipated to be the groundwater wells.

Communications. Communication facilities would consist of one of the following two options:

- A dedicated land line telephone connection to the project site, with DSL service if available. A fiber optic connection would be installed via the optical ground wire between the power plant substation(s) and the proposed Bunejug Switching Station where the line would terminate for the supervisory control and data acquisition (SCADA) system, control, protective relaying, and communications with SPPC. Restricted-access SCADA data on system performance would be streamed to the Project Control Center at one of the proposed power plants for monitoring. The communication channels and network setup for the project would be coordinated with SPPC and would adhere to the cyber security requirements of the North American Electric Reliability Company (NAERC).
- In order to handle communications (command, control, voice, and internet) at 18 GHz Ethernet/T-1 speeds, Vulcan would arrange to have installed an approximately 100-foot-tall microwave tower at each of the power plant sites that would communicate with a tower at a provider location.

Proposed Flash Power Plant. Vulcan proposes to utilize Power Plant Sites 3 and 5 (Figure 2-9) for a potential flash power plant facility where higher resource temperatures are anticipated. Geothermal flash technology is generally more cost effective and efficient than binary technology but typically requires geothermal resources with temperatures that exceed 360 degrees Fahrenheit (°F).

Power Plant Construction. A 23.5-acre site would be large enough to accommodate a construction laydown area and all the necessary facilities for the flash power plant, including the turbine and control building, mechanical draft cooling towers, a non-condensable gas removal system, a fire water storage tank, a potable water storage tank (if needed), a rock muffler, a brine holding pond, communication microwave tower, and an electrical substation (refer to **Appendix A**, Typical Geothermal Resource Development and Transmission Tools). Construction methods would be similar to those proposed under the Ormat Proposed Action and can be found under the pertinent section.

Plant Operation. Vulcan proposes to utilize two 35-MW (gross) turbine-generator sets at the flash power plant location. The turbine-generator sets would be supplied with all the necessary auxiliaries for control, lube oil, and cooling. The turbine building would also house the condenser, hot well pumps, control room, and data acquisition and control system, as well as personal hygiene facilities for employees. The motor control and switchgear would be housed in individual self-contained, weatherproof modules, which would be just outside the turbine-generator building. The layout of the power plant equipment would allow for a future hydrogen sulfide abatement system if it should become necessary, without extensive removal of piping, equipment, or supports.

Based on preliminary data from Salt Wells and data available from other Nevada projects, Vulcan anticipates that the noncondensable gas content at Salt Wells should be no greater than 500 parts per million of the brine flow. At the cooling tower, the exiting air and vapor would disperse the noncondensable gas, which would minimize collection of the gases within the power plant area, including hydrogen sulfide, and thereby reduce human exposure.

Vulcan does not expect to need an hydrogen sulfide abatement system for the power plants at Salt Wells. However, the facility would be designed so that a system could be added should the noncondensable gas content or environmental regulations change.

Water Requirements. The cooling water system would consist primarily of the cooling tower, pumps, and condenser. For the flash power plant, approximately 2,250 gpm of condensate would be needed for each 30-MW (net) unit. On a hot, dry summer day, approximately 2,000 gpm would be lost to evaporation. During the night time hours of the summer and winter, the evaporation loss would be significantly less. The average annual evaporation is expected to be approximately 1,700 gpm for each 30-MW (net) power plant or less than 5,500 ac-ft per year for a 60-MW flash power plant facility (**Table 2-5**).

Communications. Proposed communications would be the same as identified under the Binary Power Plant description.

Substations

Each of the geothermal power plants would include an electrical substation on a footprint of approximately 300 by 200 feet. Surrounding the substation would be an 8-foot-tall chain-link fence with vehicle and personnel access gates. The surface of the substation would consist of crushed rock and would be bermed for spill containment.

The substation equipment would be installed on concrete foundations. The electrical generators would be connected to the substation via a 13.8-kV line.

Bunejug Switching Station

Vulcan proposes a switching station called the Bunejug Switching Station to interconnect the proposed Vulcan geothermal power plant(s) to the SPPC 230-kV transmission line proposed under the Fallon 230-kV Source Project. The Bunejug Switching Station would involve the construction of a four-breaker switching station on an approximate 500-foot by 500-foot parcel; the switching station itself would be approximately 310 feet by 310 feet. The south and north breakers, at the Bunejug Switching Station, would allow for the connection of the proposed SPPC 230-kV transmission line. The west breaker would allow for connection of the Vulcan 230-kV interconnection transmission line originating at Vulcan's Power Plant Sites 2, 3, and 5 to the west of the switching station and the east breaker would allow for interconnection tie to the Vulcan power plants (Sites 1 and 4) to the east side of the switching station. The 230-kV interconnection transmission line between Vulcan's power plants and the Bunejug Switching Station is discussed in the next section.

Construction methods would be the same as identified under the proposed SPPC Bass Flat Switching Station.

Interconnection Transmission Lines

To connect the Vulcan power plants to the Bunejug Switching Station, Vulcan proposes a 230-kV interconnection transmission power line. The transmission interconnection line and construction methods are similar to the 230-kV transmission line proposed by SPPC. Vulcan's interconnection line would run from, and between, Vulcan's power plants to the Bunejug Switching Station via a single 230-kV circuit transmission line. In addition, Vulcan would construct a transmission line from the Bunejug Switching station the SPPC 230-kV transmission line, which would run adjacent to the Bunejug site. Each structure would carry a single overhead ground wire/fiber optic cable for lightning protection and fiber-optic communications. A steel dead-end structure measuring 30 feet wide by 45 feet tall would provide a termination point for the overhead Vulcan 230-kV interconnection line.

Proposed staging areas, which would be up to approximately five acres, and other associated construction needs, would be identified and provided for in a POD as previously discussed under the SPPC Proposed Action.

Pipelines

Pipelines would be constructed as identified under the Ormat Proposed Action, described previously.

Well Pads

Vulcan has obtained approval from BLM for exploratory drilling and well pad construction at 20 well pad locations, 11 of which have already been constructed (EA-NV-030-07-05 and DOI-BLM-NV-C010-2009-0006-EA). Vulcan proposes to construct 26 new well pads. The proposed well pads would be 400 feet by 450 feet (4.2 acres) and would be covered with compacted gravel and sloped downward to a 200-foot by 60-foot reserve pit located within the footprint of the well pad. The 11 existing well pads may be used as laydown areas while constructing the proposed well pads. The reserve pits would be lined with local clay material to impede infiltration of drilling fluids to groundwater. Each well pad would have a berm around its perimeter and secondary containment would be provided around the fuel tank. During drilling operations, ditches that drain to the reserve pit would be provided. The well pads would be oriented so that excavation operations could be minimized. **Table 2-6**, Proposed Well Pad Sites, describes each well pad site.

Wells

Binary Power Plant Support. All wells would be constructed using the same methods as identified under the previously described Ormat Proposed Action.

Production Wells and Injection Wells. At a 360°F geothermal resource temperature, each 30-MW (net) binary project would need approximately 18,000 gpm of geothermal resource water, which would require up to eight production wells and four injection wells. The injection wells would be strategically placed to support the reservoir pressure and to ensure that the fluids are not directly reproduced. Injection wells may be located on a dedicated injection pad or may be located on the same pad as the production wells but drilled to a different depth.

Water Wells. To supply water during construction and operation, several groundwater wells would be drilled (see Table 2-5). Estimated consumptive use is detailed in the Power Plant Water Requirements section.

Flash Power Plant Support. Wells would be constructed similarly to wells used for a binary power plant as identified under the Ormat proposal.

Production Wells and Injection Wells. At 360°F, the proposed flash configuration would need an estimated 11,120,000 pounds per hour of fluid to generate 60 MW (net), requiring up to 14 production wells and 7 injection wells (21 wells per 60-MW facility). Production wells for a flash project are typically deep wells, and with directional drilling more flash production wells can be located on the

Table 2-6
Proposed Well Pad Sites

Well Pad No.	Kettlemen Number	Lease Number	Township/ Range	Section
21	72-10	N-79666	17N30E	10
22	31-13	N-79665	17N30E	13
23	65-13	N-79665	17N30E	13
24	12-14	N-79665	17N30E	14
25	87-9	N-79666	17N30E	9
26	28-10	N-79666	17N30E	10
27	23-15	N-79310	17N30E	15
28	21-16	N-79665	17N30E	16
29	51-16	N-79665	17N30E	16
30	83-16	N-79665	17N30E	16
31	67-20	N-79663	17N30E	20
32	75-20	N-79663	17N30E	20
33	81-20	N-79663	17N30E	20
34	16-1	N-79668	17N30E	1
35	34-1	N-79668	17N30E	1
36	68-1	N-79668	17N30E	1
37	33-2	N-79668	17N30E	2
38	61-11	N-79666	17N30E	11
39	55-12	N-79666	17N30E	12
40	77-12	N-79666	17N30E	12
41	86-29	N-79663	17N30E	29
42	63-32	N-79664	17N30E	32
43	71-32	N-79664	17N30E	32
44	11-33	N-79664	17N30E	33
45	17-33	N-79664	17N30E	33
46	23-33	N-79664	17N30E	33

same pad. Vulcan anticipates drilling three to five wells on each 450-foot by 400-foot pad. Thus, each 60-MW flash power plant would require a minimum of five pads for production and injection wells. The injection wells would be strategically placed to support the reservoir pressure and to ensure that the fluids are not directly reproduced. Injection wells may be located on a dedicated

injection pad or may be located on the same pad as the production wells but drilled to a different depth. When injection wells are on the same well pad as production wells, the injection well depth would be significantly different. Therefore, to maximize and protect the resource, eight or nine well pads may be developed. Should the actual resource temperature be higher, the amount of wells needed to generate 60 MW would be less.

A typical production wellhead assembly would consist of two shut-in valves, a removable gooseneck section, and instrumentation. High temperature wells for a flash power plant generally do not require pumping.

The injection wells are generally the same for a flash power plant as a binary power plant. However, injection pumps would be required at the power plant in order to transport the brine to the well field and supply the required pressure for injection into the reservoir.

Water Wells. Water wells would be constructed and operated as identified under the binary power plant proposal.

Access Roads

Vulcan would access the project area from the Macari and Salt Wells Road turnoffs from Highway 50. New access roads would be developed off the existing roads in the project area. Vulcan would maintain the access roads as provided for in the POU.

Access roads would be constructed with methods similar to those identified under the Ormat Proposed Action and can be found under the pertinent section.

Material for Construction Fill and Base

During previous well pad construction, Vulcan found that suitable fill materials exist on site and presumes that the need for additional rock would be unlikely; this would be determined on a case-by-case basis.

If additional base rock or other earth materials are needed for road building or power plant construction, they would be obtained locally from the sites themselves; from the on-site borrow pit east of the Bunejug Mountains in Section 14, Township 17 North, Range 30 East; from the on-site commercial quarry (Glacier Construction) west of the Bunejug Mountains in Section 21, Township 17 North, Range 30 East; or from other local commercial sources such as Mackadon Cement or A&K Earthmovers. Vulcan has obtained BLM Mineral Material Contract N-83072 to purchase up to 40,000 cubic yards of borrow materials from the borrow pit east of the Bunejug Mountains.

Construction Water

Vulcan would need water for dust control and soil compaction during construction of the power plant sites, well field facilities, and interconnection

lines. Water for construction would be obtained from a combination of the following three sources:

- On-site water well(s): As stated, Vulcan may apply to the Nevada Division of Water Resources and the NDEP for approval to drill one or more additional wells for dust control and compaction during construction of the power plant sites and related facilities.
- Water purchased from irrigation district: Vulcan has also purchased water from the TCID. The TCID has been an important source of water during drilling.
- Water purchased from private parties: Vulcan has identified numerous private parties in Fallon who have potable and non-potable water available for sale.

Vulcan would obtain concrete from an off-site batch plant with its own water supply and would supply water for construction workers from off-site sources as well. During the early phase of construction at the power plant sites, it is anticipated that Vulcan would water the disturbed areas up to three times daily.

Workforce

Binary Power Plants. Vulcan may use two or three drilling crews at a time to complete drilling of the proposed production and injection wells needed for the 120 MW of proposed development. Each drilling crew would have approximately six workers, and drilling is expected to continue to the completion of power plant construction. Well pads typically require a crew of six workers for their construction.

Workforce estimates for the binary power plants include up to 122 workers during the construction of each 30-MW (net) power plant and associated well field and interconnection facilities. If two 30-MW (net) power plants are constructed two months apart, up to 244 workers would be needed. Once both 30-MW power plants are installed, the power plants and well field operations would have a combined estimated 33 employees. This staffing plan assumes six power plant operators for the first 30-MW binary power plant and four for the second 30-MW binary power plant.

Flash Plant. Vulcan estimates that it would need up to 130 workers during the construction of the 60-MW (net) flash power plant and associated well field and interconnection facilities. Once the 60-MW power plant is installed, the power plant and well field operations would have an estimated 26 employees.

The 60-MW flash power plant construction is expected to take 12 to 15 months. Construction of the 60-MW (net) flash well field pipelines requires the same estimated work force as identified under the binary power plant development. The staffing plan assumes five power plant operators for the first

power plant. Complete 24-hour coverage 7 days per week requires 168 hours, divided into 40-hour shifts, resulting in 4.2 shifts per week. Factoring in sick time and vacation, five power plant shift operators could handle power plant operations.

Vulcan may use two or three drilling crews to complete drilling of the 24 production and injection wells needed for the first 60-MW phase of development. Each drilling crew would have approximately six workers, and drilling is expected to continue to the completion of power plant construction. If additional well pads are needed, a crew of six workers would be needed to construct each proposed well pad.

Vulcan Power Company - No Action

Under the No Action Alternative, the geothermal power plants and associated facilities would not be constructed. The No Action Alternative would not facilitate geothermal development or meet the stated purpose and need. The No Action Alternative is carried forward, however, for detailed analysis in accordance with CEQ guidance to provide a benchmark against which impacts from the action Alternatives can be evaluated (40 CFR 1502.11[d]).

2.3 ALTERNATIVES

Sierra Pacific Power Company – Fallon 230-kV Source Project

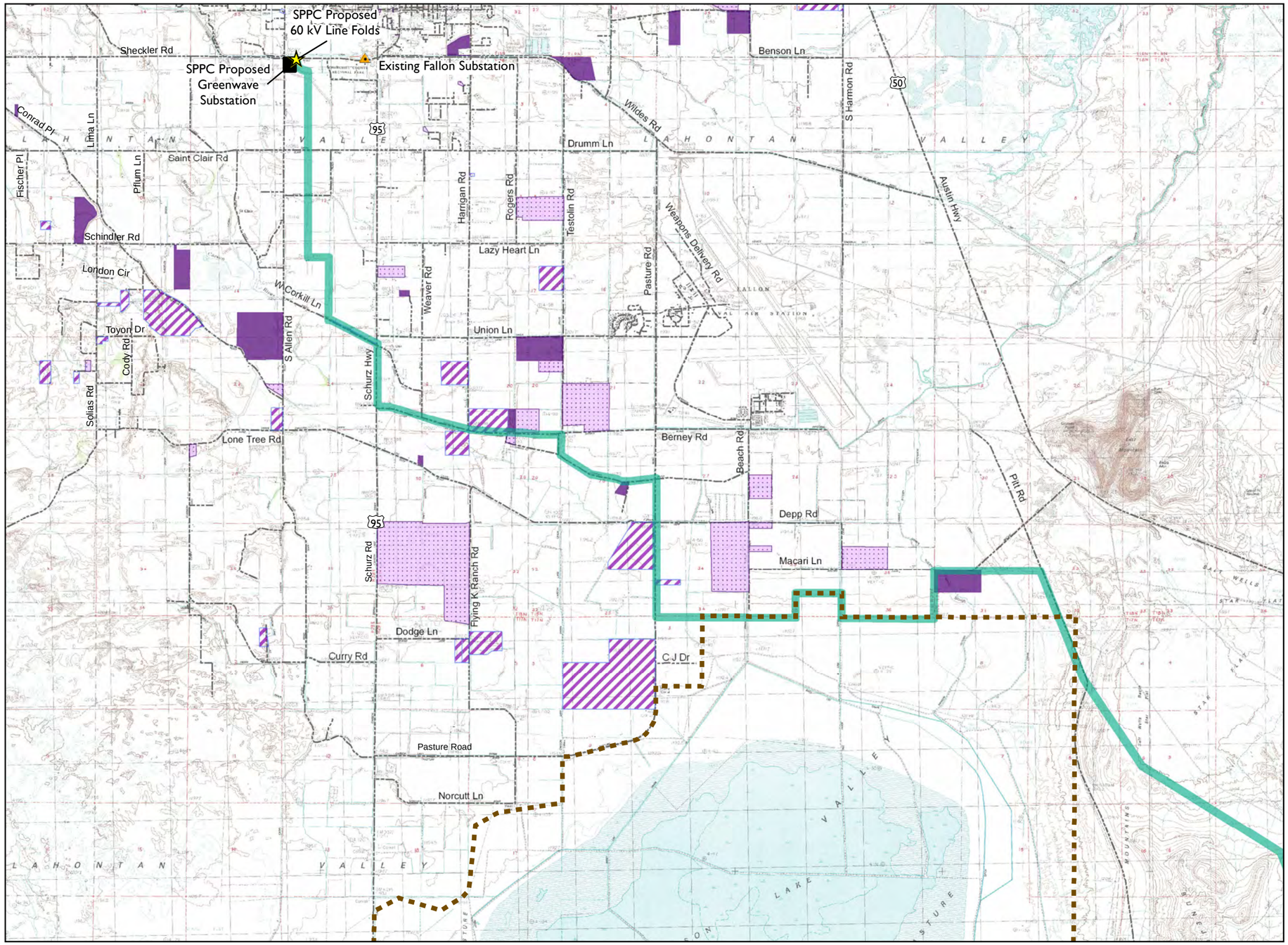
Alternative 1

From the Macari Switching Station, Alternative 1 would travel south of the Proposed Action route, following the Carson Lake and Pasture Title Transfer boundary from east to west, then running north of the Corkill Ranch on Cushman Road (**Figure 2-15**, Sierra Pacific Power Company Alternative 1). This Alternative was proposed to minimize the impact on existing conservation easements that are either bisected or bordered by the Proposed Action. Deeds to the conservation easements include an 80-foot height restriction and restrict uses to those that support agriculture.

- Length of Alternative 1 Transmission line: 22.4 miles (118,272 feet)
- Total Temporary Disturbance under Alternative 1: 838 acres
- Total Permanent Disturbance under Alternative 1: 362 acres

Alternative 2

The route would be the same as the Proposed Action except the initial portion from the Macari Switching Station would continue west along Macari Lane for an additional 2 miles before going south for one half mile along Schaeffer Lane and connecting back into the Proposed Action route (**Figure 2-16**, Sierra Pacific



Sierra Pacific Power Company Alternative 1

Churchill County, Nevada

SPPC Facilities

- Alternative 1 230 kV Transmission Line Corridor
- Proposed 60 kV Line Folds

Other Features

- Proposed Substation
- Existing Substation
- CLP Title Transfer
- Existing Conservation Easement
- Approved, Pending Conservation Easement
- Proposed Conservation Easement

Source: BLM 2010, Churchill County 2010, SPPC 2010

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Figure 2-15

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Power Company Alternative 2). This Alternative was developed to address concerns about bisecting land parcels south of Macari Lane.

- Length of Alternative 2 Transmission line: 21.7 miles (114,576 feet)
- Total Temporary Disturbance under Alternative 2: 813 acres
- Total Permanent Disturbance under Alternative 2: 352 acres

Macari Fiber Optic Alternative

Under this Alternative, SPPC would construct an additional fiber optic line to connect communications from the Highway 50 (**Figure 2-17**, Sierra Pacific Power Company Macari Fiber Optic Alternative). This Alternative from Macari Lane would involve trenching about one mile along Macari Lane to Highway 50. The fiber optic communications cable from the 230-kV transmission line would be routed underground east along Macari Lane via two four-inch PVC conduits. The conduits would pass beneath the Fallon Canal, or over the canal in association with the Ormat-proposed geothermal pipeline crossing, and would continue 1.25 miles to Highway 50. A bore would be performed under Highway 50, and the conduits would then continue approximately 150 feet west and intercept an existing company-owned communication conduit system. The trench would be a maximum of 1-foot wide and 42 inches deep and would use native fill unless required otherwise. Two four-inch PVC conduits would be placed in the trench with a minimum of 36 inches of native cover. Along with the two four-inch conduits, four 2-foot by 4-foot by 3-foot deep pull boxes would be constructed. Aboveground marker posts (approximately 3 to 4 feet tall) would be placed at 400-foot intervals; these marker posts would display a company logo depicting buried fiber optic cable.

The conduit path would have cable pulling vaults set at 600-foot intervals and on either side of the canal and highway crossings. Additionally, an existing communications vault 3,500 feet east along Highway 50 would be excavated for splicing.

- Length of Macari Fiber Optic Line: 1.5 miles
- Temporary disturbance width of Macari Fiber Optic Line: 8 feet
- Permanent disturbance width of Macari Fiber Optic Line: 6 feet
- Total Temporary Disturbance under the Macari Fiber Optic Alternative: 63,360 square feet (1.45 acres)
- Total Permanent Disturbance under Macari Fiber Optic Alternative: 47,520 square feet (1.09 acres)

Ormat Technologies

Alternative

For the Ormat project, the BLM developed an Alternative to relocate Well Sites U and V and that portion of the pipeline running from Well Site T to W (see Figure 2-7) to protect riparian and surface waters within canals.

- Alternate Pipeline Length: 6.4 miles
- Temporary Alternate Pipeline Corridor width: 300 feet
- Permanent Alternate Pipeline Corridor width: 155 feet
- Total Area of Temporary Alternate Pipeline Disturbance: 233 acres
- Total Area of Permanent Alternate Pipeline Disturbance: 120 acres
- Total Estimated Temporary Disturbance: 318 acres
- Total Estimated Permanent Disturbance: 195 acres

Vulcan Power Company

Alternative

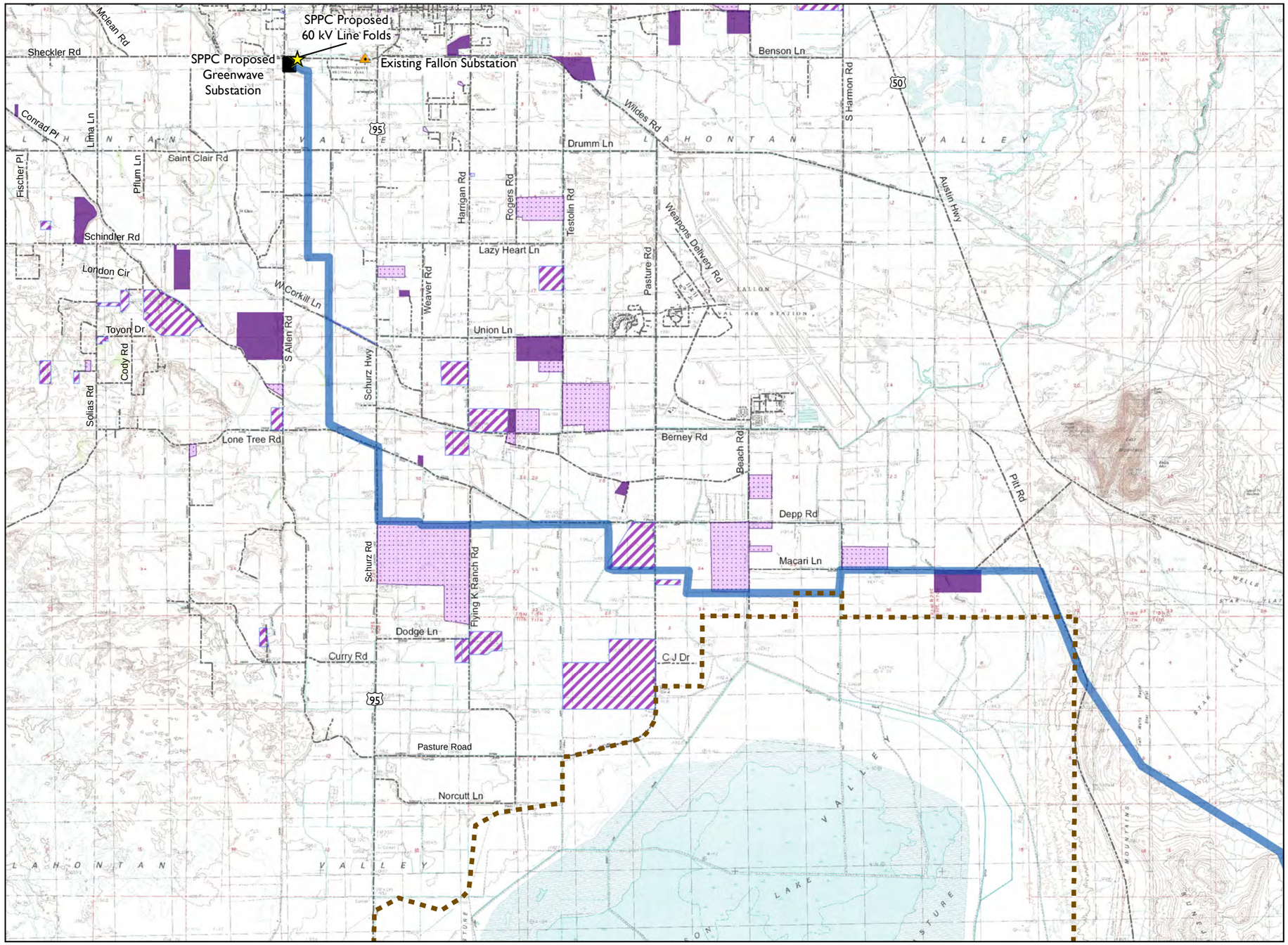
An Alternative for the Vulcan project, should SPPC elect not to build its project, would be for Vulcan to propose to construct the Bass Flat Switching Station and extend its proposed interconnection 230-kV transmission power line from the Site 5 power plant to their Alternative Bass Flat Switching Station (see Figure 2-9). The Alternative Bass Flat Switching Station would be constructed as previously described under the SPPC Proposed Action and would allow Vulcan to tie into the existing Austin to Fort Churchill 230-kV transmission line (see Figure 2-12). The transmission line from Power Plant Site 5 to the Bass Flat Switching Station would be constructed adjacent to an existing road.

- Transmission line corridor from Power Plant Site 5 to Bass Flat: 4.6 miles (24,288 feet)
- Temporary corridor disturbance width: 300 feet
- Permanent corridor disturbance width: 125 feet
- Bass Flat Switching Station: 5.75 acres
- Alternative 1 Total Temporary Disturbance: 1,427 acres
- Alternative 1 Total Permanent Disturbance: 826 acres

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

Sierra Pacific Power Company – Fallon 230-kV Source Project

Alternative transmission line routes and substation locations were assessed in the SPPC *Salt Wells to Fallon 230-kV Project Environmental Constraint Identification,*



Sierra Pacific Power Company Alternative 2

Churchill County, Nevada

SPPC Facilities

- Alternative 2 230 kV Transmission Line Corridor
- Proposed 60 kV Line Folds

Other Features

- Proposed Substation
- Existing Substation
- CLP Title Transfer
- Existing Conservation Easement
- Approved, Pending Conservation Easement
- Proposed Conservation Easement

Source: BLM 2010, Churchill County 2010, SPPC 2010

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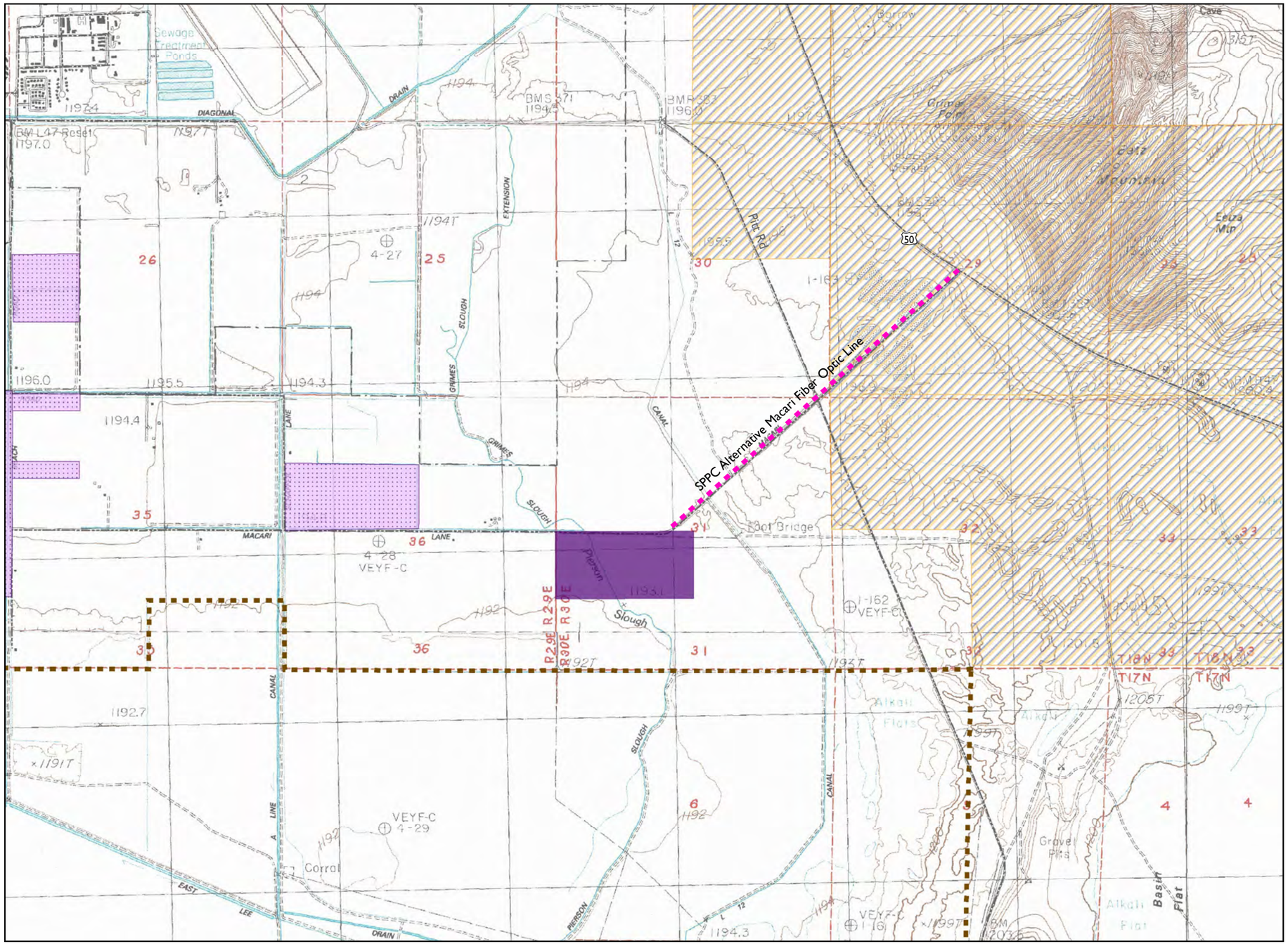

Sierra Pacific Power Company Macari Fiber Optic Alternative

Churchill County, Nevada

SPPC Facilities

- Alternative Macari Fiber Optic Line

Other Features

- CLP Title Transfer
- Existing Conservation Easement
- Proposed Conservation Easement
- No Surface Occupancy

Souce: BLM 2010, Churchill County 2010, SPPC 2010

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Figure 2-17

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Substation Siting, and Routing Study (2008), which was submitted with the ROW application to BLM. SPPC based its determined of the proposed route from this study, which indicated it would result in the fewest or smallest scope of environmental impacts. As part of the EIS process, the BLM, cooperating agencies, and SPPC worked to develop Alternative transmission line routes to address issues and concerns identified in scoping and in meetings with the cooperating agencies. Those Alternatives that were carried forward are discussed previously in **Section 2.3**. The following alternatives were considered but eliminated from further consideration.

Allen Road to the Greenwave Substation

An Alternative was considered to extend either the Proposed Action or Alternative 1 routes to Allen Road and then north along Allen Road to the Greenwave Substation. This Alternative was eliminated for the following reasons:

- Ditches and canals run along both sides of North Allen Road, which would force the line to be pushed further from the road and would be much more intrusive to the residents.
- The route would impact approximately 12 to 15 home fronts, as the proposed route along North Allen Road would run close to these homes.
- The existing distribution line along Allen Road is the only power source to this area of Fallon. If the 230-kV transmission line was routed along Allen Road, the existing distribution line would be taken out of service for an undetermined time. This would result in outages of power in the area during construction, requiring that backup or Alternative power be supplied, significantly increasing the construction costs.

Along Highway 50

An Alternative was considered to route the power line from Macari Lane along Highway 50 and across Wildes Road to the existing Fallon Substation. This Alternative was eliminated for the following reasons:

- The route does not meet planning requirement to be within one mile of the existing Fallon 60-kV substation.
- It would result in a negative visual impact on the Grimes Point Archeological Site.
- It would include a portion within the No Surface Occupancy Area.
- It would possibly conflict with Native American concerns.
- Wildes Road is very congested and would be very difficult to locate the line.

- It contained possible safety issues with regard to naval operations.
- It would not provide any future expansion towards Fernley.
- No suitable Greenwave site was identified.
- It would be more expensive due to greater distance and potential underbuild of distribution.

Macari Lane Alternative

An Alternative was considered that would continue the line along Macari Lane and meet up with Proposed Action route at Pasture Road. This Alternative was eliminated for the following reasons:

- The western portion of Macari Lane is congested with ditches, canals, and existing distribution.
- It would affect multiple home fronts.
- It would have safety issues for NAS Fallon since it would be closer to the runway.
- It would be more expensive due to potential underbuild of distribution.

South of Carson Lake

An Alternative was considered to route the line south of Carson Lake. This Alternative was eliminated for the following reasons:

- Potential impacts on the Pony Express National Historic Trail.
- A second 230-kV transmission line is hard to protect electrically.
- It would result in changes to cost responsibility between utility and geothermal generators, which may jeopardize project feasibility.
- It would be more expensive due to distance and potential underbuilding.
- It contained unknown impacts due to an entirely new (unstudied) route.

CJ Drive to HWY 95 Alternative

The CJ Drive to HWY 95 Alternative would have been the same as Alternative 1 up until one mile east of Pasture Road, where the route would have turned south to CJ Drive and then continue west to Pasture Road south and around to Highway 95. At Highway 95 the route would go north to Depp Road and then cut across at an angle to the Proposed Action route. This Alternative was

proposed to avoid conflicts with the conservation easements and other uses, however it was eliminated for the following reasons:

- It would have greater impacts on resources in the Project Area.
- It would have greater impacts on private landowners.

CJ Drive-West Alternative

This alternative would have followed the same route as the CJ Drive-HWY 95 Alternative except instead of going north on Highway 95 to Depp Road, this route would only extend one and one half miles north on Highway 95 then go west and north to meet up with the Proposed Action route to the Greenwave Substation. This Alternative was proposed to avoid conflicts with the conservation easements and other uses while considering the engineering constraints for routing the transmission line along Highway 95. This alternative was eliminated from further analysis because of the following:

- It would pose engineering challenges for the construction of the transmission line along Highway 95.
- It would have greater impacts on resources in the Project Area.
- It would have greater impacts on private landowners.
- The propose route ran closer to Carson Lake for a longer stretch.

Ormat Technologies – Carson Lake Geothermal Project

Constructing and operating a binary power plant with exclusive air-cooled technology was considered as an Alternative. This Alternative was eliminated due to the fact that using exclusive air-cooled technology would be inefficient and uses more energy and costs more money than would be created from the power plant.

Vulcan Power Company – Salt Wells Geothermal Development Project

Cocoon Switching Station

An Alternative was considered to construct the Cocoon Switching Station approximately 2.25 miles southwest of the existing ENEL Geothermal Power Plant and tie into the station via a 230-kV transmission line from power plant Site 5 by continuing the transmission line south approximately 2.5 miles and then heading west approximately one mile to connect to the Cocoon Switching Station. This Alternative was eliminated due to engineering challenges.

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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;
- 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 (WSAs), Areas of Critical Environmental Concern (ACECs), or other special designation areas near the Salt Wells Energy Projects Area. The closest WSA is the Job Peak WSA, which is located approximately 18 miles northeast of the Projects Area. The Pah Rah Petroglyph ACEC is the closest ACEC, 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 southeast of Fallon. The three proposals cover an area of approximately 23,764 acres. The primary uses within the area include agriculture, the Newlands

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 US Fish and Wildlife Service (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.

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.

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

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), US Fish and Wildlife Service (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).

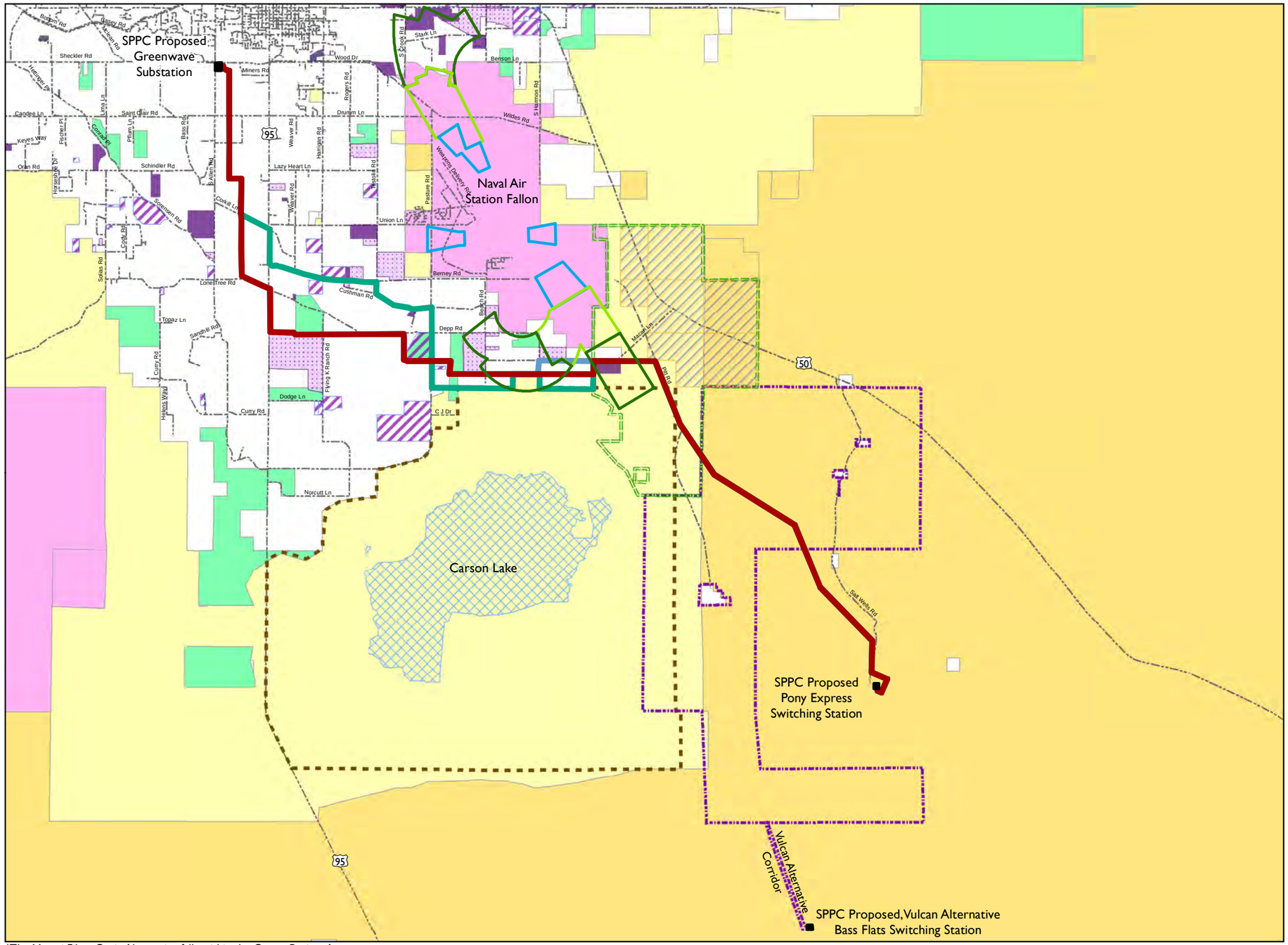
The plan classifies geothermal as one of the four main industry sectors within the County and calls for the County to, "Retain existing geothermal and mining areas and promote and encourage the expansion of these operations and areas."

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 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 BLM and Navy RMP for Certain Federal Lands in Churchill County, Nevada (September 2001), outlines how resources on the Navy lands in the project vicinity are to be managed by the DOD. The Navy has lands that overlap the Ormat Project Area adjacent to NAS Fallon in Sections 19 and 30 of T18N R30E. Development of structures in excess of 50 feet above ground level on these lands is prohibited.

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 Settlement Act, Pub. L. 101-618, for use as a wildlife management area. However, the property has not been transferred to the state, and the area remains under Reclamation jurisdiction and managed according to Reclamation procedures.



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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching and Substations
- CLP Title Transfer
- 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

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

Figure 3-1

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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 NAS Fallon withdrawn lands and 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

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, the Navy lands overlap the Ormat Project Area adjacent to NAS Fallon in Sections 19 and 30 of T18N R30E. Development of structures in excess of 50 feet on these lands is prohibited. 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 Clean Air Act (CAA) established the principal framework for national, state, and local efforts to protect air quality in the United States (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 megawatts 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.

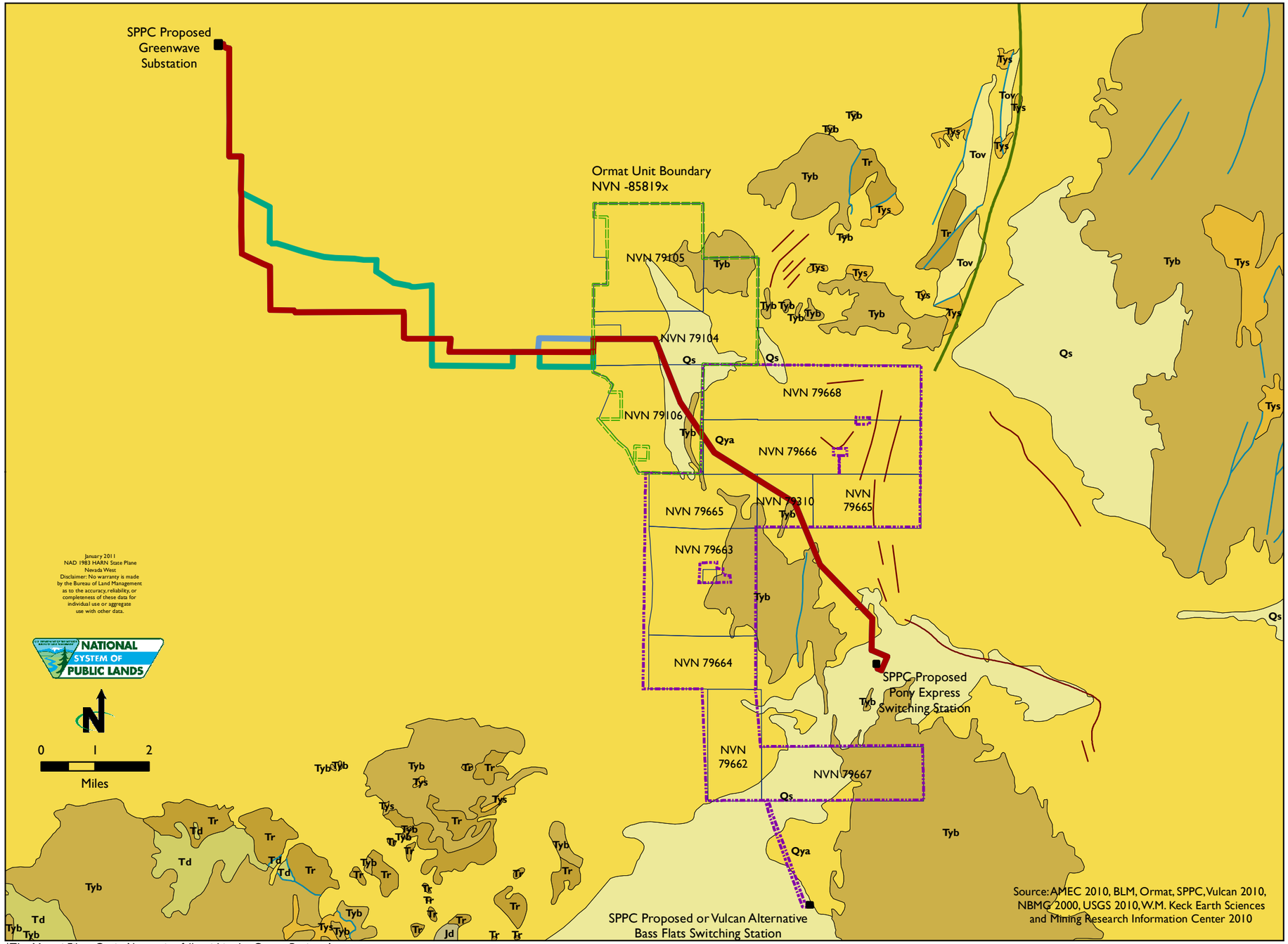
3.4 MINERALS/GEOLOGY

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



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
- ls, limestone

SPPC Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 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

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

Figure 3-2

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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 SPCC 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 and 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.

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

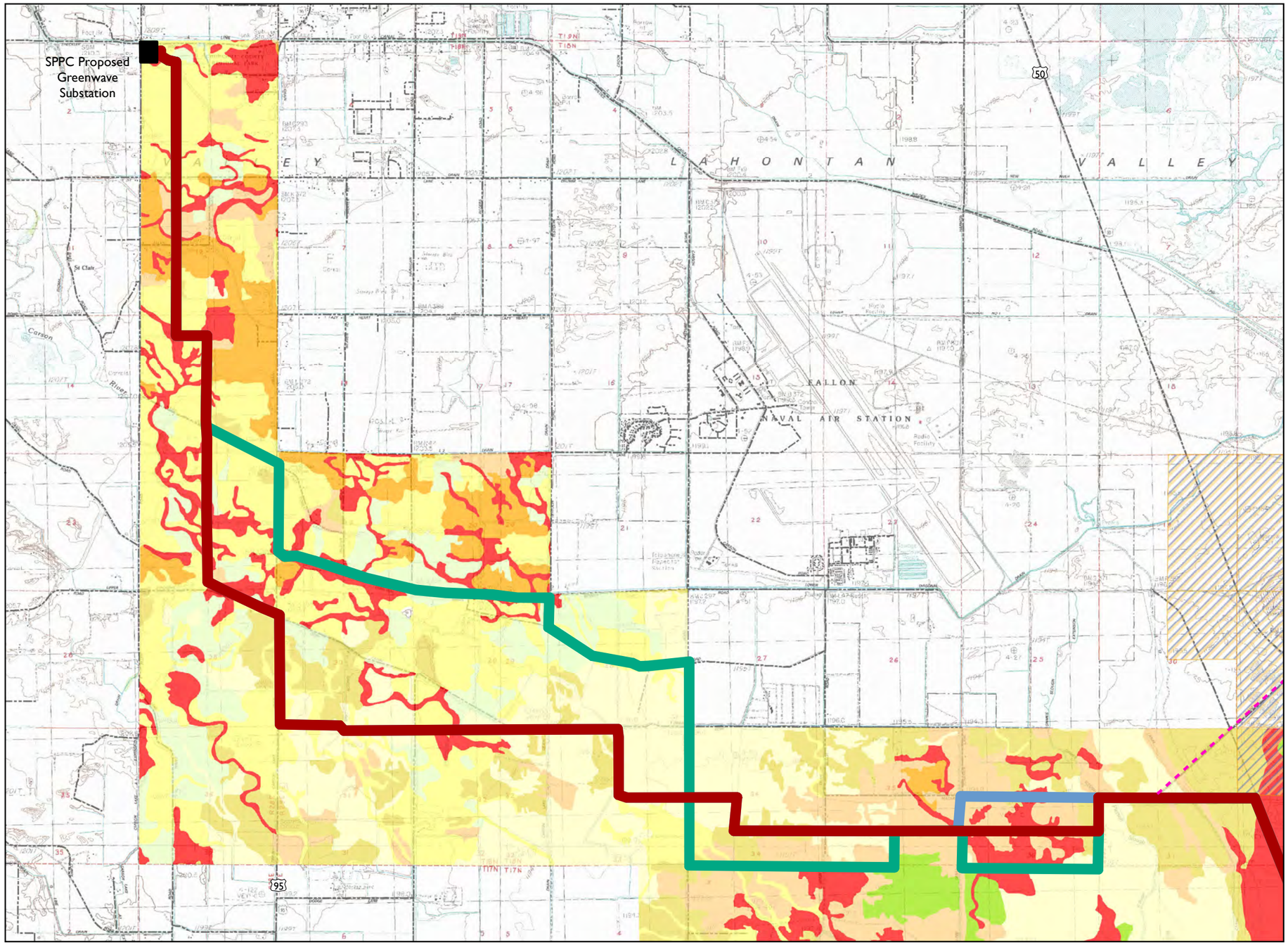
units 132, 133, 140, and 149), with smaller areas of sandy stream terraces (NRCS map unit 154) occur in this portion of the Project Area, which includes the proposed transmission line route. Soil map units in this area are similar in size to map units in the complex floodplain of the central portion 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



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 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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Figure 3-3

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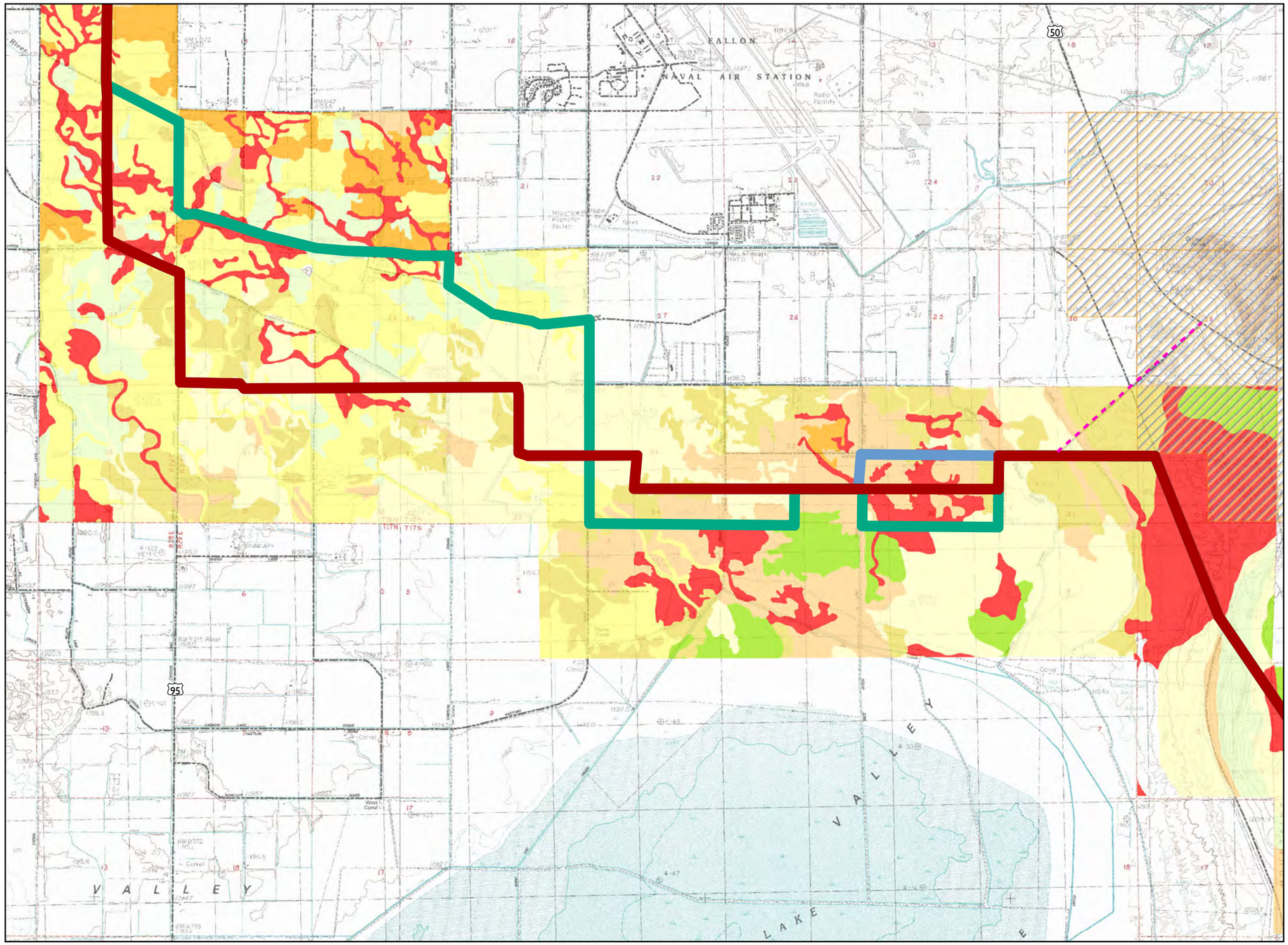

Soil Wind Erodibility Group, SPPC Central

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 Macari Fiber Optic Line

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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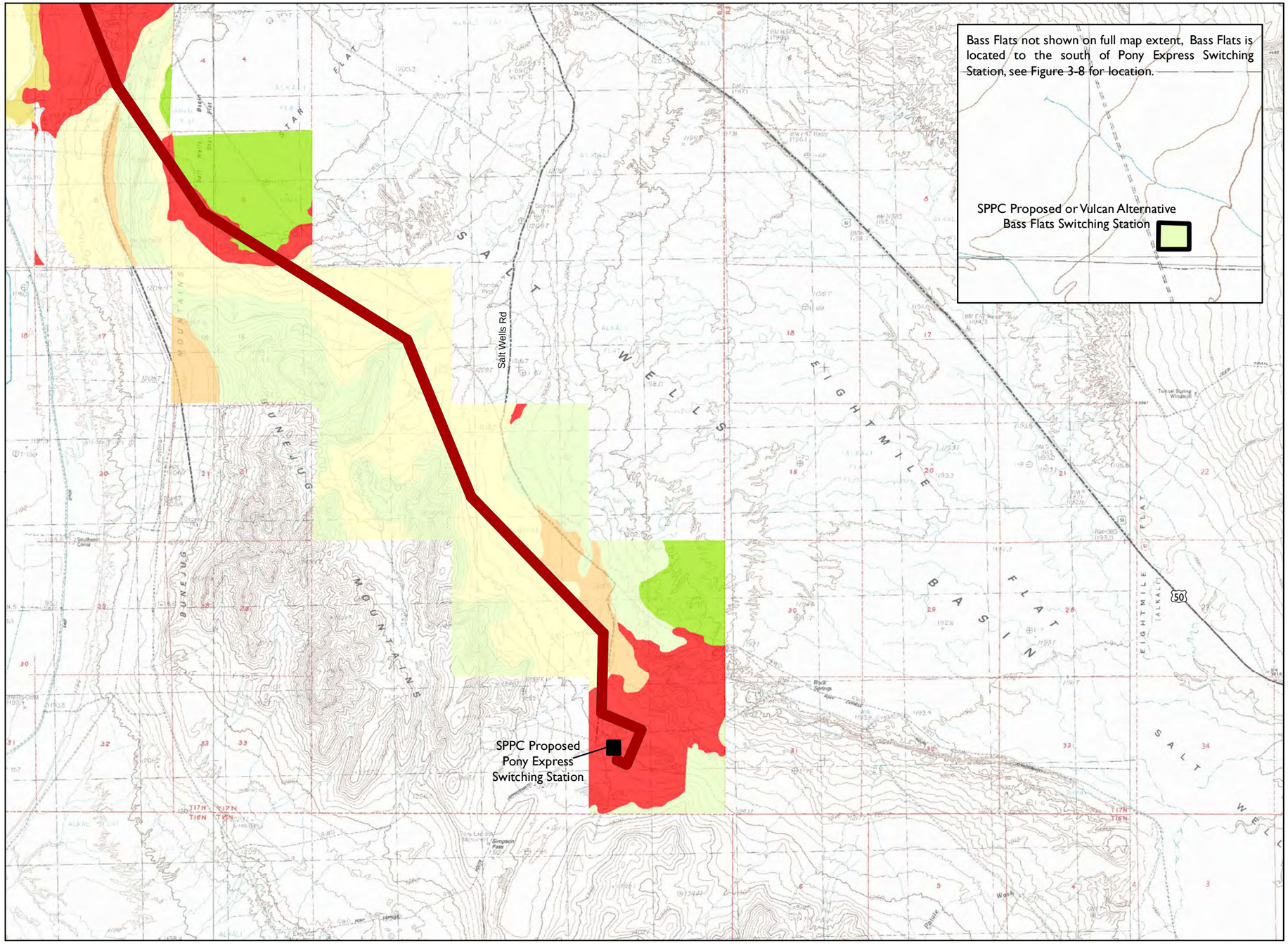

Soil Wind Erodibility Group, SPPC Southern

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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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.

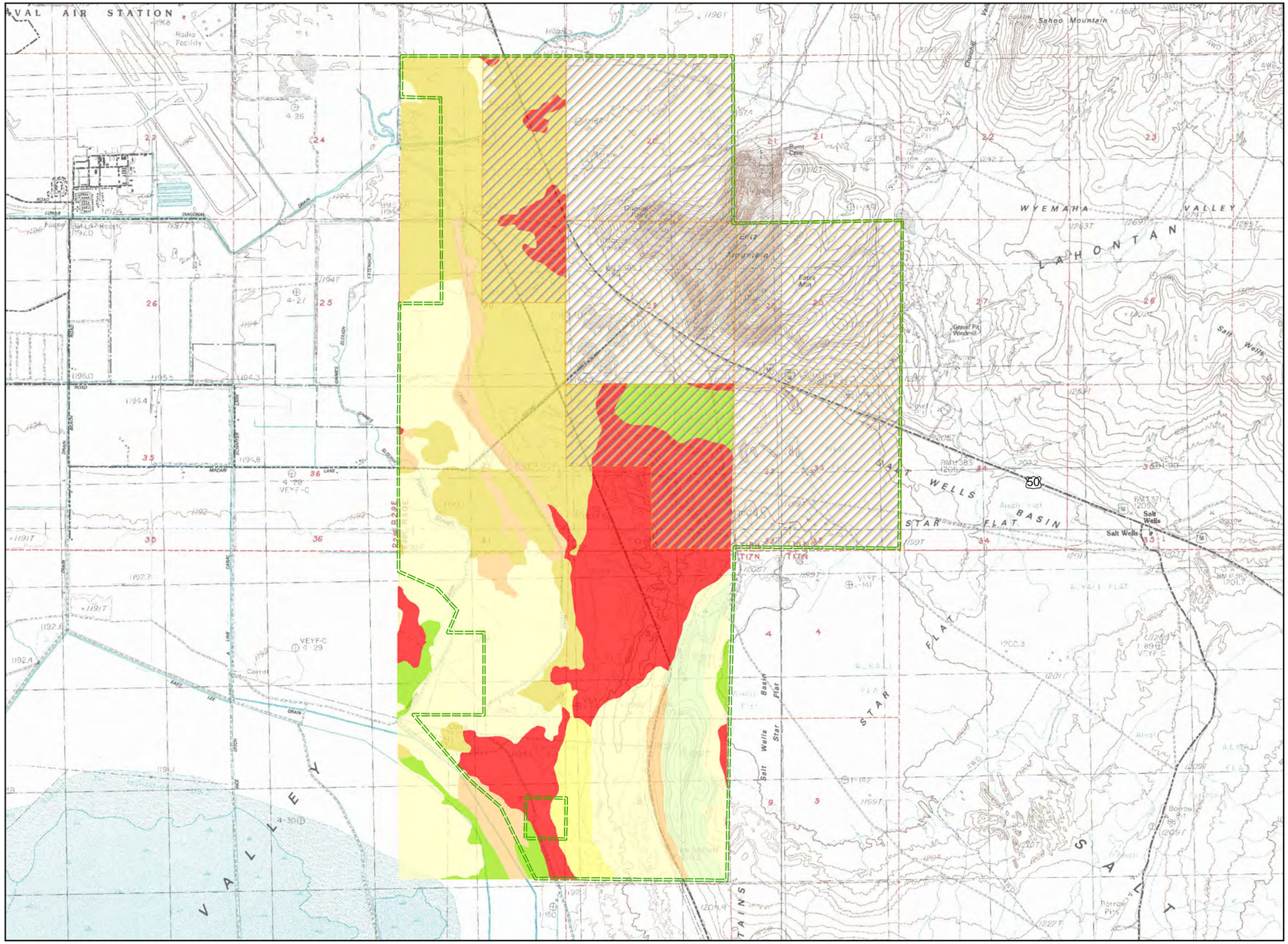
The depth of the surface horizon in the Ormat Survey Area ranges from 2 to 18 inches, with most areas having surface horizon thicknesses from 5 to 10 inches. Although in many areas this material is not considered topsoil, the surface horizon represents the growth medium present. Most of the surface horizon 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.

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 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

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 3-6

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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).

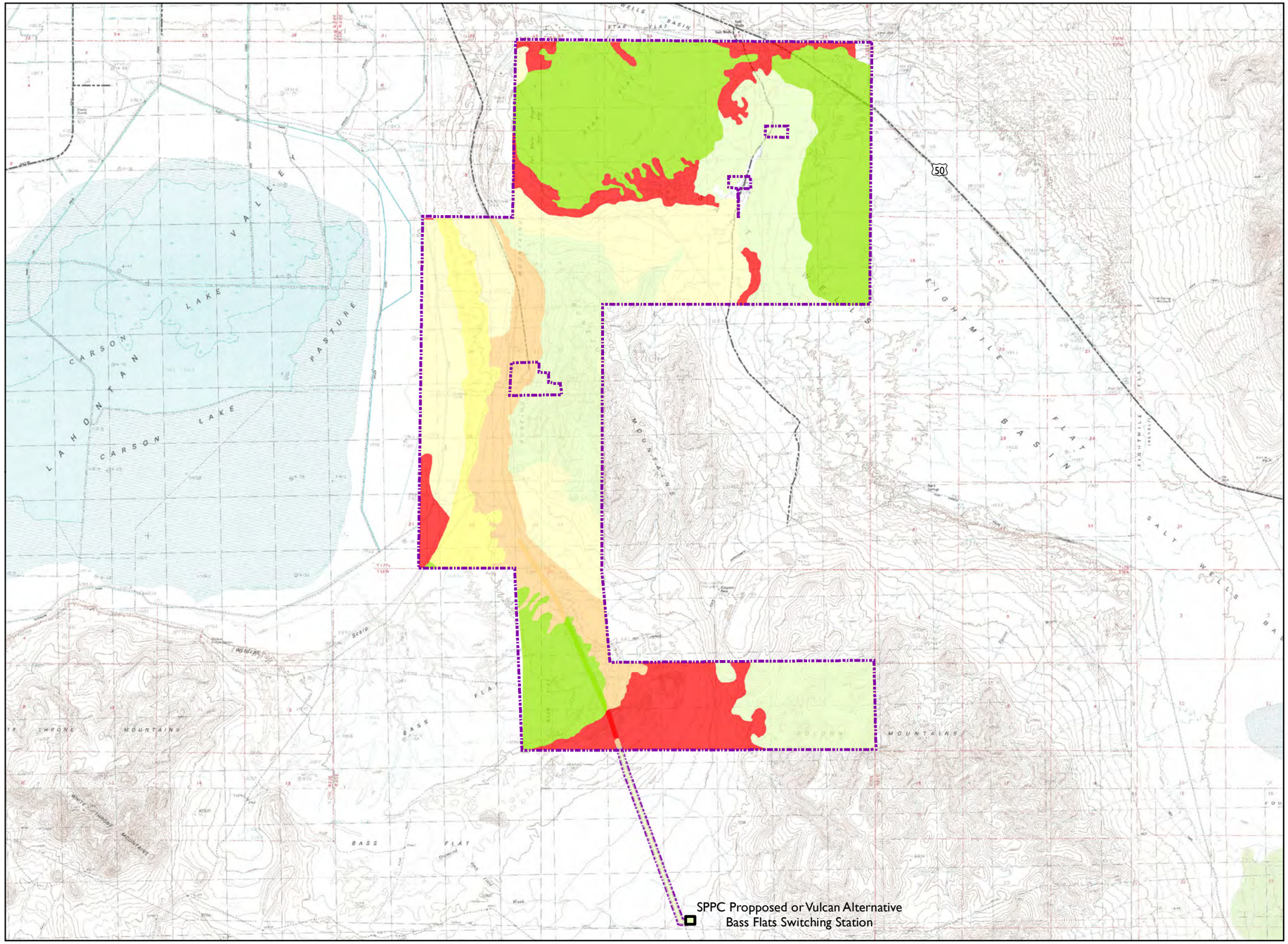
Regional Overview

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, 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



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

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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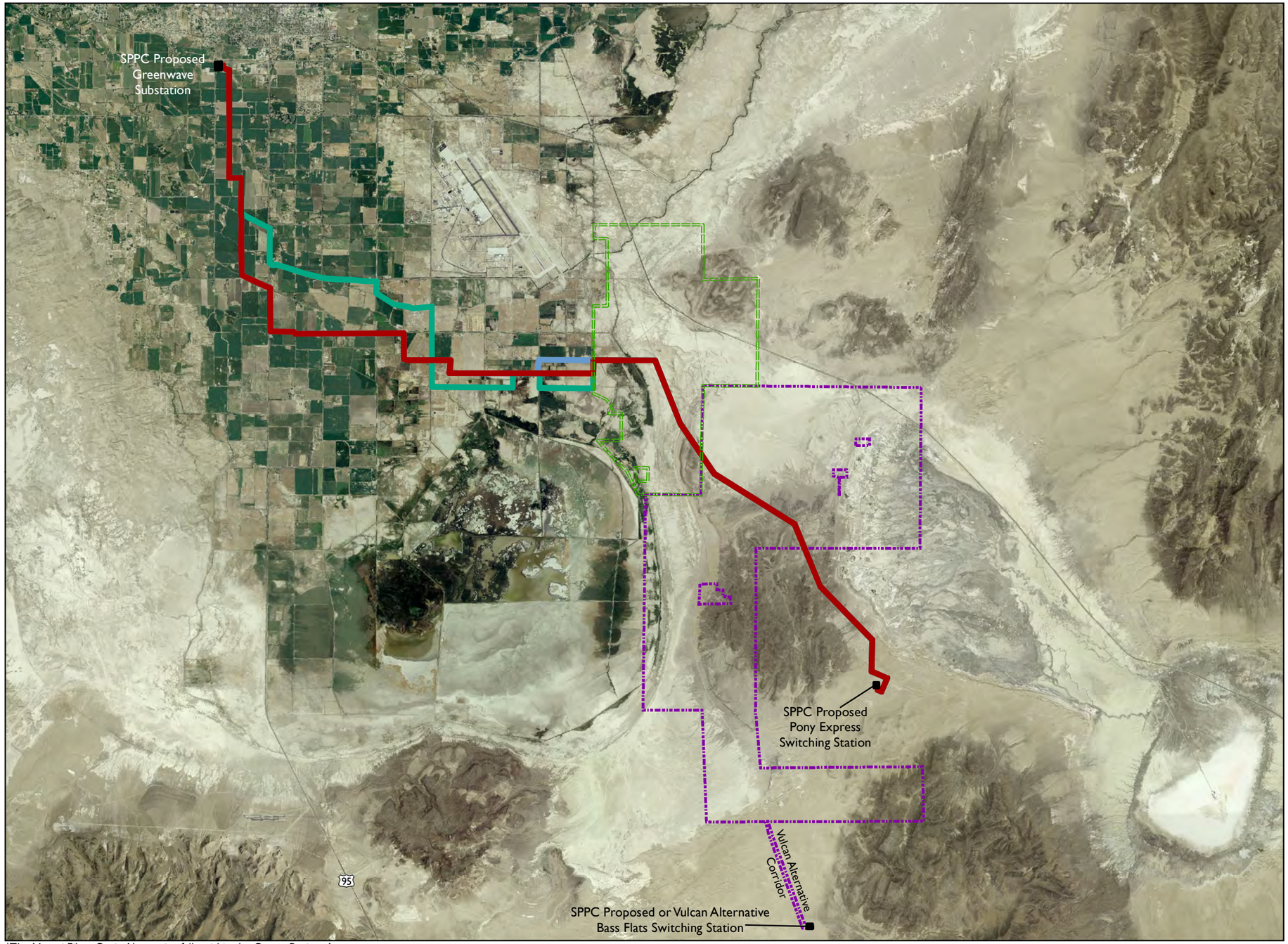

Farmlands

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

Ormat Project Area

Ormat Project Area Boundary

Vulcan Project Area

Vulcan Project Area Boundary

Other Features

Proposed Switching or Substation

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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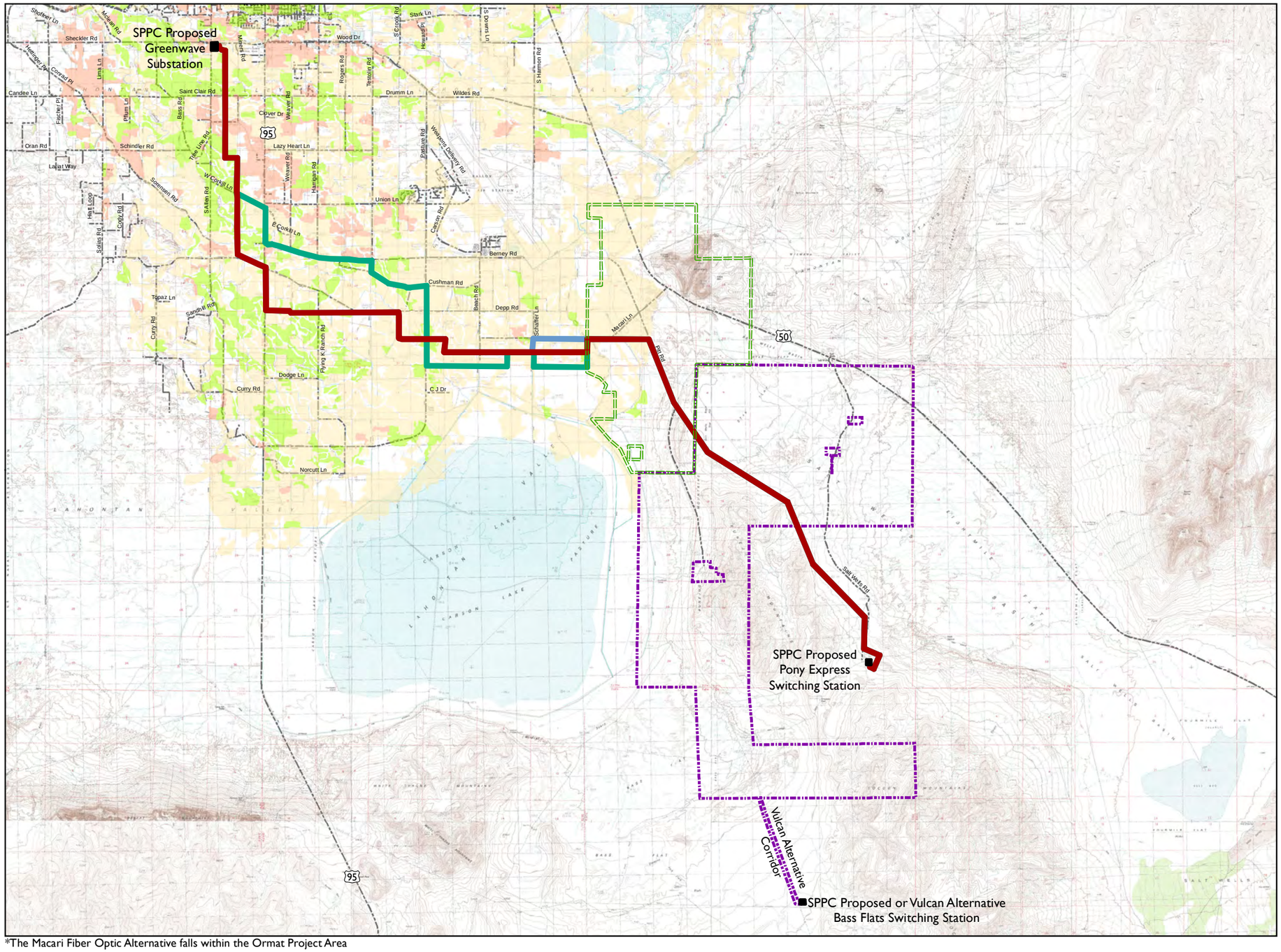

Prime Farmlands

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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation

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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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.

Vulcan Project Area

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

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

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.

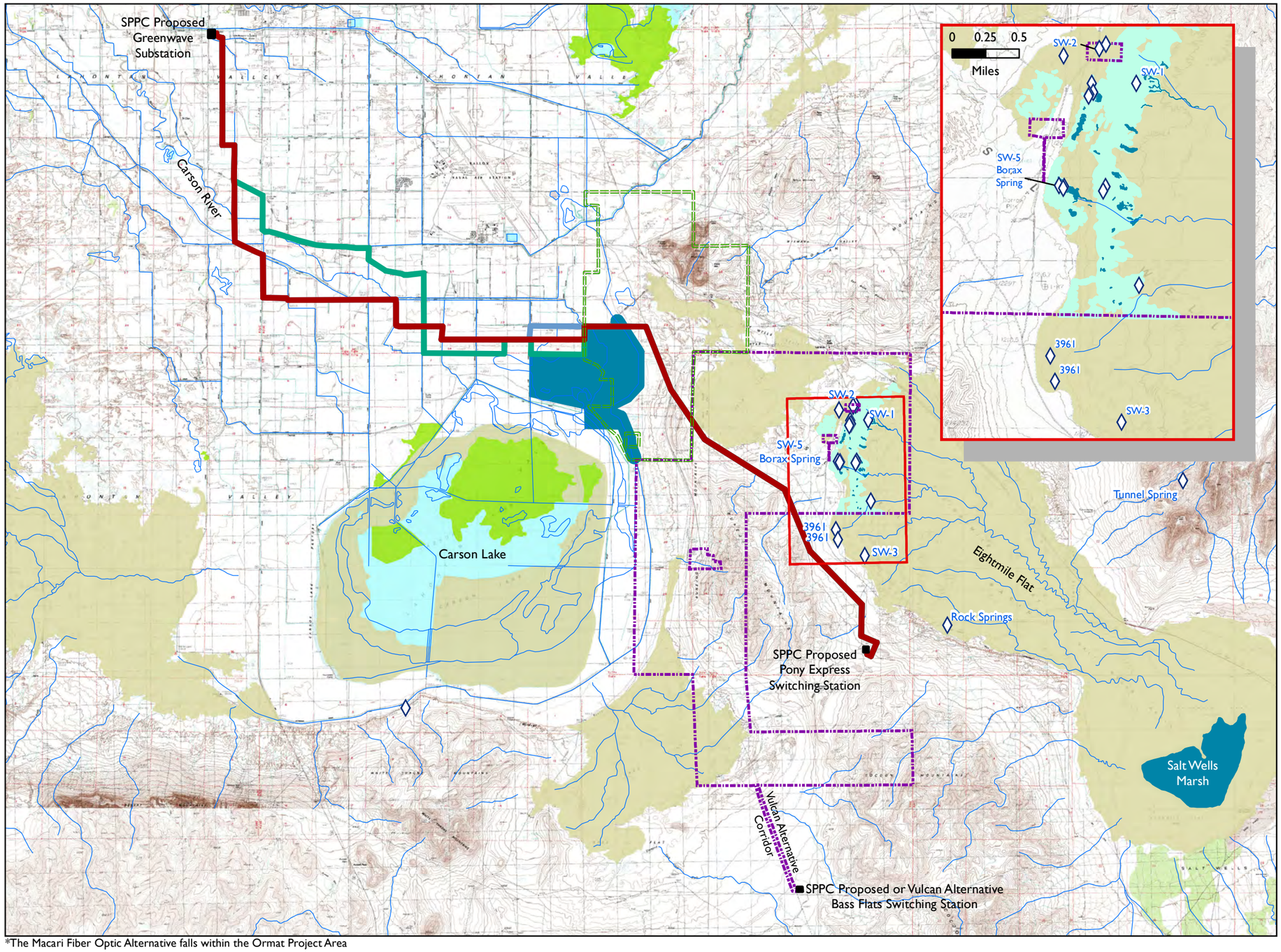
Regional Overview

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).

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



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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation

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 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 (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.

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 diversions: Truckee Diversion with water diverted at Derby Dam from the Truckee River into the Truckee Canal and then to the Lahontan Reservoir; and Carson Diversion with water released from the Carson River near the Lahontan Reservoir (Reclamation 2010). The Carson Diversion 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 Diversion 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.

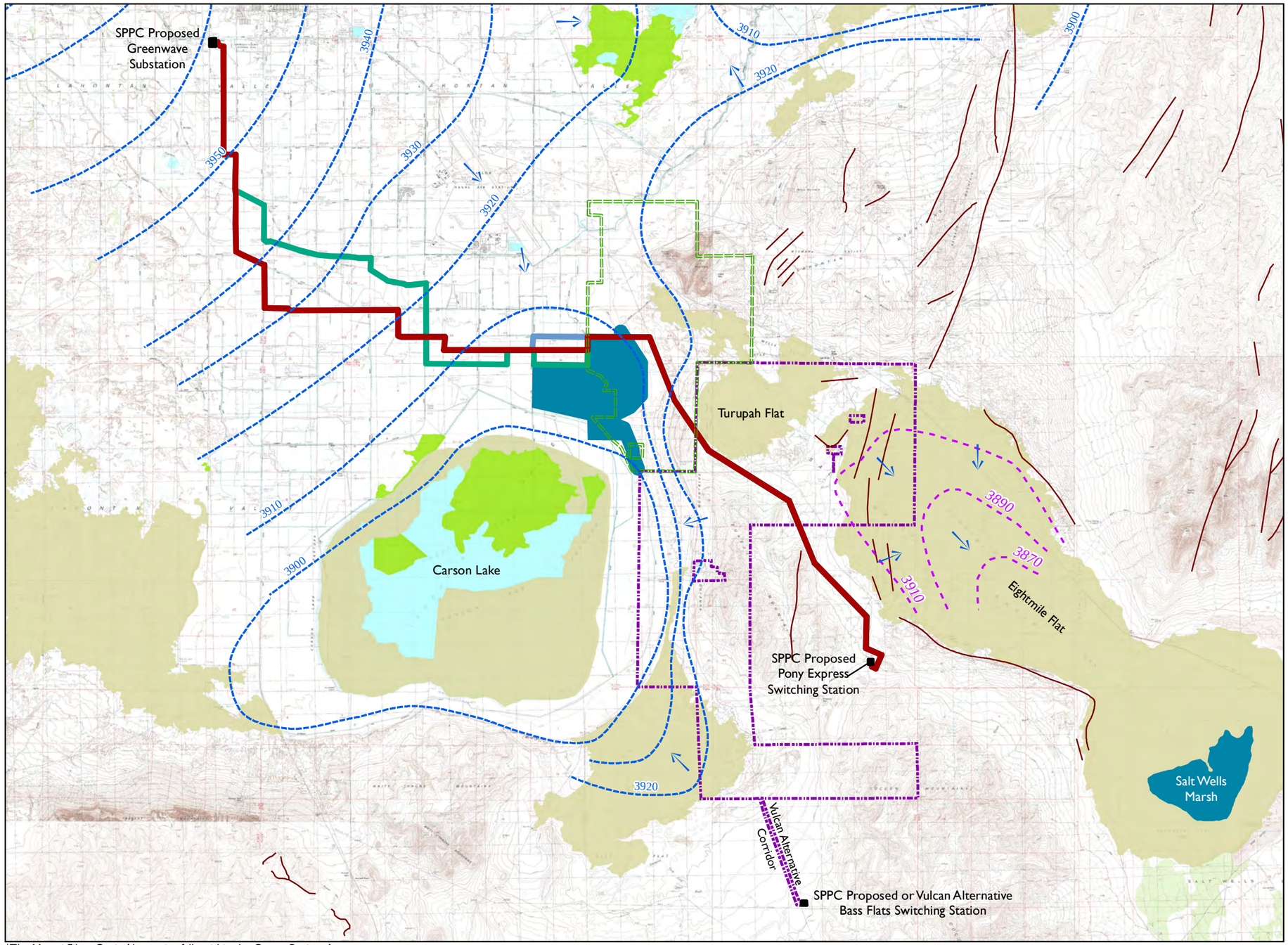
Within the basin, perennial wetlands are found in topographically low areas where groundwater discharges to the surface (Huffman and Carpenter 2009a). Larger seasonal wetland areas adjacent to perennial wetlands may be supported by precipitation, although the average annual precipitation in the Salt 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.



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

Sierra Pacific Project Area*
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation

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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Miles

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

Figure 3-11

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Surface Water Quality and Temperature

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 one sample collected in March 1988. Low values of temperature, silica (SiO2), sodium (Na), potassium (K), sulfate (SO4), and chloride (Cl) suggest that geothermal groundwater is not a major source of surface water flow in the Carson River.

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

TDS	SC	pH	Cl	SO_4	K	Na	Mg	Ca	HCO_3	SiO_2
256	406	8.9	21	50	4.3	55	7.1	25	122	21

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: Lico and Seiler 1993

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 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 Description	SW-1 seep	SW-2 seep	SW-3 spring	SW-5 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

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

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 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, the Fallon Naval Air Station, 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).

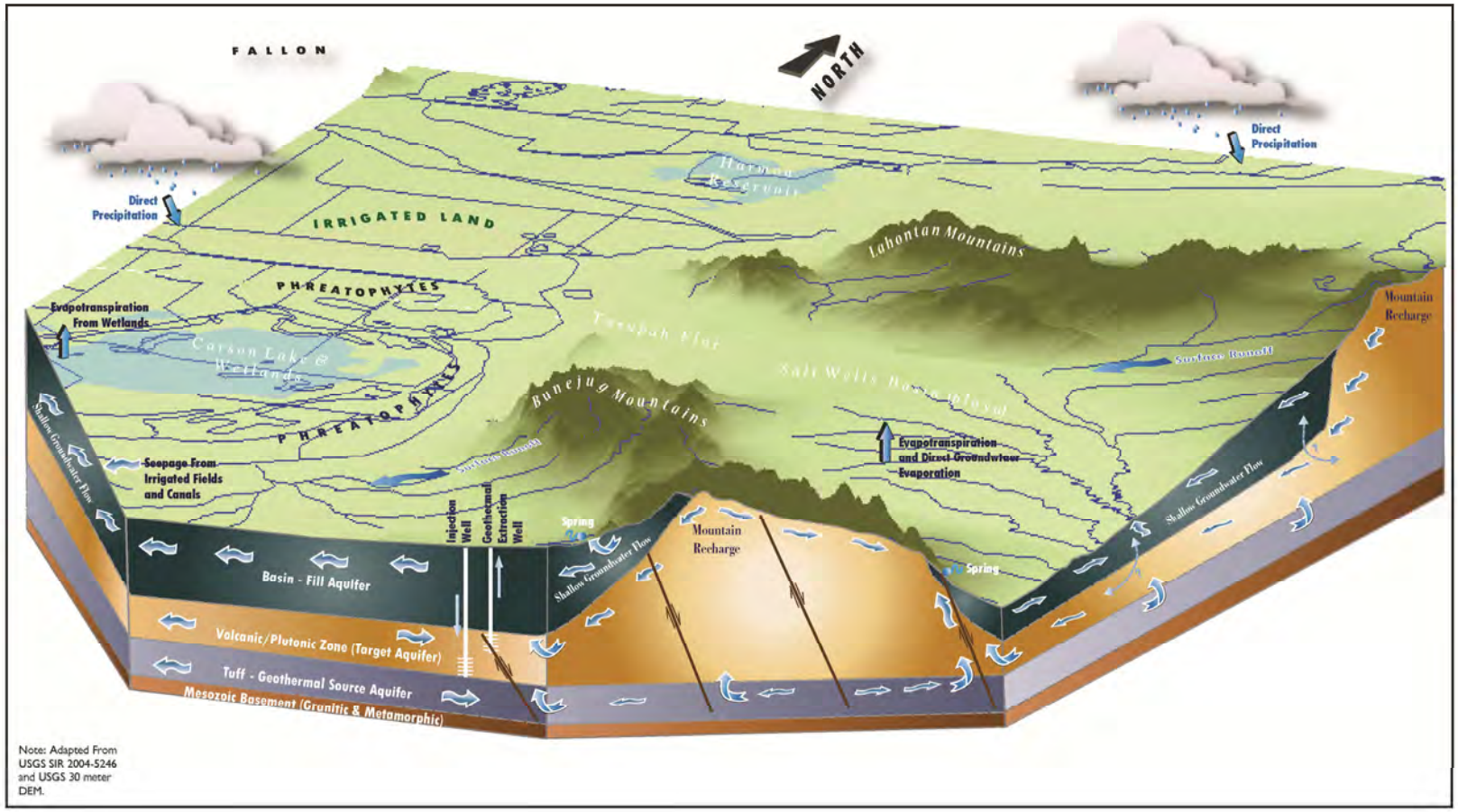
Geothermal Flow System. The unconsolidated basin-fill aquifers overlie a basalt-rich volcanic/plutonic zone (**Figure 3-12**, Conceptual Hydrologic Block Model Diagram). The geothermal source aquifer is an ash-flow tuff unit which underlies the basin-fill aquifers. The tuff is underlain by granitic and 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 Environmental Assessment 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 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 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



SOURCE: USGS SIR 20045-246

LEGEND:

Conceptual Hydrogeologic Block Model Diagram

Not To Scale

Normal Fault Thought To Control The Vertical Flow Of Geothermal Groundwater

Groundwater Flow Path

Suspected Groundwater Flow Path

NATIONAL SYSTEM OF PUBLIC LANDS

Figure 3-12

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

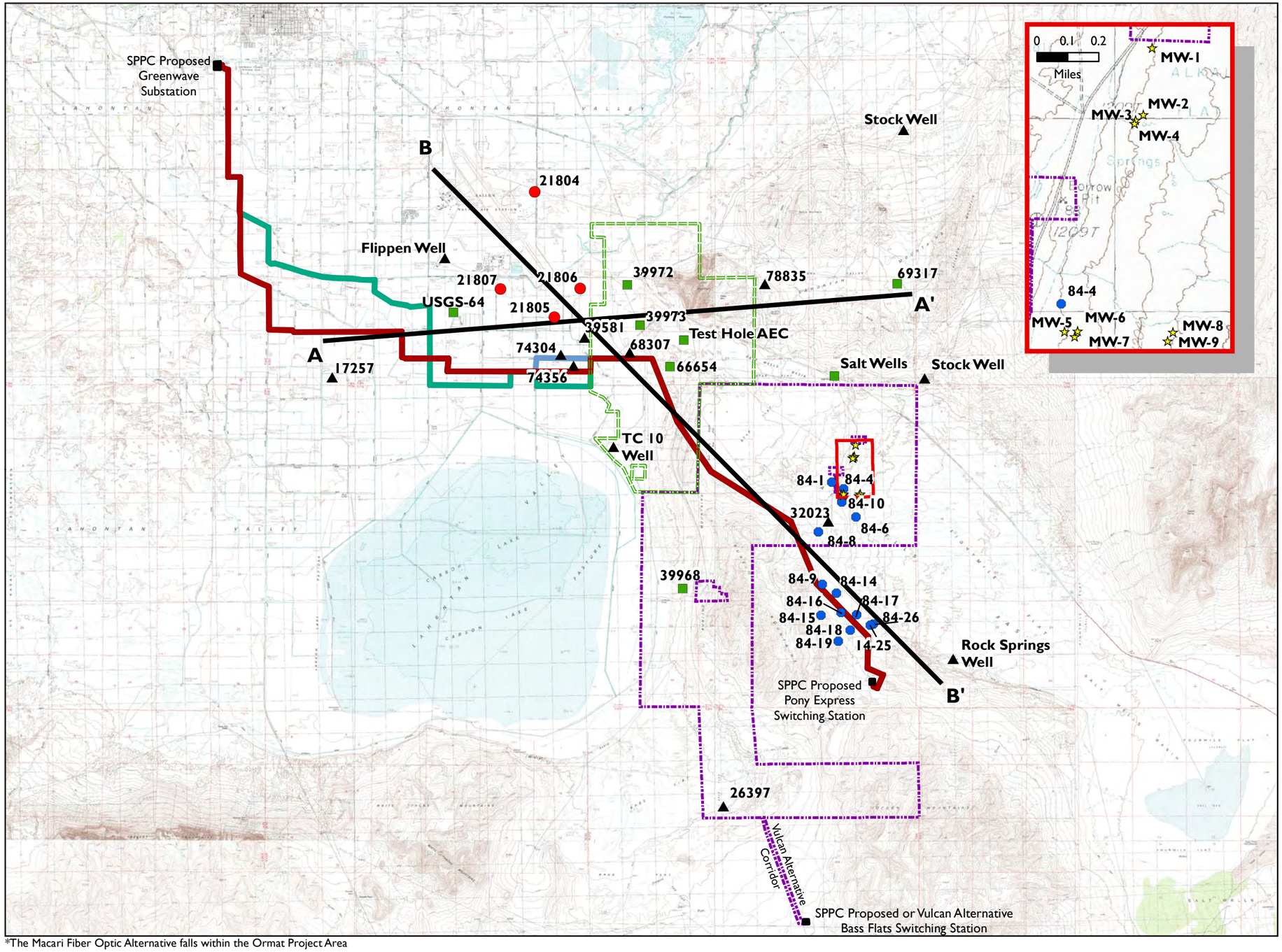
Area using information from some of the wells shown on Figure 3-13. The cross sections represent the hydrostratigraphy discussed previously and indicate that unconsolidated deposits (basin-fill aquifers) overlie basalt-rich rocks within the ROI. Due to a lack of lithologic and completion logs for deep 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).

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



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

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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation

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

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Figure 3-13

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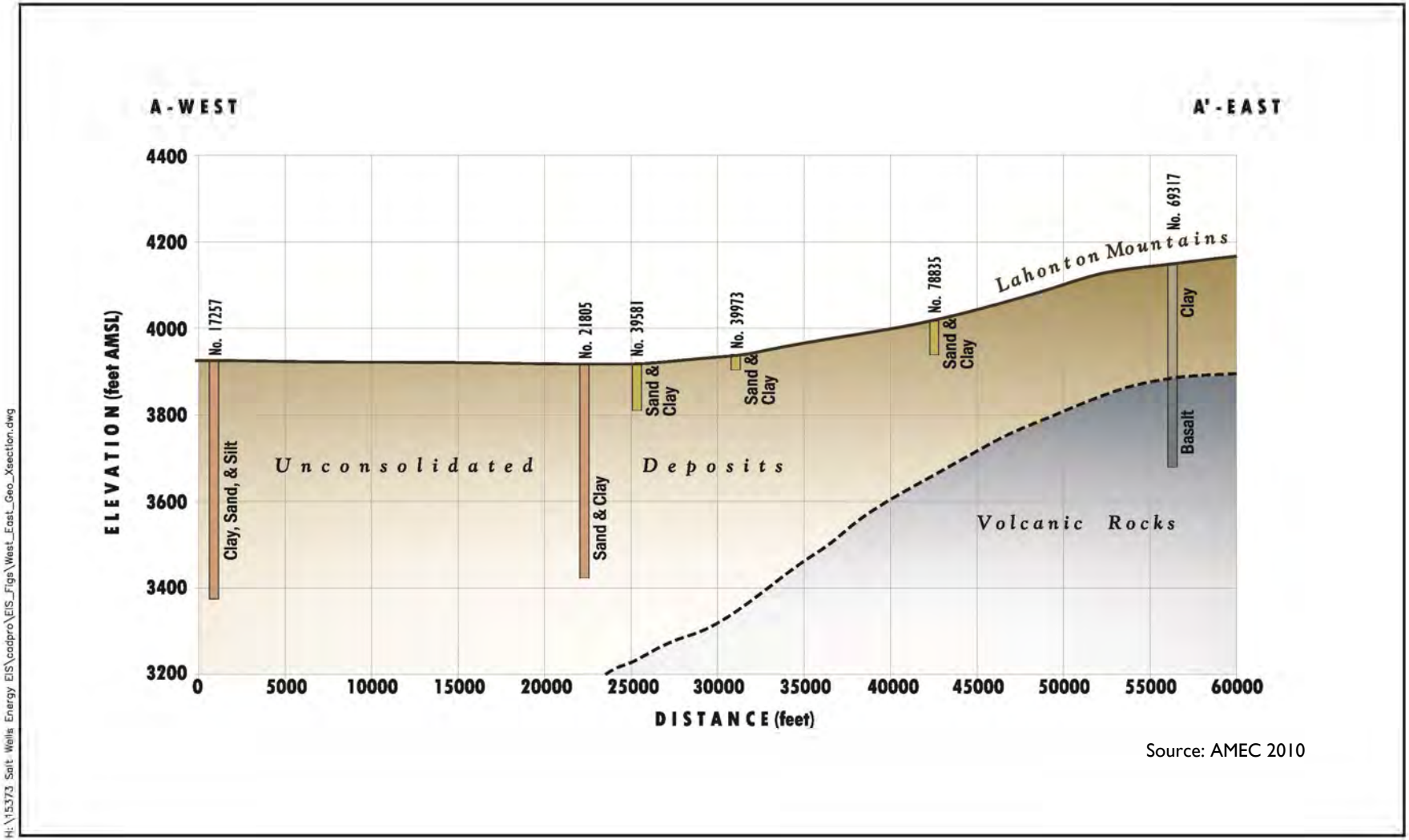

Source: AMEC 2010

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Hydrogeologic Cross-Section A-A'

0 Feet 320
Vertical

0 Feet 8000
Horizontal

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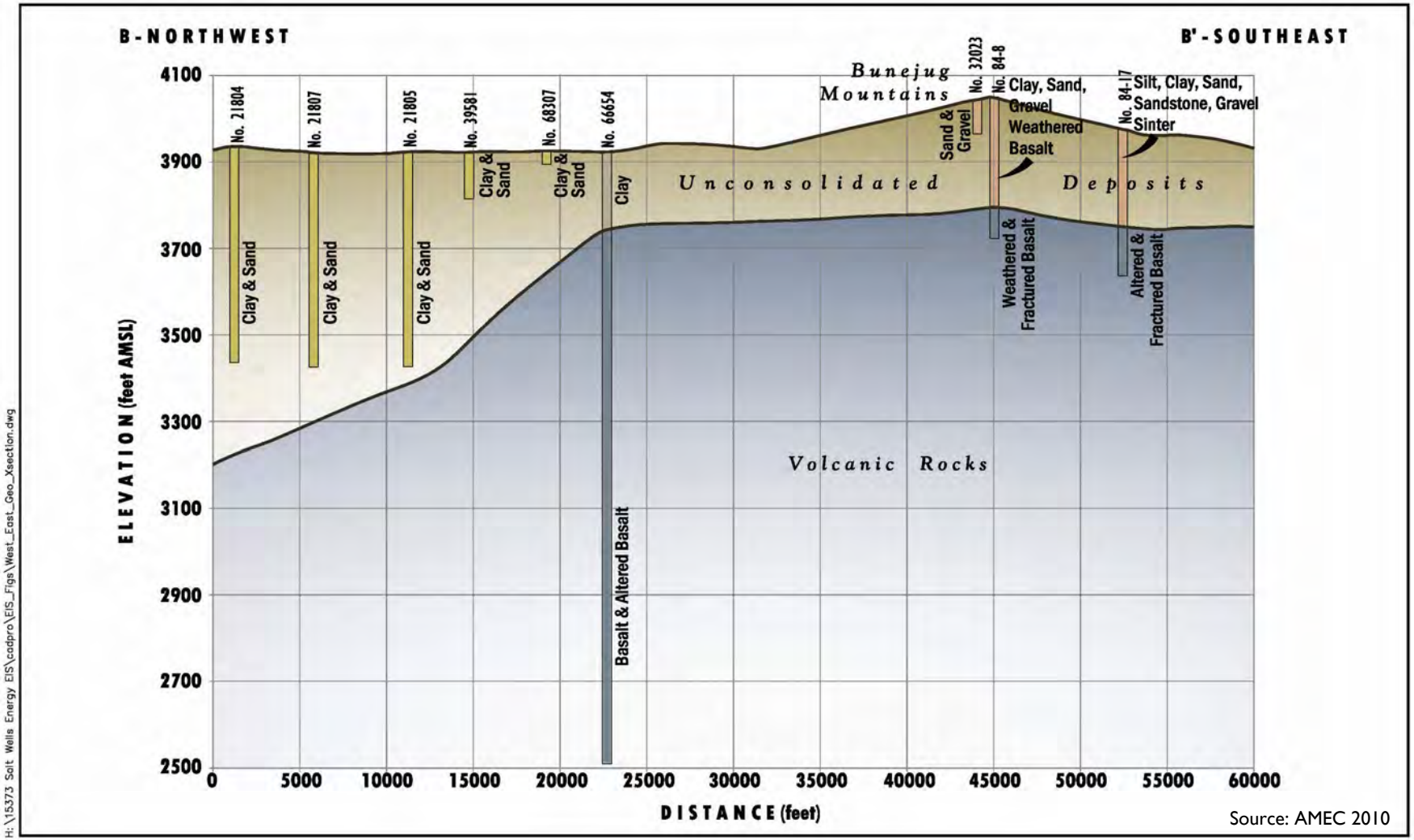
Figure 3-14



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Hydrogeologic Cross-Section B-B'

0 Feet Vertical 320

0 Feet Horizontal 8000

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Figure 3-15

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

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.

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.

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

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.

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

Geochemical data provided by GeothermEx (1977) are summarized in **Table 3-16**, Groundwater Quality Data for Selected Wells Within and Near the Salt Wells Energy Projects Area, 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 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 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

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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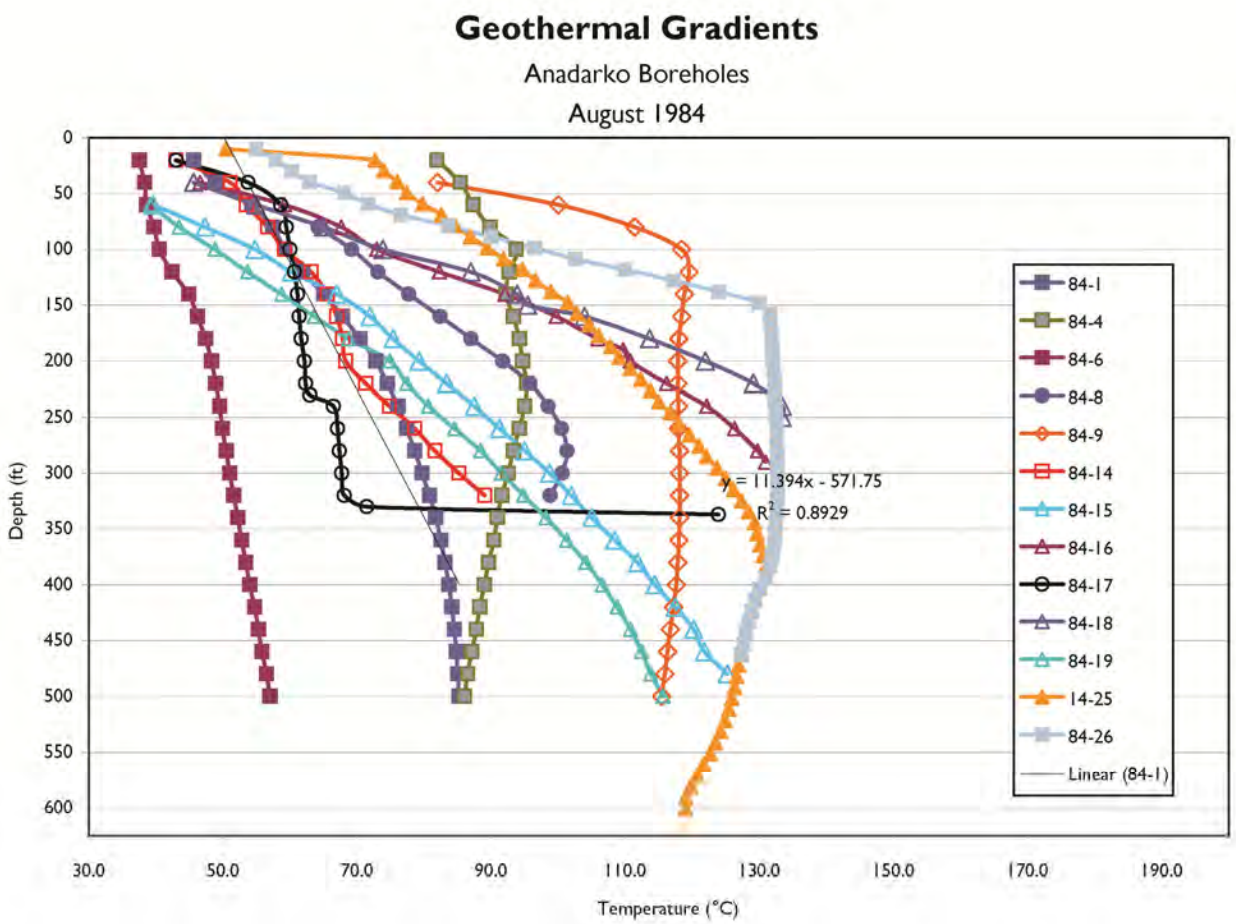


Source: AMEC 2010

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)

Geothermal Gradients for Selected Boreholes

Figure 3-16

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 Nevada Division of Water Resources (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;
- 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, Naval Air Station, 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. 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 facilities would cross several irrigation drains and canals. 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 US Army Corps of Engineers (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. The USACE has indicated that they would exert jurisdiction over wetlands associated with the Newlands canals. 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. The Carson Lake and Pasture area is a 30,000-acre wetland that is a component of the Western Hemisphere Shorebird Reserve Network.

Riparian Zones

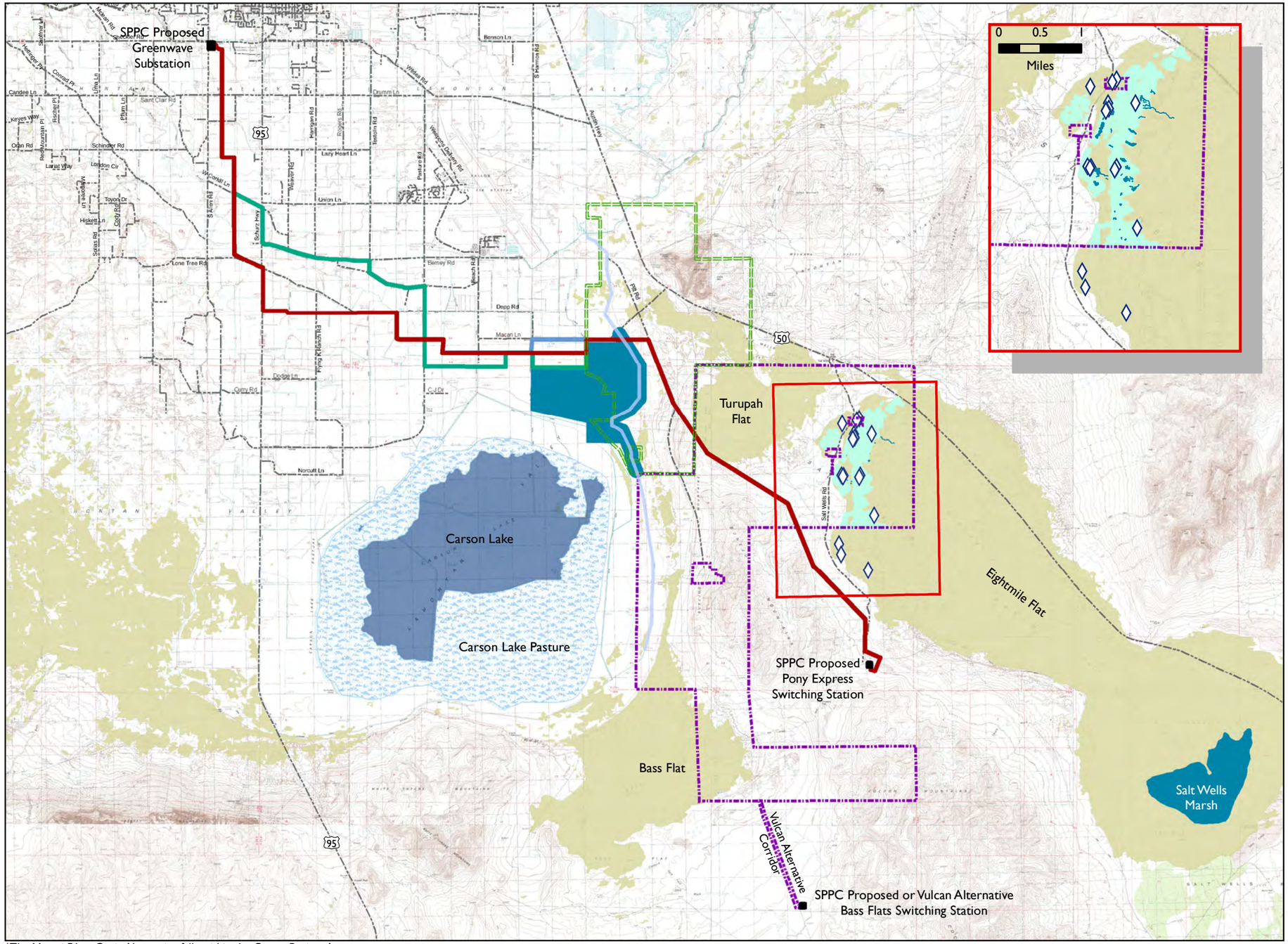
Within the Salt Wells Energy Projects Area, riparian zones are limited to the banks of Newlands canals, within Eightmile Flat in association with springs, and in other areas of high water table surrounding the Carson Lake.

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. The USACE may exert jurisdiction over these wet meadows. 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).



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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation

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

NATIONAL SYSTEM OF PUBLIC LANDS

0 1 2
Miles

January 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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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).

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 that are unlikely to be repaired (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, and the USACE has indicated that they would exert jurisdiction over these wetlands. 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.

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.

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). While the USACE may take jurisdiction over playas and wetlands as "special aquatic sites," the USACE is not expected to take jurisdiction over these sites since they do not abut and have no 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

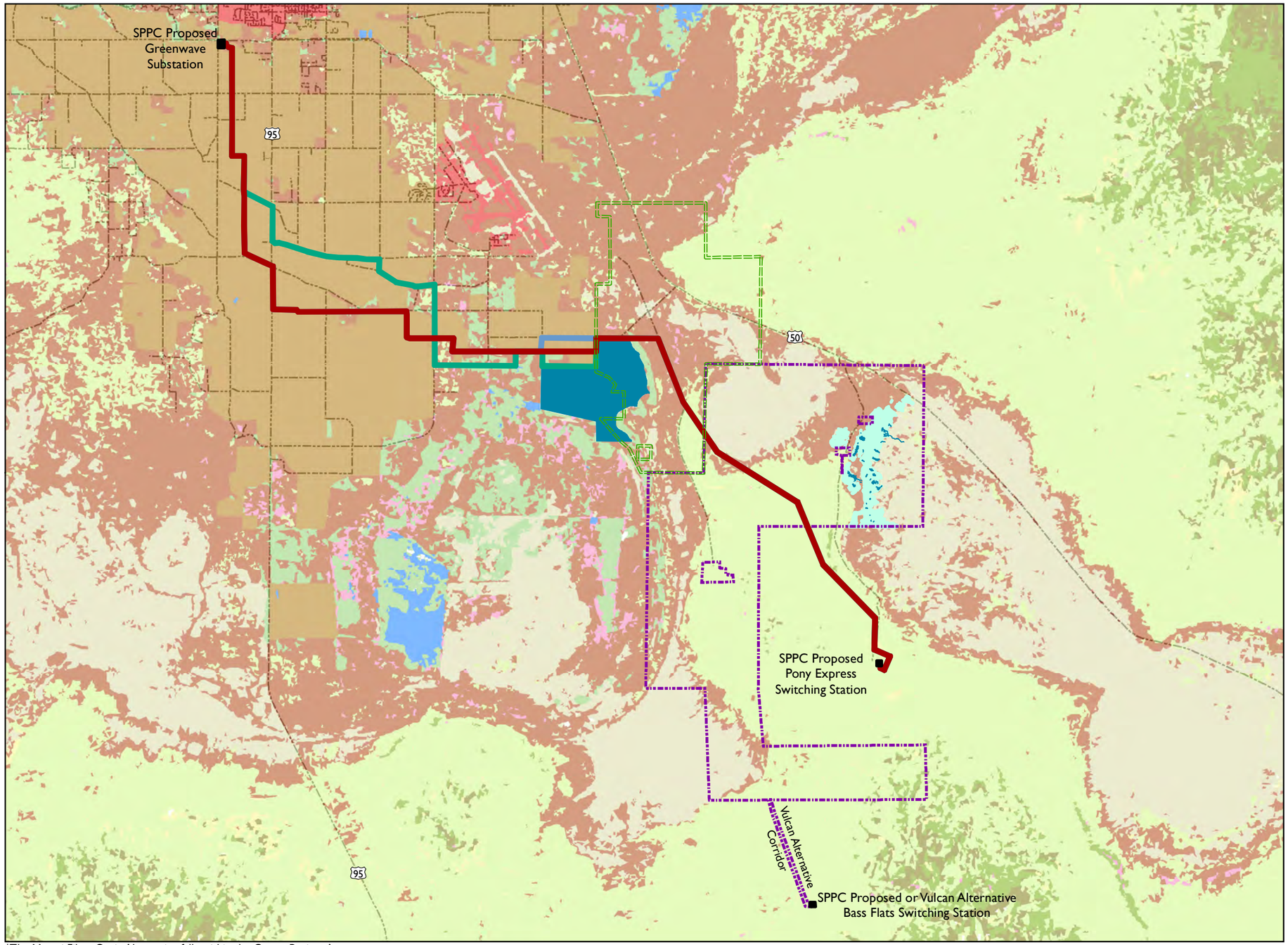
Vegetation communities were broadly classified using the SWReGAP and field documentation (**Figures 3-18** through **3-20**, Habitat Types, Overall, Northern, and Southern Views). SWReGAP was developed by using geospatial data and is used to create the land cover map and to model vertebrate habitat. 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 saltgrass (*Distichilis spicata*) are common. Soils within this community are generally quite alkaline (Pondera 2010).



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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation

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

NATIONAL SYSTEM OF PUBLIC LANDS

0 0.5 1 2
Miles

January 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 3-18

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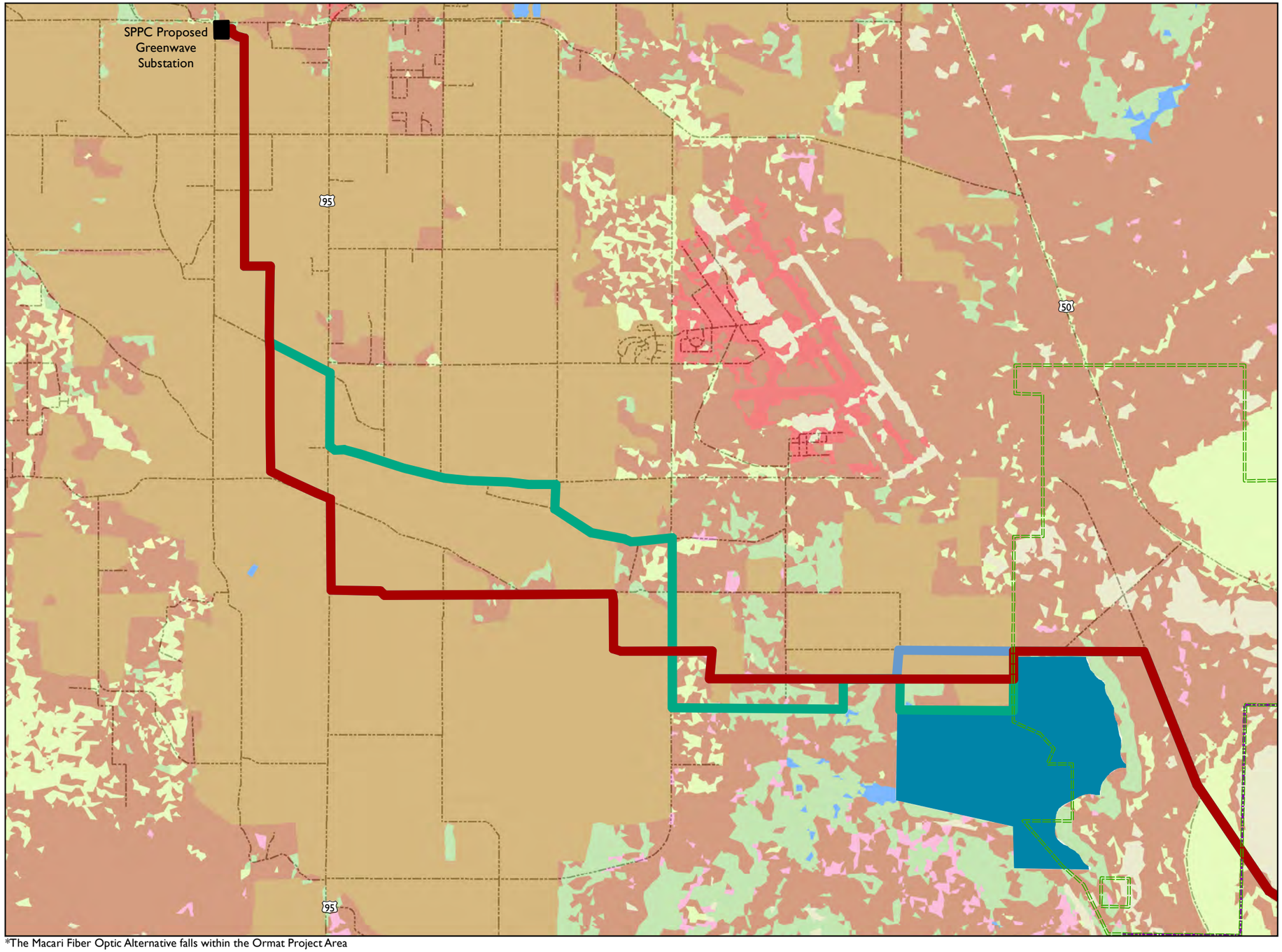

Habitat Types, Northern View

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
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor

Ormat Project Area
- Ormat Project Area Boundary

Other Features
- Proposed Substation

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

NATIONAL SYSTEM OF PUBLIC LANDS

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Miles

January 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 3-19

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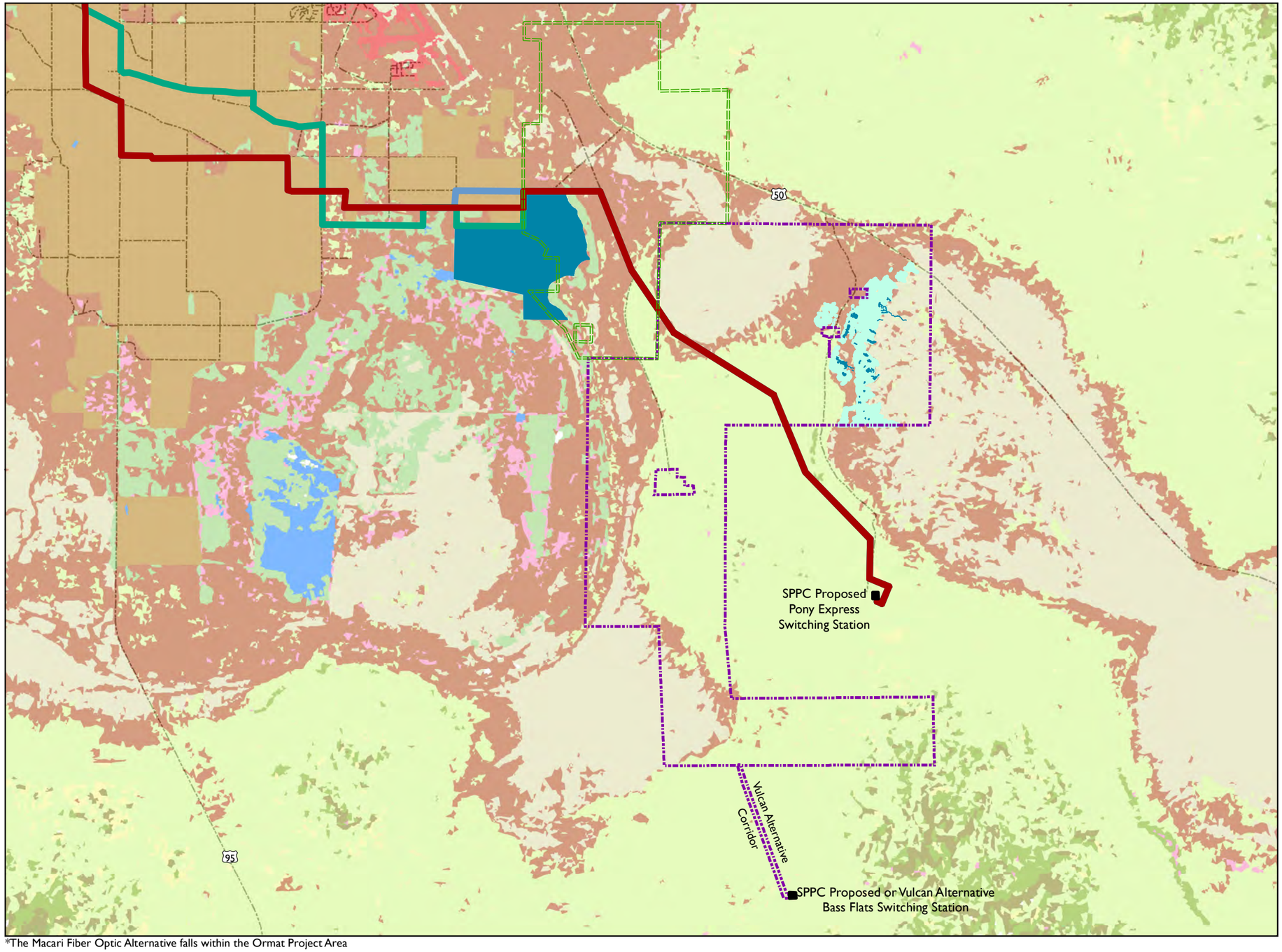

Habitat Types, Southern View

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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching Station

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

NATIONAL SYSTEM OF PUBLIC LANDS

0 0.5 1 2

Miles

N

January 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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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 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 saltgrass 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 bullrush (*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 reedgrass (*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 adjacent to 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

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

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 unauthorized breaches in the banks of the Extension Canal, which conveys water to the Carson Lake and Pasture (Pondera 2010).

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

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

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 bullrush, which are only found at springs or areas with obvious shallow groundwater such as low-lying areas within Eightmile Flat. While inland saltgrass 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).

Seasonal Wetlands

Seasonal wetlands within the Vulcan Project Area are wetlands dominated by the facultative species inland saltgrass. 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 reedgrass, 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) (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

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

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.

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).

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). **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).

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]
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).

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]
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).
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).

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]
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.
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.
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).

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]

[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, NDOW 2010, Bradley et al. 2006, Floyd et al. 2007, and GBBO 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 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 Stillwater Field Office 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.

Reclamation-administered lands are currently undergoing the development of a resource management plan. Reclamation management plans only manage federally listed species and do not account for state or other designated sensitive species. BLM-designated sensitive species found within Reclamation and private lands are addressed as if they were within BLM managed lands (Pondera 2010).

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).
Prairie falcon *Falco mexicanus*	S/--	Nests on cliff faces adjacent to foraging habitat of saltbush, sagebrush, creosote bush, greasewood, agricultural crops, and	Known to occur; suitable nesting habitat exists on rock outcrops. Seen in 2010 surveys. Known to

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

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
		native perennial grasses.	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 variety of settings (rocks, trees, buildings, caves, adits, etc.).	Known to occur; foraging habitat available, roost sites exist within rock outcrops. One dead pallid bat was noted within the Projects Area at a rock outcrop during the 2010 surveys. 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]
			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. Roosts in a variety of settings.	Could occur; foraging habitat available, roost sites exist within rock outcrops. Known to occur east of Lahontan Valley in the Desatoya Mountains (Bradley et al. 2006).

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

Species	Status[1] (BLM/ USFWS)	Habitat	Potential for Occurrence [2]
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, NDOW 2010, Bradley et al. 2006, Floyd et al. 2007, and GBBO 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 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 National Historic Preservation Act of 1966 as amended (NHPA), the Archaeological Resources Protection Act (ARPA), the American Indian Religious Freedom Act and Executive Order 13007, and the Native American Grave Protection and Repatriation Act (NAGPRA). Cultural resources within the Salt Wells Energy Projects also fall under purview of the Programmatic Agreement among the BLM, Bureau of Reclamation (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, 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. A later version of the stage line went through the Stillwater Range, about 12 miles north of the APE. 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 before present (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 Eight Mile 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, the first reclamation project in the West covering 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

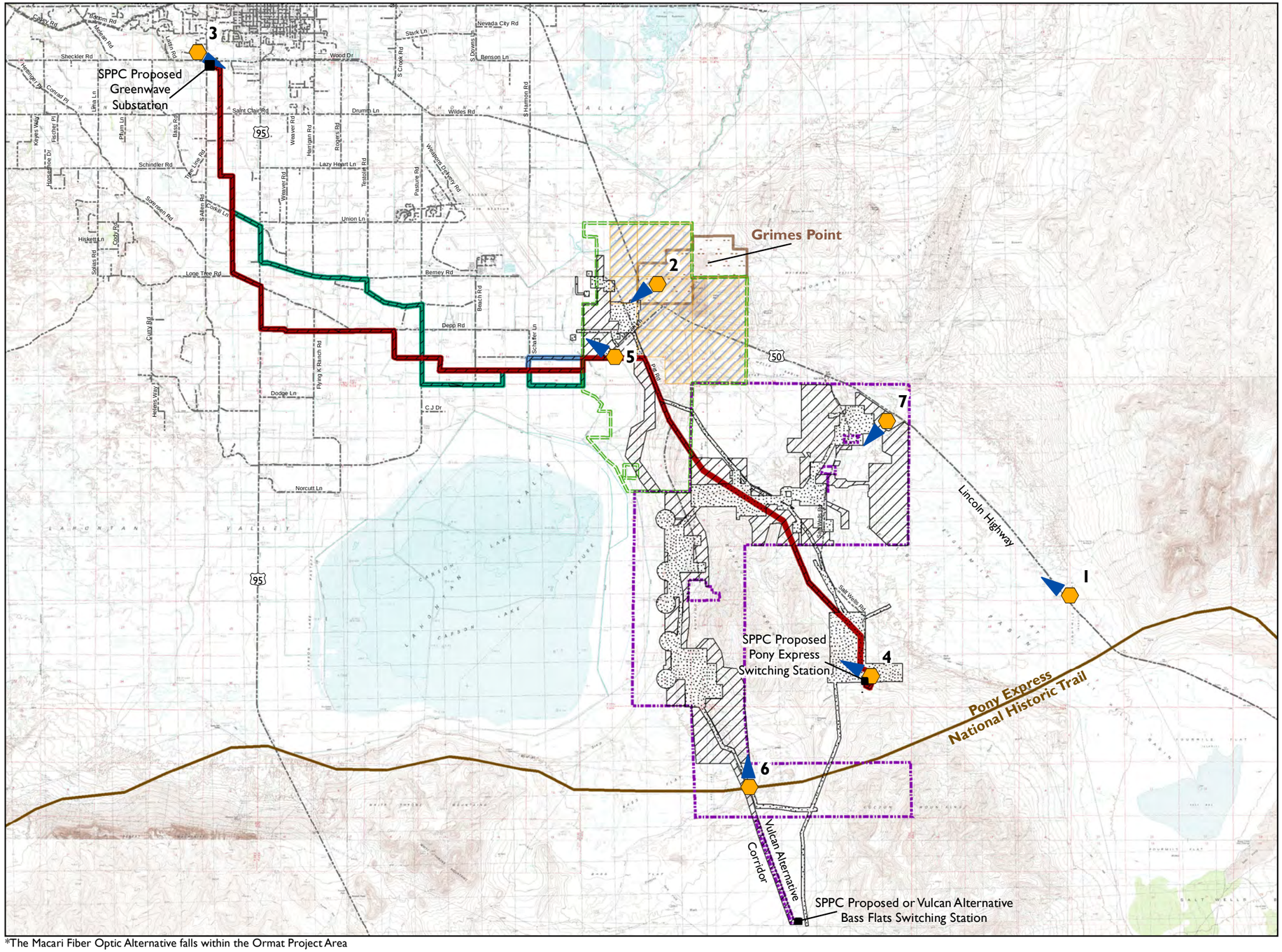
The Modern Period (AD 1941 to present) has experienced continued agricultural and community growth in the Fallon area, even though the Newlands Project is limited in the amount of land that can be irrigated. Fallon Naval Air Station was established just southeast of Fallon in 1942 in support of World 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.

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 94 previous study areas. Sixty-two (62) of these cultural resource projects resulted in the discovery of one or more archaeological sites and three were Class I studies.

Three hundred twenty-nine (329) cultural resource sites 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,



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

Cultural and Visual Resources

Churchill County, Nevada

Cultural Survey Area
- 2010 Survey Area
- Previous Surveys

Archeological Site
- Grimes Point
- Pony Express National Historic Trail

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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- No Surface Occupancy

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

NATIONAL SYSTEM OF PUBLIC LANDS

0 0.5 1 2
Miles

January 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.

Figure 3-21

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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 329 previously documented cultural resources within the Class I study area can be described in terms of their evaluation for listing in the NRHP. One hundred fifty (150) sites have been determined ineligible to the NRHP, 90 sites are unevaluated for the National Register, 63 sites are determined eligible and thus considered historic properties with 5 of those nominated to the National Register. Twenty-six (26) of the resources are isolates and are also considered ineligible for the National Register. 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 National Register 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 National Register 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 National Register District, and a borax extraction complex. These resources are reported under their respective project areas below.

The Newlands Project National Register 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 5,923 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 115 Churchill County Assessor Parcels (APNs) was inventoried by Far Western's architectural historians, Zeier and Associates, LLC, during the fall of 2010.

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register 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
3-5079	2128	V3	BLM	Pony Express National Historic Trail segment	Eligible: A	Avoidance; Mitigation through public interpretation
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	CGS	Ineligible	None
3-7862		V11	BLM	SGS (Simple Ground Stone Assemblage)	Eligible: D	Avoidance
3-7863		V12	BLM	SFS	Eligible: D	Avoidance
3-7864		V13	BLM	SFS	Eligible: D	Avoidance
3-7865		V14	BLM	SFS	Ineligible	Avoidance
3-7866		V15	BLM	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 Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
3-6924	2567	V16	BLM	SFS	Ineligible	None
3-478	486	V17	BLM	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	CGS	Ineligible	None
3-568/ 226/ 523	18/89	V31	BLM	CGS locus with Feature	Unevaluated with Ineligible component	None

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
3-7877		V32	BLM	Historic-era linear road segments	Ineligible segments	None
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	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	Unevaluated with Ineligible segment	None

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
3-7891		V49	BLM	Historic-era Rock Features	Ineligible	None
3-3830	1157	V50	BLM	SFS Chert Source Area	Ineligible	None
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	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	None
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

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
				Ormat Project Area Sites		
		O2	Reclamation	CGS with FAR	Eligible: D	Avoidance
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	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	Eligible: D	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

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
3-7900		O12	Reclamation	CGS with Features; Ethnohistoric	Prehistoric, Ethnohistoric Eligible: D	Avoidance
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 debris in FAR scatters	Prehistoric, Ethnohistoric; Eligible: D; Historic: Ineligible	Avoidance
3-5941		O15	Reclamation	Mixed; 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	SGS 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

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
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; Ethnohistoric	Prehistoric, Ethnohistoric Eligible: D	Avoidance
3-7907		O28	Reclamation	Historic-era bottle fragments	Ineligible	None
3-7908		O29	Reclamation	SGSA	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	Homestead?	Unevaluated	Avoidance
3-7913		O35	Reclamation	SGS with Feature	Eligible: D	Avoidance
3-7914		O36	Reclamation	SGS with FAR Features	Eligible: D	Avoidance
3-7915		O37	Reclamation	SGS with FAR Features	Eligible: D	Avoidance
3-7916		O38	Reclamation	SFS with FAR Feature	Ineligible	None
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

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
3-7920		O42	Reclamation	SGS with FAR Features	Eligible: D	Avoidance
3-7921		O43	Reclamation	CGS with FAR Features	Eligible: D	Avoidance
3-7922		O44/Pacific Legacy CL-A167	Reclamation	CGS with FAR Features	Eligible: D (this recording), previously ineligible by Pacific Legacy	Avoidance
3-7923		O45	Reclamation	SGS 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)						
		CL-A117	Reclamation	SFS with FAR and Historic-era Artifacts	Ineligible P and H per Pacific Legacy	
		CL-A118	Reclamation	SFS	Ineligible per Pacific Legacy	
		CL-A119	Reclamation	SFS with FAR	Ineligible per Pacific Legacy	
		CL-A120	Reclamation	SFS with FAR	Ineligible per Pacific Legacy	
		CL-A121	Reclamation	SFS with FAR Features, Ethnohistoric trade bead (bead was collected)	Eligible: D	
		CL-A122	Reclamation	SGS with FAR Features	Eligible: D	
		CL-A123	Reclamation	SGS with FAR Features; tested with FAR and flakes to 40 cm below surface	Ineligible	

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
		CL-A124	Reclamation	CGS with FAR Features (obsidian point and Olivella shell disk bead collected)	Eligible: D	
		CL-A125	Reclamation	SGS with FAR Features	Eligible: D	
		CL-A144	Reclamation	CGS with FAR Feature	Ineligible	
		CL-A146	Reclamation	SGS with FAR Feature	Ineligible	
		CL-A169	Reclamation	SGS	Ineligible	
		CL-A170	Reclamation	CGS with FAR Features and Ethnohistoric trade bead (obsidian core and flakes, and glass trade bead collected)	Ineligible	
		CL-A171	Reclamation	SGS	Ineligible	
		CL-A172	Reclamation	SGS with FAR and charcoal stain features	Eligible: D	
		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	
		CL-A174	Reclamation	SFS	Ineligible	
		CL-A184	Reclamation	CGS with FAR Features and Ethnohistoric glass trade beads (trade beads collected)	Ineligible	

Table 3-23
Salt Wells Energy Projects Archaeological Site Summary

BLM No. (CrNV-)	Trinomial (26CH#)	Temp. No.	Land Status	Site Class Type	National Register Eligibility Recommendation and Criteria	Treatment Recommendations
				SPPC Sites (in Progress)		
Newlands Project		S1	Private	Newlands Project Ditches and Associated Features	Some contributing elements to the Newlands Project National Register District	Mitigation-Public Interpretation
Newlands Project		S2/O27	Private	Newlands Project Drains and Associated Features/O27 Pierson Slough	Some contributing elements to the Newlands Project National Register District	Mitigation-Public Interpretation
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

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 3-24
Salt Wells Energy Projects Area Architectural Summary

APN	Parcel Eligible	Buildings Eligible	Proposed Action	Alternative 1	Alternative 2
001-871-97			x	x	x
008-851-28		x	x	x	x
008-851-09			x	x	x
008-831-81			x	x	x
008-831-84			x	x	x
008-871-04			x	x	x
001-871-98	x	x	x	x	x
006-191-06			x	x	x
006-211-32	x	x	x	x	x
006-211-45			x	x	x
006-191-16		x	x	x	x
006-351-03			x	x	x
006-351-02	x	x	x	x	x
006-351-30			x	x	x
006-351-33	x	x	x	x	x
006-411-44	x	x	x	x	x
006-411-62		x	x		x
006-491-36			x		x
006-411-02		x	x		x
006-411-03		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
006-351-22	x	x	x	x	x
006-351-09			x	x	x
006-351-46	x	x	x	x	x
006-411-46		x	x	x	x
006-331-15	x	x	x	x	x
006-871-04	x	x	x	x	x
006-831-29		x		x	
006-851-20	x			x	
006-851-03				x	

Table 3-24
Salt Wells Energy Projects Area Architectural Summary

APN	Parcel Eligible	Buildings Eligible	Proposed Action	Alternative 1	Alternative 2
006-851-79				x	
006-851-39	x	x		x	
008-831-25			x	x	x
006-831-36			x	x	x
006-411-26	x	x	x	x	x
006-411-38		x	x	x	x
006-411-42		x	x	x	x
006-351-11		x	x	x	x
006-351-27			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
006-091-04		x		x	
006-831-19	x	x	x	x	x
006-851-09	x	x	x	x	x
006-591-04	x	x			
006-101-02		x	x		x
006-091-19		x			
006-831-05				x	
006-851-17		x		x	
006-531-13			x	x	x
006-511-06			x	x	x
006-531-03		x	x		x
006-531-08	x	x	x		x
006-541-47		x			
006-871-46			x	x	x
006-871-25	x	x	x	x	x
006-871-57			x	x	x
003-011-04*	x	x	x	x	x
001-304-04	x	x	x	x	x
001-304-06		x	x	x	x
006-191-11			x	x	x
006-111-26		x			
006-111-27		x			
006-091-58	x	x	x	x	x
006-091-09		x	x	x	x
006-091-08		x		x	
006-071-01	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
006-091-17	x	x			
006-111-28	x	x			
006-191-14	x	x	x	x	x
006-391-02			x	x	x
006-811-38		x		x	
006-811-82		x		x	
006-411-29			x	x	x
006-411-37	x	x	x	x	x
006-411-30			x	x	x
006-811-11				x	
006-811-31		x		x	
006-811-12	x	x		x	
006-411-04			x	x	x
006-831-10		x	x	x	x
006-831-11		x	x	x	x
006-511-09		x	x	x	x
006-831-18	x	x	x	x	x
006-511-02	x	x	x	x	x
006-511-03			x	x	x
006-531-01		x	x	x	x
006-851-08	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
006-191-20		x	x	x	x
006-211-03			x	x	x
006-191-17		x	x	x	x
006-211-20			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

* Also in Ormat Project Area.
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 1,570 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 849 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 and Overland Stage Route, and the Newlands Project National Register 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 National Register 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

Five cultural resources sites and multiple contributing and non-contributing elements of the Newlands Project National Register District were recorded in the SPPC Project Area APE during the Salt Wells Energy Projects Class III inventory. Two NRHP eligible prehistoric sites; two ineligible prehistoric sites; NRHP eligible laterals, drains, and associated features of the Newlands Project National Register District; and the Berney Road segment of the NRHP eligible Lincoln Highway occur. At this time, Alternatives 1 and 2 are not completely inventoried pending rights of entry. Alternatives 1 and 2 are known to contain additional elements of the Newlands Project National Register District and the Berney Road segment of the Lincoln Highway (Alternative 1 only). A few other historic or prehistoric sites may occur in this agricultural landscape within Alternatives 1 and 2.

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 inventoried, 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. anticipated 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 National Register District. Eighteen of these previously recorded sites were recently recorded by Pacific Legacy (Jackson et al. undated) 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 one unevaluated site (pending historic context), 35 NRHP eligible sites, and 22 ineligible sites. The unevaluated site is a homestead. The eligible resources include 18 prehistoric sites, two ethnohistoric sites, 11 mixed component (historic, ethnohistoric, prehistoric), one historic site, 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. undated) 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 and Overland Stage Route, a NRHP nominated historic property, crosses 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 National Register 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 National Register." Although the term TCP is not found in the NHPA or its implementing regulations, it has become important for determining eligibility and compliance with Section 106 of the NHPA.

There are regulatory limitations on the 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 US Forest Service—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 United States. 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 off-highway vehicle 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 majority of the SPPC Project Area consists of remote areas with very little public access.

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 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

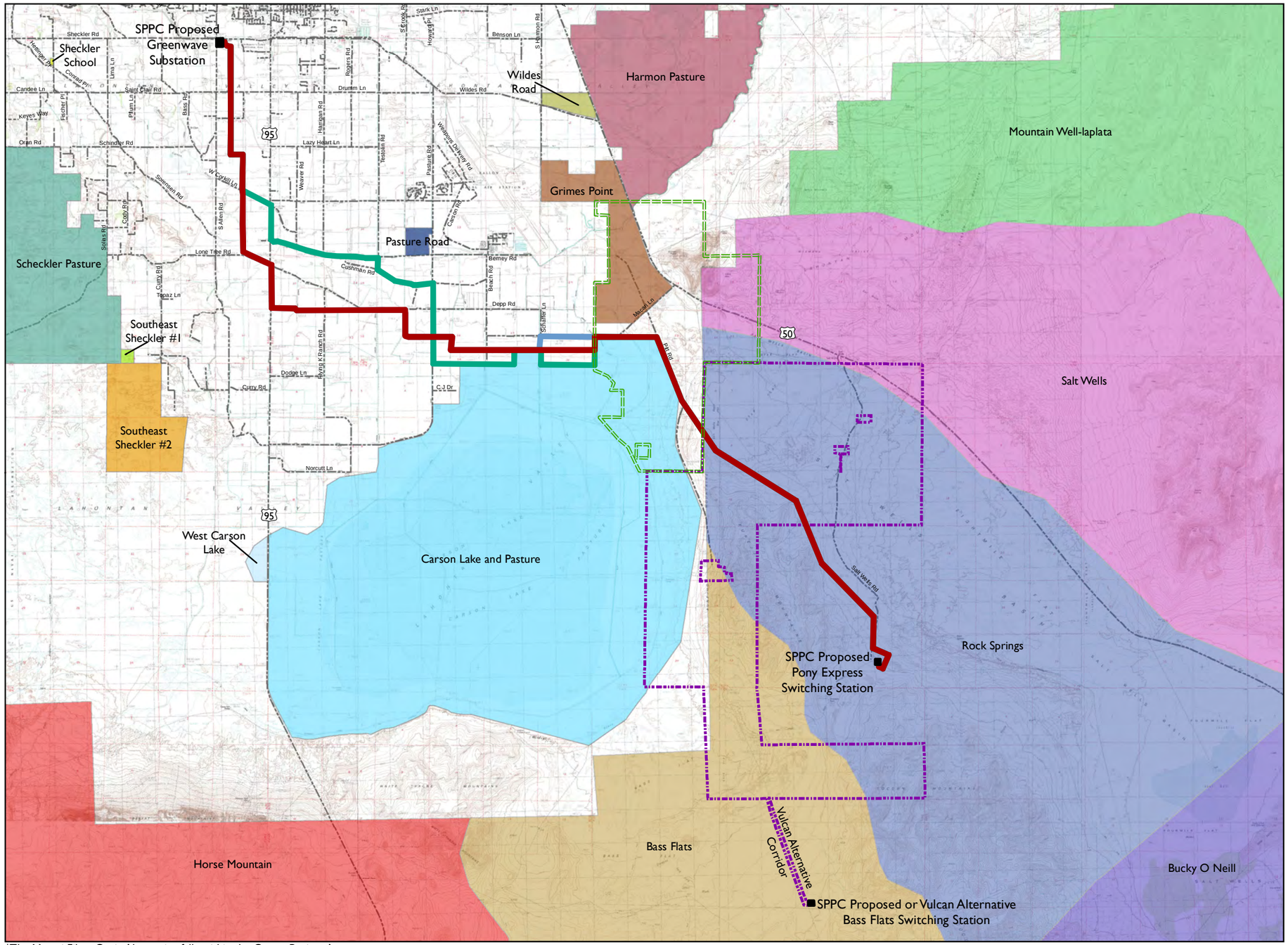
The BLM manages livestock grazing in distinct allotments within the district. This section describes grazing resources and regulations in the Salt Wells Energy Projects Area. The grazing resources are discussed for the allotments within the Salt Wells Energy Projects Area.

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. This program includes proper management of livestock grazing and such improvements as fences and water developments.

Reclamation manages grazing in distinct pastures with a cattle number restriction rather than as allotments with AUMs.

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**, Grazing). **Table 3-25**, BLM Grazing Allotments within the SPPC Project Area, provides an overview of the grazing permits within the Project Area.



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

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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation

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

NATIONAL SYSTEM OF PUBLIC LANDS

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Figure 3-22

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Table 3-25
BLM Grazing Allotments Within the SPPC Project Area

Allotment or Pasture Name	Land Owner	Total Allotment or Pasture Acreage	AUMs on Allotment	Livestock Currently Permitted on Allotment or Pasture	Season of Use
Rock Springs	BLM	42,193	535	98 Cattle	Nov 1-April 15
Bass Flat	BLM	34,915	1,589	320 Cattle	Nov 15-April 15
Carson Lake and Pasture	Reclamation	28,603	NA	2,300	April to November

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 3-26**, BLM Grazing Allotments and Reclamation Pastures Within the Ormat Project Area, provides an overview of the grazing permit on the Project Area.

Table 3-26
BLM Grazing Allotments and Reclamation Pastures Within the Ormat Project Area

Allotment or Pasture Name	Land Owner	Total Allotment or Pasture Acreage	AUMs on Allotment	Livestock Currently Permitted on Allotment or Pasture	Season of Use
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	Nov 1-April 15
Salt Wells	BLM	45,293	1,626	270 Cattle	Oct 15-April 15

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 3-27**, BLM Grazing Allotments and Reclamation Pastures Within the Vulcan Project Area, provides an overview of the grazing permits on the Project Area.

Table 3-27
BLM Grazing Allotments and Reclamation Pastures Within the Vulcan Project Area

Allotment or Pasture Name	Land Owner	Total Allotment or Pasture Acreage	AUMs on Allotment	Cattle Currently Permitted on Allotment or Pasture	Season of Use
Rock Springs	BLM	42,193	535	98 Cattle	Nov 1-April 15
Bass Flat	BLM	34,915	1,589	320 Cattle	Nov. 15-April 15
Salt Wells	BLM	45,293	1,626	270 Cattle	Oct 15-April 15
Carson Lake and Pasture	Reclamation	28,603	NA	2,300	April to November

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 12 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 several miles east 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

These routes are currently classified as existing routes of travel and provide opportunities for the motorized recreationists to access public lands. 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. 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:

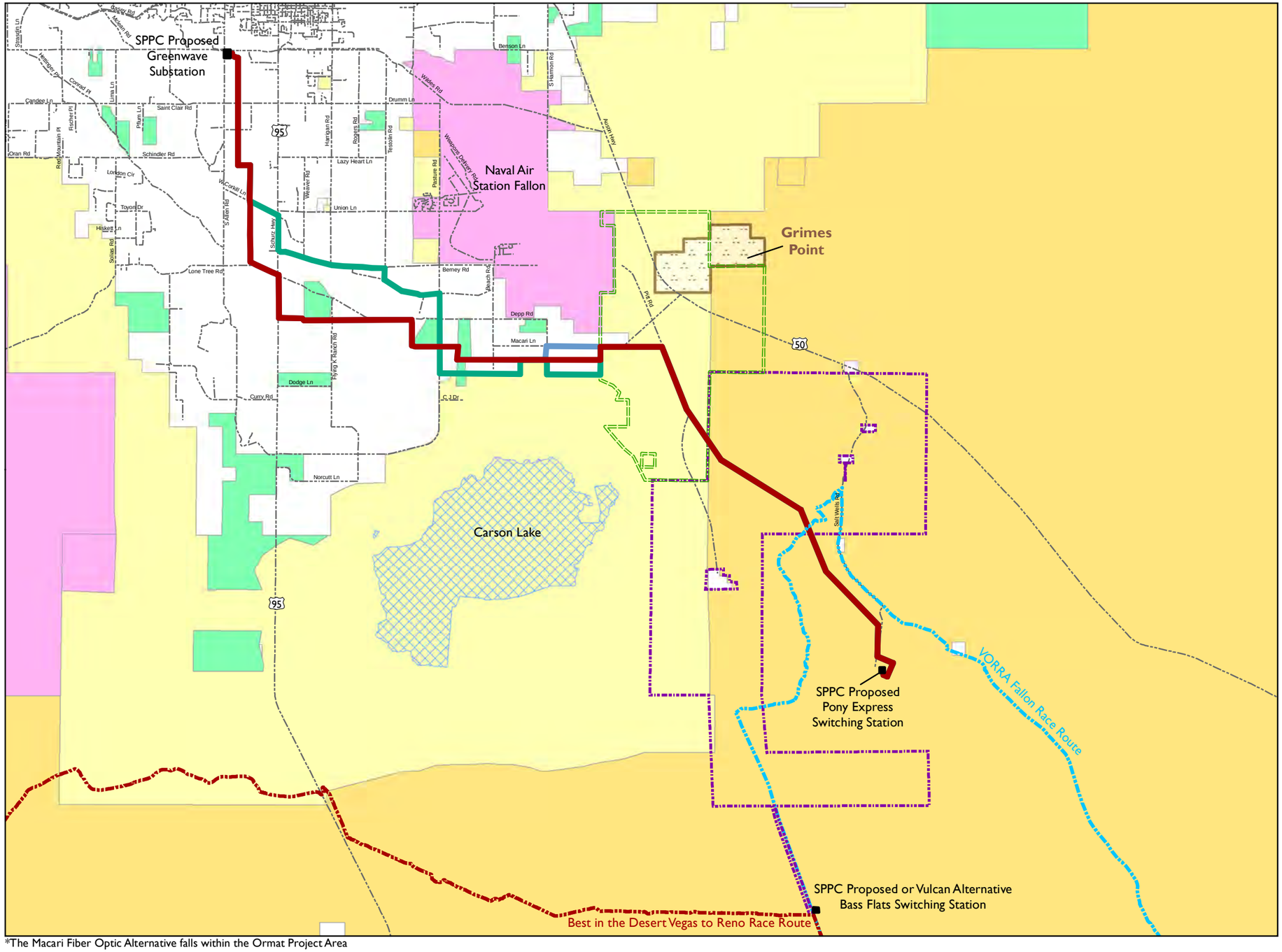
- Bighorn Sheep, November 20-Dececember 20
- Mountain Lion, March-February
- Antelope, August 1-September 5
- Mule Deer, August 1-November 2

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 3.19.1**, 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



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

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

Ormat Project Area
- Ormat Project Area Boundary

Vulcan Project Area
- Vulcan Project Area Boundary

Other Features
- Proposed Switching or Substation
- Open Water

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

NATIONAL SYSTEM OF PUBLIC LANDS

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Miles

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Figure 3-23

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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 3.19.1**, 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 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 3.19.1**, 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, USACE, 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 scheduled to be 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 is located approximately 1.5 miles south of the Pony Express Switching Station. 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 3.5 miles of the trail traverses lower one-third of the Vulcan Project Area.

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).

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

Regional Overview

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 or hazardous materials usages within the Salt Wells Energy Projects Area.

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]).

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 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.

The proposed project region is generally rural and undeveloped where only low level naturally occurring EMFs exist.

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 3-28**, 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).

Table 3-28
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 3-28
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

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 2005-2006 at 4,584 and 4,860 in 1999-2000 (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 3.26.1**, 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 3.26.1**, 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 1.2.1**, 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 3-29**, 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 3-29
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.

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CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

The Proposed Actions and Alternatives described in Chapter 2 may result in direct, indirect, or cumulative effects on the physical, biological, and social components of the human environment. This chapter provides discussion of the anticipated environmental consequences (impacts) that may occur as a result of implementing the Proposed Actions or any of the alternatives. Impacts may be direct, indirect, residual, or cumulative. Direct impacts are those effects that are caused by the action and occur at the same time and place as the action. Indirect impacts are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR §1508.8). Residual impacts are those effects remaining after implementation of mitigation measures. Cumulative impacts are those that result from the impact of the action when added to other past, present, and reasonably foreseeable future actions (40 CFR §1508.7).

Impacts are assessed in terms of their duration (temporary or permanent) and context (local, regional, or national effects). A temporary impact is one that occurs only during implementation of the alternative, while a permanent impact could occur for an extended period after implementation of the alternative. The impact could last several years or more. BMPs described in **Appendix E**, Environmental Protection Measures and Best Management Practices, would be used to minimize impacts, and mitigation measures designed to avoid or reduce impacts are provided. If impacts are not discussed, the analysis has indicated that none would occur or that their magnitude would be negligible.

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources and the Salt Wells Energy Projects Area, review of existing literature, and information provided by experts at the BLM or other agencies. Any impacts described in this section are based on preliminary design of the proposed action alternatives. Effects are quantified where possible. In the absence of quantitative data, best professional judgment prevailed; impacts are sometimes described using ranges of potential impacts or in qualitative terms.

A level of uncertainty is associated with any set of data in terms of predicting outcomes, especially where natural systems are involved. The predictions in this analysis are intended to allow comparison of alternatives including the Proposed

Actions, as well as provide a method to determine whether activities proposed by the applicant would be expected to comply with applicable regulations (e.g., CAA).

4.2 LAND USE AUTHORIZATIONS, AIRSPACE, AND ACCESS

Summary

Assessment Methodology

Land uses within and adjacent to the Salt Wells Energy Projects Area and the associated land use plans were outlined in **Section 3.2.** The current land use authorizations on the BLM managed lands are outlined in **Appendix F**, Land Use Authorizations in the Salt Wells Energy Project Area. The Proposed Actions and Alternatives have been analyzed to determine consistency with the land use plans and compatibility with the surrounding uses. Airspace and access were also discussed in **Section 3.2** and have been analyzed in this section. Recreational and hunting accesses are addressed in **Sections 3.19** and **4.19**.

Indicators

Impact indicators are the consistent currency used to determine the type and intensity of change in a resource. Working from an established baseline condition, an indicator can be used to predict or detect change in a resource related to causal effects of Proposed Actions and Alternatives. Indicators used to determine the potential for impacts on land use, air space and access include:

- Conflicts with existing or adjacent land uses;
- Conflicts with existing federal, state, and local land uses, plans, and policies;
- Conflicts with existing BLM land use authorizations;
- Conflicts with existing Reclamation land use authorizations; or
- Changes in public land disposition.

Region of Influence

The ROI for impacts on land use, airspace, and access includes the Salt Wells Energy Projects Area.

SPPC Project Area

Proposed Action

Direct Impacts

Implementation of the Proposed Action would not change any land uses within the SPPC Project Area. A breakdown of the land uses by Alternative is provided in **Table 4-19**, Number of Parcels and Total Acreage (not managed by BLM) Potentially Requiring Easement Acquisition by Zoning Category, in **Section**

4.26, Social and Economic Values. Construction and maintenance of the transmission line could have impacts on the adjacent land uses where the Proposed Action route crosses conservation easements with a height restriction of 80 feet. Agricultural uses and private parcels would be impacted by the Proposed Action ROW, which would include temporary impacts within the 300-foot ROW and permanent impacts within the 125-foot ROW across private lands. The permanent ROW disturbance on private land would total approximately 208 acres. However, following construction of the transmission line, the footprint of the H-frame or Single Pole towers would be the only location that would not allow for agricultural or recreational use within the transmission line corridor. In addition, private landowners could be subject to financial compensation as outlined in **Section 4.26**. A portion of the Proposed Action route would be located in Sections 35 and 36 of T18N R29E and in Section 31of T18N R30E within APZ2. APZ2 has a lower potential for aircraft accidents. Utilities and transmission lines may be compatible uses in APZ1 and APZ2. Single-pole structures are proposed in the areas adjacent to the conservation easements and within the APZ2. The single-pole structures would be approximately 80 to 85 feet above ground level. The Proposed Action route would not be located in a Clear Zone or APZ1.

The Greenwave Substation is proposed on private land along Sheckler Road. This facility would not conflict with existing or adjacent land uses or land use plans or policies and is not located within an APZ. The proposed Bass Flat Switching Station would be constructed on public land adjacent to the ENEL 230-kV transmission line and the Austin to Fort Churchill 230-kV transmission line and is not located within an APZ. Construction and maintenance of these facilities would not conflict with the adjacent land uses, and access to these facilities would be via existing roads. Therefore, no impacts on land use, airspace, and access from these project facilities are anticipated.

Access to sites within the SPPC Project Area would be via existing roads where feasible. Use of the existing roads and the temporary spur and centerline roads could temporarily disrupt or restrict access by other users in the ROI.

Indirect Impacts

No indirect impacts on land use, airspace, or access have been identified in relation to the Proposed Action.

Mitigation and Monitoring Measures

SPPC would coordinate with private landowners to obtain easements and develop a compensation plan as discussed in **Section 4.26**. SPPC would also coordinate with the Navy and Churchill County to address the height restriction of 80 feet for the conservation easement parcels. Finally, SPPC would work with the Navy to ensure compliance with the guidance for APZ2 areas.

Residual Impacts
No residual impacts are anticipated as a result of the Proposed Action following implementation of the mitigation measures.

Alternative 1

Direct Impacts
Direct impacts associated with Alternative 1 would be similar to the Proposed Action; however, the Alternative 1 route would avoid crossing through adjacent existing conservation easements. In addition, the permanent ROW disturbance on private land would total approximately 165 acres.

Indirect Impacts
No indirect impacts on land use, airspace, or access have been identified in relation to Alternative 1.

Mitigation and Monitoring Measures
Mitigation measures under Alternative 1 would be the same as those outlined for the Proposed Action.

Residual Impacts
No residual impacts are anticipated as a result of Alternative 1 following implementation of the mitigation measures.

Alternative 2

Direct Impacts
Direct impacts associated with Alternative 2 would be the same as the Proposed Action with the exception of the permanent disturbance associated with the ROW on private lands. The permanent ROW disturbance on private land would total approximately 165 acres.

Indirect Impacts
No indirect impacts on land use, airspace, or access have been identified in relation to Alternative 2.

Mitigation and Monitoring Measures
Mitigation measures under Alternative 2 would be the same as those outlined for the Proposed Action.

Residual Impacts
No residual impacts are anticipated as a result of Alternative 2 following implementation of the mitigation measures.

Macari Fiber Optic Alternative

Direct Impacts
Direct impacts associated with Macari Fiber Optic Alternative would be the same as those described for the Proposed Action.

Indirect Impacts
No indirect impacts on land use, airspace, or access have been identified in relation to the Macari Fiber Optic Alternative.

Mitigation and Monitoring Measures
Mitigation measures for the Macari Fiber Optic Alternative would be the same as those outlined for the Proposed Action.

Residual Impacts
No residual impacts are anticipated as a result of the Macari Fiber Optic Alternative following implementation of the mitigation measures.

No Action Alternative
Under the No Action Alternative, temporary and permanent impacts on land use, airspace, and access would not occur.

Ormat Project Area

Proposed Action

Direct Impacts
Implementation of the Proposed Action would not change any land uses within the ROI. The Proposed Action would occur on lands that are administered by Reclamation and BLM, as well as on private lands. A portion of the Ormat Project Area is within a no surface occupancy area which was designated to protect cultural and natural resources. One well pad is proposed in this area. As discussed in the **Section 3.15**, Native American Consultation, the BLM, in consultation with the Fallon Paiute-Shoshone Tribe, approved the location of the proposed well site. The Proposed Action would not conflict with existing federal, state, and local land uses, plans, and policies or with existing BLM or Reclamation land use authorizations.

The proposed wells A-i, B-i, and C-i and the associated pipeline would be constructed on lands adjacent to the Navy land in APZ1 and APZ2 areas. APZ1 is the area beyond the Clear Zone that still possesses a measurable potential for accidents relative to the Clear Zone. However, utilities are generally compatible in APZ1 areas except for major transmission lines. APZ2 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). In addition, the Carson Lake Binary Power Plant would be located in an APZ2 area and drill rigs would be removed and only result in a temporary impact in the

APZ1 and APZ2 areas. The cooling tower at the power plant would be a maximum of 55 feet for an air cooled condenser or 45 feet for a wet-cooling system. The wells, pipelines, and power plant proposed within the APZ1 and APZ2 areas could have impacts on naval operations or increase risks for aircraft accidents.

The Ormat Project Area would be accessed via Highway 50 and Macari Lane. Impacts on access would occur if the historic segments of the Lincoln Highway or the old Highway 50 were damaged during construction and operation under the Proposed Action.

Indirect Impacts
No indirect impacts on land use, airspace, or access have been identified in relation to the Proposed Action.

Mitigation and Monitoring Measures
Ormat would coordinate with the Navy to develop plans for the wells, pipelines, and the Carson Lake Binary Power Plant that would meet the requirements and height restrictions for the APZ1 and APZ 2 areas.

If the historic portions of Highway 50 were damaged as a result of the Proposed Action, Ormat would repair the damage.

Residual Impacts
No residual impacts are anticipated as a result of the Proposed Action following implementation of the mitigation measures.

Alternative 1

Direct Impacts
Direct impacts associated with Alternative 1 would be the same as the Proposed Action.

Indirect Impacts
No indirect impacts on land use, airspace, or access have been identified in relation to Alternative 1.

Mitigation and Monitoring Measures
Mitigation measures for Alternative 1 would be the same as those outlined for the Proposed Action.

Residual Impacts
No residual impacts are anticipated as a result of Alternative 1 following implementation of the mitigation measures.

No Action Alternative

Under the No Action Alternative, temporary and permanent impacts on land use, airspace, and access would not occur.

Vulcan Project Area

Proposed Action

Direct Impacts

Implementation of the Proposed Action would not change any land uses within the ROI. The Proposed Action would occur on lands that are administered by Reclamation and BLM, as well as on private lands. The Proposed Action would not conflict with existing federal, state, and local land uses, plans, and policies, or with existing BLM or Reclamation land use authorizations.

The power plant and well locations proposed under the Proposed Action would not be located in or near an APZ area. The Proposed Action would not conflict with proposed naval operations or impact airspace in the ROI.

The Vulcan Project Area would be accessed via Highway 50 and Macari Lane. Impacts on access would occur if the historic segments of the Lincoln Highway or the old Highway 50 were damaged during construction and operation under the Proposed Action.

Indirect Impacts

No indirect impacts on land use, airspace, or access have been identified in relation to the Proposed Action.

Mitigation and Monitoring Measures

If the historic portions of Highway 50 were damaged as a result of the Proposed Action, Vulcan would repair the damage.

Residual Impacts

No residual impacts are anticipated as a result of the Proposed Action following implementation of the mitigation measures.

Alternative 1

Direct Impacts

Direct impacts associated with Alternative 1 would be the same as the Proposed Action.

Indirect Impacts

No indirect impacts on land use, airspace, or access have been identified in relation to Alternative 1.

Mitigation and Monitoring Measures
Mitigation measures for Alternative 1 would be the same as those outlined for the Proposed Action

Residual Impacts
No residual impacts are anticipated as a result of Alternative 1 following implementation of the mitigation measures.

No Action Alternative
Under the No Action Alternative, temporary and permanent impacts on land use, airspace, and access would not occur.

4.3 AIR QUALITY

Summary

Assessment Methodology
Potential effects of the projects on air quality were evaluated by examining the typical air emissions associated with the various stages of transmission line construction and maintenance and geothermal development and operations. Regulatory requirements that would be required for the projects are examined here and were considered in determining both the impact criteria and in developing the impact analyses.

Indicators
The primary indicators of air quality impacts are the multiple ambient impact standards documented in **Section 3.3.1**, Regional Overview, that define ambient air quality, incremental degradation of air quality, and air quality-related values, including visibility. Indicators utilized for this analysis include the following:

- Emissions in tons per year for each type of regulated pollutant;
- Compliance with NAAQS, applicable Prevention of Significant Deterioration increment limits, and BLM air quality-related value impact thresholds;
- Amount and timeframe of steam/water vapor emitted from project operations; and
- Distance to Class I area.

Region of Influence
The ROI for assessing regional air quality impacts is the western Salt Wells Basin and Lahontan Valley east of Highway 95. The ROI for direct impacts, such as impacts on visibility and from fugitive dust, is a one buffer mile around the Salt Wells Energy Projects Area.

SPPC Project Area

Proposed Action

Potential impacts on air quality would result from construction activities and from periodic maintenance activities associated with the SPPC Project Area.

Direct Impacts

Construction. Construction activities would be the greatest source of emissions under the Proposed Action. Site grading would generate temporary and localized fugitive dust emissions. Exhaust from gas- and diesel-powered construction equipment, tractor-trailers bringing in and moving equipment, and construction personnel vehicles would generate temporary criteria air pollutant and greenhouse gas emissions. **Table 4-1**, Screening Level Analysis of SPPC Construction Emissions, shows a conservative estimate of construction emissions for development of the transmission line, switching stations, and substation.

Table 4-1
Screening Level Analysis of SPPC Construction Emissions
(tons)

	VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_{2e}
Commute Vehicle Emissions[1]	0.14	0.30	2.36	0.0	0.47	0.09	274.33
Heavy Duty Truck Trips[2]	0.03	0.24	0.31	0.0	0.08	0.02	69.81
Construction Equipment Emissions[3]	0.60	4.12	2.50	0.0	0.24	0.22	454.07
Fugitive Dust Emissions[4]	0	0	0	0	14.06	3.05	0
Total Emissions	**0.77**	**4.66**	**5.17**	**0.0**	**14.85**	**3.38**	**798.21**

Source: Urban Emissions Environmental Management Software 2007
Notes: CO_{2e} = carbon dioxide equivalents.
[1] Assumes 50 construction workers, 2 trips per worker, 10-mile commute distance, 250 days per year.
[2] Assumes 5 truck trips per day, 50 miles per trip, 250 days per year.
[3] Assumes a mix of construction equipment, construction occurs in one year.
[4] Assumes 12-month construction period; 250 acres are cleared, graded, and leveled; mitigations (soil stabilizers and watering twice daily) would reduce dust emissions by 50%.

Fugitive dust would be the primary emission of concern during project construction. The NDEP, Bureau of Air Pollution Control requires all projects that would disturb more than five acres to obtain a surface area disturbance permit prior to construction. Churchill County requires that a county dust control permit be obtained and a dust control plan be prepared for all projects that require a surface area disturbance from NDEP. This dust control plan would include BMPs defined by the Nevada State Conservation Commission in its Best Management Practices Handbook (1994), best practical methods included in the Dust Control Handbook for Churchill County (2010), and other measures that must be implemented during construction to reduce fugitive dust

emissions. Specific measures would be developed as part of the construction planning and permitting processes, but examples of dust control measures that could be employed are included in the Mitigation and Monitoring Measures.

Operation. Operation of the SPPC 230-kV transmission line and associated infrastructure would not result in criteria air pollutants or greenhouse gas emissions. Over time, minor emissions of criteria air pollutants and greenhouse gases would result from personal and maintenance vehicle and limited equipment exhaust, as well as fugitive dust emissions from windborne dust and dust generated by vehicles travelling on unpaved surfaces. Based on the small amount of surface disturbance during operations, fugitive dust emissions would be comparable to fugitive emissions from agricultural operations and recreation already occurring in the Project Area.

Indirect Impacts

No indirect impacts on air quality from construction or operation of the SPPC Project have been identified.

Mitigation and Monitoring Measures

BMPs and best practical methods that could be employed to control fugitive dust emissions and visibility impacts during construction include the following:

- Phase surface disturbance to avoid disturbing the entire area all at once;
- Apply water or dust suppressant to all active construction and site preparation work areas at least twice daily and more often during windy periods;
- Apply water or dust suppressants on all unpaved access roads and staging areas;
- Gravel access roads and staging areas;
- Limit vehicle speeds on unpaved roadways to 15 miles per hours;
- Reclaim (revegetate) disturbed areas as soon as possible after surface disturbance;
- Suspend dust-generating operations during periods of excessive winds (60-minute average wind speed greater than 25 miles per hour);
- Train construction personnel to recognize excessive fugitive dust conditions and implement dust control during these times;
- Use wind-breaks or wind-limiting fencing designed to limit wind erosion of soils;
- Cover all hauling trucks or maintain at least two feet of freeboard on all loads;

- Install trackout control devices at paved access points to control fugitive dust from leaving the project site via trucks and motor vehicles;
- Use construction equipment that meets applicable EPA standards for criteria pollutants from diesel engines and maintain this equipment per manufacturer's specifications;
- Sweep paved access roads with water sweepers; and
- Enclose or securely cover exposed stockpiles.

Residual Impacts
Implementation of BMPs and best practical methods through compliance with the surface area disturbance permits would minimize fugitive dust emissions during construction of the project, reducing fugitive dust and visibility impacts on acceptable levels.

Alternative 1

Direct Impacts
Direct air quality impacts from construction would be similar to those described for the Proposed Action because only slightly more acreage would be disturbed. Alternative 1 would require the same surface area disturbance permits and dust control plan as described for the Proposed Action. Impacts from operation would be the same as described for the Proposed Action.

Indirect Impacts
Alternative 1 would have no indirect air quality impacts.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as described for the Proposed Action.

Residual Impacts
Residual impacts would be the same as described for the Proposed Action.

Alternative 2

Direct Impacts
Direct air quality impacts from construction would be similar to those described for the Proposed Action. Alternative 2 would require the same surface area disturbance permits and dust control plan as described for the Proposed Action. Impacts from operation would be the same as described for the Proposed Action.

Indirect Impacts
Alternative 2 would have no indirect air quality impacts.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as described for the Proposed Action.

Residual Impacts
Residual impacts would be the same as described for the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
Development of the Macari fiber optic line would have minor, temporary air quality impacts during construction activities such as trenching. These impacts would include exhaust emissions from construction worker vehicles and from construction equipment such as trenchers, as well as fugitive dust emissions from surface-disturbing activities. A surface area disturbance permit would likely not be required, as the area of actual ground disturbance would likely be less than five acres. There would be no direct air quality impacts from operation of the fiber optic line.

Indirect Impacts
This Alternative would have no indirect air quality impacts.

Mitigation and Monitoring Measures
Depending upon the level of surface disturbance, mitigation measures described for the Proposed Action may be required to reduce air quality and visibility impacts related to fugitive dust emissions.

Residual Impacts
Implementation of the mitigation measures described under the Proposed Action, if required, would reduce the effects of construction on air quality and visibility.

No Action Alternative
The No Action Alternative would have no direct impacts on air quality, as the SPPC transmission line and associated infrastructure would not be developed. Minor indirect impacts on air quality and greenhouse gas emissions could occur to the extent that lack of additional transmission lines hindered the development of renewable sources of energy in the SPPC Project Area.

Ormat Project Area

Proposed Action
Potential impacts on air quality would result from construction activities, from well drilling, and from operation of the geothermal power plant facilities.

Direct Impacts

Construction. The Proposed Action would have temporary effects on air quality from construction activities. Site grading would generate temporary and localized fugitive dust emissions. Exhaust from gas- and diesel-powered construction equipment, tractor-trailers bringing in and moving equipment, and construction personnel vehicles would generate temporary criteria air pollutant and greenhouse gas emissions. **Table 4-2,** Screening Level Analysis of Ormat Construction Emissions, presents a conservative estimate of construction emissions for development of the power plant, substation, switching station, transmission interconnection line, pipelines, well pads, and access roads.

Table 4-2
Screening Level Analysis of Ormat Construction Emissions
(tons per construction phase)

	VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_{2e}
Power Plant, Substation, Switching Station, and Interconnection Line[1]							
Commute Vehicle Emissions	0.06	0.10	0.93	0.00	0.15	0.03	92.13
Heavy Duty Truck Trips	0.03	0.24	0.31	0.00	0.08	0.02	69.81
Construction Equipment Emissions	0.41	2.41	1.52	0.00	0.15	0.14	246.43
Fugitive Dust Emissions	0	0	0	0	3.00	0.63	0
Total Emissions	**0.50**	**2.75**	**2.76**	**0.00**	**3.38**	**0.82**	**408.37**
Pipelines and Access Roads[2]							
Commute Vehicle Emissions	0.08	0.17	1.31	0.00	0.25	0.05	141.14
Heavy Duty Truck Trips	0.02	0.18	0.23	0.00	0.06	0.01	52.36
Construction Equipment Emissions	0.54	3.89	2.22	0.00	0.22	0.2	400.57
Fugitive Dust Emissions	0	0	0	0	16.25	.92	0
Total Emissions	**0.64**	**4.24**	**3.76**	**0.0**	**16.78**	**1.18**	**594.07**
Well Pads[3]							
Commute Vehicle Emissions	0.04	0.07	0.64	0.00	0.12	0.02	72.42
Heavy Duty Truck Trips	0.01	0.06	0.08	0.00	0.02	0.01	17.45
Construction Equipment Emissions	0.17	1.35	0.78	0.00	0.07	0.07	134.82
Fugitive Dust Emissions	0	0	0	0	5.84	1.22	0
Total Emissions	**0.22**	**1.48**	**1.50**	**0.0**	**6.05**	**1.32**	**224.69**

Source: Urban Emissions Environmental Management Software 2007
Notes: CO_{2e} = carbon dioxide equivalents.
[1] Assumes 12 months of construction; 25 construction workers per day, 2 trips per worker, 15-mile commute distance, 250 days; 5 tractor-trailer trips per day, 50 miles per trip, 250 days; standard mix of construction equipment; and 30 acres of cleared, graded, and leveled area with 50% dust control efficiency.
[2] Assumes 9 months of construction; 35 construction workers per day, 2 trips per worker, 15-mile commute distance, 188 days; 5 tractor-trailer trips per day, 50 miles per trip, 188 days per year; standard mix of construction equipment; and 250 acres of disturbed area with 50% dust control efficiency.
[3] Assumes 6 months of construction; 35 construction workers per day, 2 trips per worker, 15-mile commute distance, 125 days; 2.5 tractor-trailer trips per day, 50 miles per trip, 125 days per year; standard mix of construction equipment; and 55 acres of disturbed area with 50% dust control efficiency.

Particulates resulting from fugitive dust would be the greatest source of emissions during project construction. The NDEP, Bureau of Air Pollution Control requires all projects that would disturb more than five acres to obtain a surface area disturbance permit prior to construction. Churchill County requires that a county dust control permit be obtained and a dust control plan be prepared for all projects that require a surface area disturbance from NDEP. This dust control plan would include BMPs defined by the Nevada State Conservation Commission in its Best Management Practices Handbook (1994), best practical methods included in the Dust Control Handbook for Churchill County (2010), and other measures that must be implemented during construction to reduce fugitive dust emissions. Specific measures would be developed as part of construction planning and the permitting process, but examples of dust control measures that could be employed are included in the following Mitigation and Monitoring Measures section.

Well Drilling Emissions. The primary sources of emissions during drilling would be diesel-powered engines on the drill rig, emissions from tractor trailer deliveries, and vehicle commute emissions. These emissions would be localized and temporary, with pollutant concentrations in the vicinity of the proposed project increasing on a temporary basis. Other ancillary equipment such as pumps could contribute to project emissions. **Table 4-3,** Ormat Production Well Drilling Emissions, shows a screening-level analysis of emissions from drilling operations, equipment deliveries, and commute traffic at each well pad site. Emissions are presented per well drilled.

Table 4-3
Ormat Production Well Drilling Emissions Per Well
(tons)

	VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_{2e}
Drilling operations per well [1]	0.28	9.85	2.62	0.06	0.17	--	508.70
Tractor-trailer trips per well [3]	0.01	0.04	0.02	0.00	0.01	0.01	10.18
Personal vehicle trips per well[4]	0.004	0.005	0.065	0.00	0.011	0.002	6.67
Total per well pad (pounds)	**0.29**	**9.90**	**2.71**	**0.75**	**0.19**	**20.01**	**525.55**

[1]Drilling rig engine is assumed to meet EPA Tier 1 large-bore diesel emission standards (40 CFR Part 89), maximum daily fuel consumption, 45 days of drilling per well, 24 hours per day. Actual well-drilling emissions are likely to be much less than estimated here, as engine use is highly variable over the course of the drilling operations. In addition, NO_x emissions under testing conditions have been found to be less than estimations using diesel emission standards.
[2] Emission factor is for particulate matter (PM); it is assumed that the PM is mostly $PM_{2.5}$.
[3] 3 tractor trailer trips per day for 45 days, 50 miles per trip.
[4] 10 construction workers per day, 2 trips per worker, 15-mile commute distance, 45 days.
Notes: Because construction equipment and vehicles no longer burn leaded fuel, no lead emissions would occur.

In addition to diesel equipment and vehicle emissions, well drilling has the potential to release non-condensable gases such as carbon dioxide, hydrogen sulfide (H_2S), methane, and ammonia, as well as trace amounts of mercury and arsenic when these compounds are contained in the geothermal resource. The

amount and ratio of these constituents varies by geothermal resource, with carbon dioxide generally comprising over 95 percent of the non-condensable gases. Emissions of non-condensable gases would occur during flow testing. These emissions would be temporary, lasting until the well is shut in or connected to the pipeline.

H_2S is the non-condensable gas of greatest concern because it can pose a threat to human health at high concentrations (BLM and USFS 2008). H_2S releases are of greatest concern in the event of a well blowout. Wells would contain BOPE; therefore, large releases of H_2S are not anticipated. Some minor releases of H_2S are expected during drilling and flow testing of wells. Monitoring devices would be installed and operated during all phases of drilling and testing, and a H_2S abatement plan would be developed and implemented if it becomes apparent during drilling operations that H_2S abatement is necessary to mitigate potential nuisance odors. With monitoring and abatement, H_2S emissions would not result in unsafe levels.

Operational Emissions. Emissions associated with operation of the Ormat Carson Lake Binary Power Plant would be limited to emissions of water vapor and gases from the cooling tower, emissions of particulates in the cooling tower drift, and vehicle emissions associated with power plant personnel. These emissions would continue for the duration of power plant operation but within acceptable levels. In addition, there is the potential for minor releases of pentane and of non-condensable gases found in geothermal fluids.

Emissions of water vapor and gases from cooling towers can form a vapor plume during times of high humidity when the water vapor is not readily absorbed into the atmosphere. Within the ROI, this usually occurs in the colder months, when the air temperature drops and the air humidity increases. Given the proximity to Grimes Point Archaeological Site and NAS Fallon, wet-cooling operations would cease from November to May, minimizing operational times when a large vapor plume would be likely to occur. Cooling tower drift is a type of moisture release that results when small quantities of water droplets of 10 microns or greater as well as small amounts of dust and dissolved and suspended solids become airborne and are carried out with the exhaust air. Cooling tower drift would be avoided through the use of drift eliminators.

The operation of the binary power plant would require as many as seven employees on weekdays and two employees on weekends. Emissions associated with commute vehicles would be low.

Under normal operations, binary power plants operate in a closed environment, where the geothermal fluid and the working fluid do not contact the atmosphere. The Ormat Binary Power Plant would use pentane as the working fluid. Pentane is a volatile organic compound and therefore an ozone precursor emission, but it is not an ozone-depleting substance. Because the power plant would be a closed system with the working fluid rarely exposed to the

atmosphere, little impact on air quality is expected from the operation of the power plant. Safety systems incorporated in the power plant design would prevent the accidental release of significant amounts of pentane to the atmosphere. During maintenance, there may be minor emissions of nitrogen, carbon dioxide, and oxygen from the pentane system. Hydrocarbon emissions from each power plant would likely be over 5 tons per year but much less than 100 tons per year; therefore, Ormat would obtain a Class II Air Quality Operating Permit from the NDEP, Bureau of Air Pollution Control for construction and operation of its binary power plant.

Given the low background concentrations of criteria pollutants in the area and the limited emissions from operation of the geothermal power plant, the Proposed Action would not result in any violations of state or federal air quality standards. The project would not occur in a nonattainment area; therefore, CAA general conformity does not apply.

Indirect Impacts

Development of the Ormat Binary Power Plant would have an indirect impact on greenhouse gas emissions if the power produced by the geothermal power plant displaced electricity generated by conventional sources of electricity.

Mitigation and Monitoring Measures

Mitigation and monitoring measures to control fugitive dust during construction would be the same as described for the SPPC Project.

The following mitigation measures would be implemented during well drilling to reduce emissions associated with off-gassing and large (over 37 kilowatts) diesel well-drilling equipment:

- Monitor H_2S emissions during all phases of drilling and testing and report the results to the BLM regularly. If the monitoring reveals emissions exceeding the Nevada ambient air quality standard, an H_2S abatement plan would be developed and implemented. The abatement plan would include additional control measures to ensure compliance with the emission limitation. Additional control measures could include, but would not be limited to, the following:
    - Reduce the number of wells venting simultaneously, as applicable; and
    - Implement additional wellhead abatement measures, such as caustic injection between the flash tank and the portable silencer.
- Ensure that generators over 37 kW (50 horse power) are diesel-fired units manufactured after January 1996, certified to meet EPA Tier 1 Emission Standards, and equipped with an exhaust particulate filter system.

The following measures would be implemented to avoid visibility impacts:

- Cease operations of wet cooling from November to May, minimizing operational times conducive to a large vapor plume.
- Require the installation of drift eliminators to prevent cooling tower drift.

The following measures would be implemented to prevent air quality-related health and safety impacts:

- Install BOPE to the production wells to prevent large releases of H_2S.
- Incorporate safety systems in the power plant design to prevent the accidental release of significant amounts of pentane to the atmosphere.

Residual Impacts
The implementation of the mitigation measures described previously would reduce potential air quality-related impacts on lower than acceptable levels.

Alternative 1
Direct and indirect impacts on air quality, mitigation and monitoring measures, and residual impacts would be the same as described for the Proposed Action.

No Action Alternative
The No Action Alternative would have no direct impacts on air quality, as the Ormat geothermal power plant and associated infrastructure would not be developed. Minor indirect impacts on air quality and greenhouse gas emissions could occur in that the impacts of greenhouse gases savings from geothermal energy production would not be realized.

Vulcan Project Area

Proposed Action
Potential impacts on air quality would result from construction activities, from well drilling, and from operation of the binary and flash geothermal power plant facilities.

Direct Impacts

Construction. The Proposed Action would have temporary effects on air quality from construction activities. Site grading would generate temporary and localized fugitive dust emissions. Exhaust from gas- and diesel-powered construction equipment, tractor-trailers bringing in and moving equipment, and construction personnel vehicles would generate temporary criteria air pollutant and greenhouse gas emissions. **Table 4-4**, Screening Level Analysis of Vulcan

Construction Emissions, presents a conservative estimate of construction emissions for development of the power plant, substation, switching station, transmission interconnection line, pipelines, well pads, and access roads.

Particulates resulting from fugitive dust would be the greatest source of emissions during project construction. The NDEP, Bureau of Air Pollution Control requires all projects that would disturb more than five acres to obtain a surface area disturbance permit prior to construction. Churchill County requires that a county dust control permit be obtained and a dust control plan be prepared for all projects that require a surface area disturbance from NDEP.

In addition to diesel equipment and vehicle emissions, well drilling has the potential to release non-condensable gases such as carbon dioxide, H_2S, methane, and ammonia, as well as trace amounts of mercury and arsenic when these compounds are contained in the geothermal resource. The amount and ratio of these constituents varies by geothermal resource, with carbon dioxide generally comprising the majority of the non-condensable gases. Emissions of non-condensable gases would occur during flow testing. These emissions would be temporary, lasting until the well is shut in or connected to the pipeline.

H_2S is the non-condensable gas of greatest concern because it can pose a threat to human health at high concentrations (BLM and USFS 2008). H_2S releases are of greatest concern in the event of a well blowout. Wells would contain BOPE; therefore, large releases of H_2S are not anticipated. Some minor releases of H_2S are expected during drilling and flow testing of wells. Monitoring devices would be installed and operated during all phases of drilling and testing, and a H_2S abatement plan would be developed and implemented if it becomes apparent during drilling operations that H_2S abatement is necessary to mitigate potential nuisance odors. With monitoring and abatement, H_2S emissions would not result in unsafe levels.

Operational Emissions. Under the Proposed Action, Vulcan would operate four geothermal power plants, one of which may be a dual flash power plant with the others being binary power plants.

Binary Power Plants. Emissions associated with operation of the binary power plants would be limited to emissions of water vapor and gases from the cooling tower, emissions of particulates in the cooling tower drift, and vehicle emissions associated with power plant personnel. These emissions would continue during operation of the power plants but within acceptable levels. In addition, there is the potential for releases of hydrocarbons from the working fluid and non-condensable gases found in the geothermal fluids.

Emissions of water vapor and gases from cooling towers can form a vapor plume during times of high humidity when the water vapor is not readily absorbed into the atmosphere. Within the ROI, this usually occurs in the colder

Table 4-4
Screening Level Analysis of Vulcan Construction Emissions
(tons per construction phase)

	VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_{2e}
Power Plant and Substation[1]							
Commute Vehicle Emissions	0.36	0.77	6.10	0.00	1.14	0.21	655.98
Heavy Duty Truck Trips	0.03	0.24	0.31	0.00	0.08	0.02	69.81
Construction Equipment Emissions	0.46	2.57	1.67	0.00	0.17	0.15	263.10
Fugitive Dust Emissions	0	0	0	0	1.91	0.40	0
Total Emissions per power plant	***0.85***	***3.58***	***8.08***	***0.00***	***3.30***	***0.78***	***988.89***
Total Emissions for Four Power Plants	**3.40**	**14.32**	**32.32**	**0.00**	**13.20**	**3.12**	**3,955.56**
Pipelines and Access Roads[2]							
Commute Vehicle Emissions	0.04	0.07	0.68	0.00	0.13	0.02	77.31
Heavy Duty Truck Trips	0.015	0.12	0.15	0.00	0.04	0.01	34.9
Construction Equipment Emissions	0.44	3.51	1.88	0.00	0.18	0.16	356.91
Fugitive Dust Emissions	0	0	0	0	18.75	3.84	0
Total Emissions	**0.50**	**3.70**	**2.71**	**0.00**	**19.10**	**4.03**	**469.12**
Well Pads[3]							
Commute Vehicle Emissions	0.08	0.14	1.28	0.00	0.24	0.04	144.95
Heavy Duty Truck Trips	0.03	0.24	0.31	0.00	0.08	0.02	69.81
Construction Equipment Emissions	0.34	2.70	1.56	0.00	0.14	0.07	134.82
Fugitive Dust Emissions	0	0	0	0	11.68	2.44	0
Total Emissions	**0.45**	**3.08**	**3.15**	**0.00**	**12.14**	**2.57**	**349.58**
Water Wells, Interconnection Line, and Switching Station[4]							
Commute Vehicle Emissions	0.02	0.04	0.40	0.00	0.08	0.02	49.36
Heavy Duty Truck Trips	0.01	0.06	0.08	0.00	0.02	0.01	17.45
Construction Equipment Emissions	0.41	2.95	1.72	0.00	0.16	0.15	324.58
Fugitive Dust Emissions	0	0	0	0	8.25	1.73	0
Total Emissions	**0.44**	**3.05**	**2.2**	**0.0**	**8.51**	**1.91**	**391.39**

Source: Urban Emissions Environmental Management Software 2007
Notes: CO_{2e} = carbon dioxide equivalents.
[1] Assumes 12 months of construction per power plant; 122 construction workers per day, 2 trips per worker, 15-mile commute distance, 250 days; 5 tractor-trailer trips per day, 50 miles per trip, 250 days; standard mix of construction equipment; and 24 acres of cleared, graded, and leveled area with 50% dust control efficiency.
[2] Assumes 6 months of construction; 40 construction workers per day, 2 trips per worker, 15-mile commute distance, 125 days; 5 tractor-trailer trips per day, 50 miles per trip, 125 days per year; standard mix of construction equipment; and 350 acres of disturbed area with 50% dust control efficiency.
[3] Assumes 12 months of construction; 35 construction workers per day, 2 trips per worker, 15-mile commute distance, 250 days; 2.5 tractor-trailer trips per day, 50 miles per trip, 250 days per year; standard mix of construction equipment; and for 26 well pads, 110 acres of disturbed area with 50% dust control efficiency.
[4] Assumes 6 months of construction; 25 construction workers per day, 2 trips per worker, 15-mile commute distance, 250 days; 2.5 tractor-trailer trips per day, 50 miles per trip, 125 days per year; standard mix of construction equipment; and 150 acres of disturbed area with 50% dust control efficiency.

Table 4-5
Vulcan Production Well Drilling Emissions Per Well
(tons)

	VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_{2e}
Drilling operations per well [1]	0.28	9.85	2.62	0.06	0.17	--	508.70
Tractor-trailer trips per well [3]	0.01	0.04	0.02	0.00	0.01	0.01	10.18
Personal vehicle trips per well[4]	0.004	0.005	0.065	0.00	0.011	0.002	6.67
Total per well pad (pounds)	**0.29**	**9.90**	**2.71**	**0.75**	**0.19**	**20.01**	**525.55**

[1]Drilling rig engine is assumed to meet US Environmental Protection Agency Tier 1 large-bore diesel emission standards (40 CFR Part 89), maximum daily fuel consumption, 45 days of drilling per well, 24 hours per day. Actual well-drilling emissions are likely to be much less than estimated here, as engine use is highly variable over the course of the drilling operations. In addition, NO_x emissions under testing conditions have been found to be less than estimations using diesel emission standards.
[2] Emission factor is for particulate matter (PM); it is assumed that the PM is mostly $PM_{2.5}$.
[3] 3 tractor trailer trips per day for 45 days, 50 miles per trip.
[1] 10 construction workers per day, 2 trips per worker, 15-mile commute distance, 45 days.
Notes: Because construction equipment and vehicles no longer burn leaded fuel, no lead emissions would occur.

months, when the air temperature drops and the air humidity increases. Vulcan would adjust operations to meet Nevada Administrative Code 445B.22033 standards. Cooling tower drift is a type of moisture release that results when small quantities of water droplets of 10 microns or greater as well as small amounts of dust and dissolved and suspended solids become airborne and are carried out with the exhaust air. Cooling tower drift would be avoided through the use of drift eliminators. The operation of the binary power plant would require as many as 33 employees to staff the first two binary power plants and 26 workers to staff a flash power plant. Emissions associated with commute vehicles would be low.

Under normal operations, binary power plants operate in a closed environment, where the geothermal fluid and the working fluid do not contact the atmosphere. The Vulcan binary power plants would use a hydrocarbon working fluid that would be determined once the temperature of the geothermal resource is known. Because the power plants would be a closed system with the working fluid rarely exposed to the atmosphere, little impact on air quality is expected from the operation of the power plants. Safety systems incorporated in the power plant design would prevent the accidental release of significant amounts of hydrocarbons to the atmosphere. During maintenance, there may be minor emissions of nitrogen, carbon dioxide, and oxygen from the working fluid system. Hydrocarbon emissions from each power plant would likely be over 5 tons per year but much less than 100 tons per year; therefore, Vulcan would obtain a Class II Air Quality Operating Permit from the NDEP, Bureau of Air Pollution Control for construction and operation of each binary power plant.

Flash Power Plant. Emissions of water vapor from the cooling tower and emissions of particulates in the cooling tower drift would be similar to those

described previously for the binary power plants. In addition, in a dual flash power plant system, the non-condensable gases in the geothermal resource flow through the turbines to the condenser (versus being contained in a closed loop). Some of the H_2S would dissolve and oxidize in the condensate, but most would be extracted by the non-condensable gas removal system and released to the atmosphere through the cooling tower. Vulcan has calculated that a 60-MW flash power plant could approach the 100 ton per year threshold for H_2S, which is below the level that constitutes a major source of new emissions in the federal Prevention of Significant Deterioration program but would trigger the need for a Class I Air Quality Operating Permit from the NDEP, Bureau of Air Pollution Control.

Once the concentrations of non-condensable gases in the geothermal resources are known and the design of the release points have been established, Vulcan would perform stationary source modeling to determine the contribution of H_2S at publically accessible areas. Based on similar projects in other locations, the proposed project is expected to meet the Nevada ambient air quality standard for hydrogen. If this standard could not be met, a H_2S abatement system would be installed at the flash power plant.

Indirect Impacts

Development of the Ormat Binary Power Plant would have an indirect impact on greenhouse gas emissions if the power produced by the geothermal power plant displaced electricity generated by convention sources of electricity.

Mitigation and Monitoring Measures

Mitigation and monitoring measures to control fugitive dust during construction would be the same as described for the SPPC Project.

The following mitigation measures would be implemented during well drilling to reduce emissions associated with off-gassing and large (over 37 kilowatts) diesel well-drilling equipment:

- Monitor H_2S emissions during all phases of drilling and testing and report the results to the BLM regularly. If the monitoring reveals emissions exceeding the Nevada ambient air quality standard, an H_2S abatement plan would be developed and implemented. The abatement plan would include additional control measures to ensure compliance with the emission limitation. Additional control measures could include, but would not be limited to, the following:
    - Reduce the number of wells venting simultaneously, as applicable; and
    - Implement additional wellhead abatement measures, such as caustic injection between the flash tank and the portable silencer.

- Ensure that generators over 37 kW (50 horse power) are diesel-fired units manufactured after January 1996, certified to meet EPA Tier 1 Emission Standards, and equipped with an exhaust particulate filter system.

The following measures would be implemented to avoid visibility impacts:

- Adjust operations to avoid significant vapor plumes.
- Require the installation of drift eliminators to prevent cooling tower drift.

The following measures would be implemented to prevent air quality-related health and safety impacts:

- Install BOPE to the production wells to prevent large releases of H_2S.
- Incorporate safety systems in the power plant design to prevent the accidental release of significant amounts of hydrocarbons and non-condensable gases to the atmosphere.

Residual Impacts
The implementation of the mitigation measures described previously would reduce potential air quality-related impacts on lower than acceptable levels.

Alternative 1
Direct and indirect impacts on air quality, mitigation and monitoring measures, and residual impacts would be the same as described for the Proposed Action for all project elements except the interconnection line. Under Alternative 1, Vulcan would construct the Bass Flat Switching Station and an additional 4.6 miles of transmission line. This Alternative would have a slightly greater impact from construction than the Proposed Action. However, these impacts would be mitigated by implementing the construction measures described under Mitigation and Monitoring Measures discussed for the SPPC Project. Operational impacts under Alternative 1 would be the same as described for the Proposed Action, as the switching station and transmission line would have no effect on air quality.

No Action Alternative
The No Action Alternative would have no direct impacts on air quality, as the Vulcan Geothermal Power Plants and associated infrastructure would not be developed. Minor indirect impacts on air quality and greenhouse gas emissions could occur in that the impacts of greenhouse gases savings from geothermal energy production would not be realized.

4.4 MINERALS/GEOLOGY

Summary

Assessment Methodology

The potential effects of the Proposed Actions and Alternatives on geologic and mineral resources were evaluated by assessing the location of project components relative to the geological resources within the Salt Wells Energy Projects Area.

Specific geologic features may have value to mineralogical, paleontological, scenic, recreational, or cultural resources, and impacts on these resources are discussed in their respective sections. In this section, impacts on geologic features are evaluated only from the perspective of scientific value. Effects are quantified where possible.

Indicators

The following indicators were developed to evaluate potential project impacts on mineral and geologic resources:

- The number and type of claims for locatable, leasable, and salable mineral resources in the Salt Wells Energy Projects disturbance footprint. The Projects Area may be located on or near a locatable, leasable, and salable mineral resource;
- Earthquake activities, ground failure, or landslides;
- Substantial erosion of geological units, such as with landslides and subsidence; and
- Unstable geological units, including parent material, slope angle, amount of vegetation, and location of fault lines within the Projects Area disturbance footprint. Facilities located on a geologic unit that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

Region of Influence

The ROI for this analysis is the Salt Wells Energy Projects Area.

SPPC Project Area

Proposed Action

Potential impacts on geological and mineral resources would be limited to circumstances where the power line route would preclude access to mineral resources. Based on a review of mining claims and leases issued for mineral resources within the proposed transmission corridor, the corridor would not present an access or development issue for any identified mineral resource.

Direct Impacts

No direct impact on geological or mineral resources would result from implementation of the proposed transmission line project. Footings that would be constructed for each power pole would not be of sufficient depth to pose an issue concerning stability of the land surface. Between the southern SPPC Project terminus and the north end of the Bunejug Mountains, there would be little potential for geological slope stability impacts as a result of construction of the Proposed Action. From the Bunejug Mountains north to the northern Project terminus, the Project is located on level ground surfaces and would not be subject to geological instability. The Proposed Bass Flat and Pony Express Switching Stations and Fallon and Greenwave Substations are on level surfaces and not subject to general geological instability.

The proposed transmission line corridor would not preclude development of mineral resources identified in the SPPC Project Area. No salable or locatable mineral leases are located within the Project Area (BLM and USFS 2010).

Indirect Impacts

No unique geologic or mineral or mineral features have been identified within the Project Area. As such, no indirect impacts are expected to occur.

Mitigation and Monitoring Measures

No mitigation and monitoring measures are proposed. Construction activities would be required to comply with the BLM and Churchill County grading and drainage ordinance provisions for developing hillsides.

Residual Impacts

No residual impacts would occur.

Alternative 1

Impacts to geological and mineral resources resulting from implementation of Alternative 1 would be the same as those described for the Proposed Action.

Direct Impacts

Direct impacts on geological and mineral resources resulting from implementation of Alternative 1 would be similar to those described for the Proposed Action.

Indirect Impacts

No unique geologic or mineral or mineral features have been identified within the Alternative 1 Project Area. As such, no indirect impacts on unique geologic or mineral features would occur.

Mitigation and Monitoring Measures

No mitigation and monitoring measures are proposed. Construction activities would be required to comply with the BLM and Churchill County grading and drainage ordinance provisions for developing hillsides.

Residual Impacts
No residual impacts would occur.

Alternative 2
Impacts to geological and mineral resources resulting from the Alternative 2 would include localized increases in erosion and runoff rates at construction sites. Impacts would be highest during construction, and impact intensity would diminish as disturbed sites are stabilized and revegetated, consequently reducing erosion and runoff. Once the ground surface has been stabilized, the potential for erosion and impacts on geological and mineral resources would diminish.

Direct Impacts
Direct impacts on geological and mineral resources resulting from implementation of Alternative 2 would be similar to those described for the Proposed Action.

Indirect Impacts
No unique geologic or mineral features have been identified within the Project Area. As such, no indirect impacts on unique geologic or mineral features would occur.

Mitigation and Monitoring Measures
No mitigation and monitoring measures are proposed. Construction activities would be required to comply with the BLM and Churchill County grading and drainage ordinance provisions for developing hillsides.

Residual Impacts
No residual impacts would occur.

No Action Alternative
There would be no impacts on geological or mineral resource conditions under the No Action Alternative.

Ormat Project Area

Proposed Action

Direct Impacts
No potential impacts on geological and mineral resources are expected to result from the proposed Ormat Project. Construction and operation of the proposed geothermal power plant and ancillary wells and pipeline infrastructure would not result in limited access and would not precluding development of mineral resources in the Ormat Project Area.

Ground disturbance during construction of the structures associated with the proposed Ormat Project have the potential to create unstable cut-and-fill slopes, particularly areas underlain by weak rock material and areas on or near

unstable fault lines. Project construction would include grading the landscape to produce suitable footings for the transmission towers and construction of well pads, aboveground pipeline systems, Carson Lake Binary Power Plant and Substation, and associated roads. Overall, the proposed Project would be located on gentle slopes or level ground surfaces and is not subject to general geological instability.

Earthquakes can add to the instability of the weak geological features upon which structures associated with Project transmission lines, pipelines, power plants, and substations are constructed. Structures constructed on fault lines or scarps would be at higher risk of structural failure than structures situated on stable rock formations or level ground surfaces. Potential effects of earthquake activity that results in surface rupture or movement on Project features could include collapse or shearing of wells and pipelines. Consequences of this displacement would result in release of geothermal water to the surface environment and loss of production and injection well functions.

The proposed Ormat Project would not affect existing mineral development in the Project Area. No salable or leasable mineral resources are located within the Project Area (BLM and USFS 2010).

Indirect Impacts
No unique geologic or mineral features have been identified within the Project Area. As such, no indirect impacts on unique geologic or mineral features would occur.

Mitigation and Monitoring Measures
No mitigation and monitoring measures are proposed. Construction activities would be required to comply with the BLM and Churchill County grading and drainage ordinance provisions for developing hillsides.

Residual Impacts
No residual impacts would occur.

Alternative 1

Direct Impacts
Direct impacts on geological and mineral resources resulting from implementation of Alternative 1 would be similar to those described for the Proposed Action.

Indirect Impacts
No unique geologic or mineral features have been identified within the Project Area. As such, no indirect impacts on unique geologic or mineral features would occur.

Mitigation and Monitoring Measures
No mitigation and monitoring measures are proposed. Construction activities would be required to comply with the BLM and Churchill County grading and drainage ordinance provisions for developing hillsides.

Residual Impacts
No residual impacts would occur.

Vulcan Project Area

Proposed Action

Direct Impacts
No potential impacts on geologic or mineral resources are expected to result from the proposed Vulcan Project. Construction and operation of the proposed geothermal power plant and ancillary wells and pipeline infrastructure would not result in limiting access or precluding development of mineral resources in the Vulcan Project Area.

Ground disturbance during construction of the structures associated with the proposed Vulcan Project has the potential to create unstable cut-and-fill slopes, particularly areas underlain by weak rock material and areas on or near unstable fault lines. Project construction would include grading the landscape to produce suitable footings for the transmission towers and construction of well pads, aboveground pipeline systems, Carson Lake Binary Power Plant and Substation, and associated roads. Overall, the proposed Project would be located on gentle slopes or level ground surfaces and is not subject to general geological instability.

Earthquakes can add to the instability of the weak geological features upon which structures associated with Project transmission lines, pipelines, power plants, and substations are constructed. Structures constructed on fault lines or scarps would be at higher risk of structural failure than structures situated on stable rock formations or level ground surfaces. Potential effects of earthquake activity that results in surface rupture or movement on Project features could include collapse or shearing of wells and pipelines. Consequences of this displacement could result in release of geothermal water to the surface environment and loss of production and injection well functions.

The proposed Vulcan Project would not affect existing mineral development in the Project Area. No salable or leasable mineral resources are located within the Project Area (BLM and USFS 2010).

Indirect Impacts
No unique geologic or mineral features have been identified within the Project Area. As such, no indirect impacts on unique geologic or mineral features would occur.

Mitigation and Monitoring Measures
No mitigation and monitoring measures beyond those described in **Chapter 2**, Description of the Proposed Action and Alternatives would be required. Construction activities would be required to comply with the BLM and Churchill County grading and drainage ordinance provisions for developing hillsides.

Residual Impacts
No residual impacts would occur.

Alternative 1

Direct Impacts
The actions proposed in Alternative 1 would not directly impact geological or mineral resources.

Indirect Impacts
No unique geologic or mineral features have been identified within the Project Area. As such, no indirect impacts on unique geologic or mineral features would occur.

Mitigation and Monitoring Measures
No mitigation and monitoring measures are proposed. Construction activities would be required to comply with the BLM and Churchill County grading and drainage ordinance provisions for developing hillsides.

Residual Impacts
No residual impacts would occur.

4.5 SOILS

Summary

Consequences of the Salt Wells Energy Projects on soil resources include temporary reduction in soil productivity at the margin of construction and staging areas, minor erosion and sedimentation due to the effects of wind and surface water runoff on exposed soil during construction, and long-term commitment of soil resources with conversion to non-soil features, including wells, pipelines, power plants, electrical substations, and transmission line towers.

Assessment Methodology
Baseline information for existing soil types and soil map units in the Salt Wells Energy Projects Area was compiled from the Soil Survey of Churchill County published by the NRCS (NRCS 2001) and information contained in the NRCS online soil database (NRCS 2010). This information includes typical parent materials, degree of vegetation, landforms/topography, and depth to shallow groundwater. In addition, an inventory of the following attributes of soil map

units is included: surface texture (clay to sand), salinity or sodicity, Kw, and WEG. The surface horizon in each area is considered the growth medium available for reclamation. Each Proposed Action and Alternative is evaluated based on the information listed previously.

Indicators

Indicators of effects of the Proposed Actions and Alternatives are as follows:

- Acres and locations of proposed soil disturbance;
- Locations of proposed disturbance to highly erodible soil types; and,
- Quantity and quality of growth media present and salvageable for reclamation activities.

Region of Influence

The ROI for direct and indirect effects on soil resources includes areas where soil would be directly disturbed and adjacent areas that may be influenced by wind or water-borne sediment, which includes the SPPC, Ormat, and Vulcan Survey Areas.

SPPC Project Area

Proposed Action

The area of proposed temporary and permanent disturbance for the SPPC Proposed Action is shown in Table 2-1. Approximately six inches, or 655,480 cubic yards, (see **Appendix G**, Table G-2) of surface horizon material is present along the proposed transmission line route. Much of the surface horizon material has a high salt and sodium content, and is of poor quality for reclamation purposes.

SPPC would finalize the POD for submittal to BLM. The POD would include implementation of BMPs to minimize impacts on soil resources.

In addition SPPC would develop a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the NPDES General Construction Stormwater Permit to minimize erosion from the project construction worksites. The SWPPP would include maps of the SPPC Project Area with potential locations for appropriate BMPs. The SWPPP would be available on site throughout the construction period. Surface water control measures identified in the SWPPP would be inspected weekly and after rain events of 0.5 inches or more in a 24-hour period.

SPPC would also prepare and implement a Reclamation Plan as described in the POD to minimize the permanent effects of soil disturbance. The Reclamation Plan is described in **Chapter 2**, Description of the Proposed Actions and Alternatives.

Direct Impacts

Potential direct impacts on soil resources would occur during soil salvage operations and soil redistribution activities. Impacts to soil during salvage and stockpiling operations include physical loss of soil from excavating and handling the soil and interruption of soil biological, physical, and chemical activity as a result of placement of soil in stockpiles. Additional soil loss would occur during reclamation when soil is re-handled from stockpiles and distributed on regraded areas. Soil loss associated with salvage, temporary stockpile, and replacement typically total about 10 percent.

Soil would be directly impacted by grading activities during construction. Limited grading would occur along access and centerline roads to allow vehicles and equipment to travel along the transmission line route. Transmission structure and stringing sites would be graded to form a relatively flat working surface. Holes would be excavated for both temporary crossing structures and permanent transmission line structures. Topsoil, where present, would be salvaged for reapplication; however soil structure and soil biota would be disturbed during the salvaging operation. Disturbance would occur in areas of cryptobiotic soils likely present in the southwestern portion of the SPPC Survey Area.

In grading areas where topsoil is not present, surface and subsurface horizons would be mixed. Mixing causes temporary dilution of organic material and salts which are frequently concentrated in the surface horizon. Mixing also may increase the coarse fragment content of the soil surface and shallow rooting zone. Potential impacts of mixing include reduced retention of soil moisture during dry periods. Potential impacts could also include temporary reductions in salinity and slight armoring of the soil surface against water erosion.

Indirect Impacts

After growth media salvage activities, some areas may be subject to deposition of wind-blown material outside the footprint of construction areas, or loss of soil due to wind erosion. These areas are described in **Table G-1**, Soil Map Units in Proposed Areas of Disturbance – SPPC Project Area, and shown in Figures 3-3, Soil Wind Erodibility Group, SPPC Southern, 3-4, Soil Wind Erodibility Group, SPPC Central, and 3-5, Soil Wind Erodibility Group, SPPC Northern.

Mitigation and Monitoring Measures

No mitigation or monitoring measures have been identified by BLM. Implementation of reclamation activities and Environmental Protection Measures outlined in **Appendix E** would reduce potential soil loss associated with the Proposed Action.

Residual Impacts

Residual impacts of soil mixing would include decreased productivity in those locations where organic matter and beneficial microbes were previously

concentrated. In contrast, the likelihood of plant establishment would temporarily increase in locations where salts were previously concentrated, but were diluted by the project.

Alternative 1

Direct Impacts
Implementation of Alternative 1 would include temporary disturbance of five additional acres and 10 acres in the area of permanent disturbance as compared to the Proposed Action. Therefore, impacts under Alternative 1 would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for Alternative 1 would be the same as those outlined for the Proposed Action.

Alternative 2

Direct Impacts
Under Alternative 2 the transmission route would differ over a 2.5 mile distance resulting in a reduction of temporary disturbance of 23.5 acres compared to the Proposed Action. Therefore, impacts under Alternative 2 would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 2 would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for Alternative 2 would be the same as those outlined for the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
Impacts under the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts under the Macari Fiber Optic Alternative would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for the Macari Fiber Optic Alternative would be the same as those outlined for the Proposed Action.

No Action Alternative
The No Action Alternative would have no impacts on soil resources as the transmission line and associated facilities would not be developed.

Ormat Project Area

Proposed Action
Temporary and permanent disturbance areas for the Ormat Proposed Action are shown in Table 2-2. 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 is present in the footprint of the Proposed Action. Most of this surface horizon material has a high salt and sodium content, and is a poor quality growth medium for typical reclamation plants.

Ormat Technologies would prepare and implement an SWPPP to minimize erosion from the project construction worksites. The SWPPP would be prepared in accordance with the NPDES General Construction Stormwater Permit and identify existing drainage patterns of construction worksites and ROWs, nearby drainages and washes, potential pollutant sources other than sediment, and the BMPs that that would be implemented to minimize off-site erosion and sedimentation. The SWPPP would include maps of the Project Area with potential locations for appropriate BMPs. Surface water control measures identified in the SWPPP would be inspected weekly and after rain events of 0.5 inches or more in a 24-hour period.

Ormat Technologies would prepare and implement a Reclamation Plan to minimize the permanent effects of soil disturbance in those areas not committed

to non-soil features. The Reclamation Plan is described in **Chapter 2**, Description of the Proposed Action and Alternatives.

Direct Impacts

In the area of permanent disturbance (208 acres), soil resources would be committed to development of non-soil features, such as well pads, access roads, pipelines, the power plant, and interconnection line. In the area proposed for temporary disturbance (124 acres), topsoil, where present, would be salvaged for reapplication.

Potential direct impacts on soil resources would occur during soil salvage operations and soil redistribution activities. Impacts to soils during salvage and stockpiling operations include physical loss of soil from excavating and handling the soil and interruption of soil biological, physical, and chemical activity as a result of placement of soil in stockpiles. Additional soil loss would occur during reclamation when soil would be re-handled from stockpiles and distributed on regraded areas. Soil loss associated with salvage, stockpile, and replacement typically totals approximately 10 percent.

In graded areas where topsoil is not present, surface and subsurface horizons would be mixed. Mixing causes temporary dilution of organic material and salts which are frequently concentrated in the surface horizon. Mixing also may increase the coarse fragment content of the soil surface and shallow rooting zone. Potential impacts of mixing include reduced retention of soil moisture during dry periods. Potential impacts could also include temporary reductions in salinity and slight armoring of the soil surface against water erosion.

Indirect Impacts

After implementation of the Proposed Action, some areas may be subject to the deposition of wind-blown material outside the footprint of construction areas, or loss of soil due to wind erosion. Multiple locations along the Ormat Survey Area exhibit susceptibility to wind erosion (WEG 1). These areas are outlined in Table G-4 and are shown on Figure 3-6. In addition, construction in areas with seasonal ponding of water may cause soil to have increased moisture on the upgradient side of the constructed feature which may cause increased soil salinity in areas where ponded or shallow water becomes more isolated and stagnant.

Mitigation and Monitoring Measures

No mitigation or monitoring measures have been identified by BLM. Implementation of reclamation activities and BMPs outlined in the Proposed Action would reduce potential soil loss associated with the Proposed Action.

Residual Impacts

Residual impacts of soil mixing would include decreased productivity in those locations where organic matter and beneficial microbes were previously concentrated. In contrast, the likelihood of plant establishment would

temporarily increase in locations with slightly elevated salt concentrations that become diluted with non-saline or less saline subsoil.

Alternative 1

Direct Impacts
Alternative 1 includes three fewer acres of temporary disturbance and 13 fewer acres of permanent disturbance than the Proposed Action. Impacts under Alternative 1 would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for Alternative 1 would be the same as those outlined for the Proposed Action.

No Action Alternative
The No Action Alternative would have no impacts on soil resources as the power plant and associated facilities would not be developed.

Vulcan Project Area

Proposed Action
Temporary and permanent disturbance areas for the proposed Vulcan Project are shown in Table 2-4. Approximately five inches, or 842,799 cubic yards, (see Table D-8) of surface horizon material is present in the footprint of the Proposed Action. Most of this surface horizon material has a high salt and sodium content, and is a poor quality growth medium for typical reclamation plants.

Vulcan would prepare and implement an SWPPP to minimize erosion from the project construction worksites. The SWPPP would be prepared in accordance with the NPDES General Construction Stormwater Permit and identify existing drainage patterns of construction worksites and ROWs, nearby drainages and washes, potential pollutant sources other than sediment, and BMPs that would be implemented to minimize off-site erosion and sedimentation. The SWPPP would include maps of the Project Area with potential locations for appropriate BMPs. Surface water control measures identified in the SWPPP would be inspected weekly and after rain events of 0.5 inches or more in a 24-hour period.

Vulcan would prepare and implement a Reclamation Plan to minimize the permanent effects of soil disturbance in those areas not committed to non-soil features. The Reclamation Plan is described in **Chapter 2**, Description of the Proposed Action and Alternatives.

Direct Impacts

In the area of permanent disturbance (750acres), soil resources would be committed to development of non-soil features, such as well pads, access roads, pipelines, the power plant, and transmission lines. In areas proposed for temporary disturbance (504 acres), growth media, where present, would be salvaged for reapplication.

Potential direct impacts on soil resources would occur during soil salvage operations and soil redistribution activities. Impacts to soil during salvage and stockpiling operations include physical loss of soil from excavating and handling the soil and interruption of soil biological, physical, and chemical activity as a result of placement of soil in stockpiles. Additional soil loss would occur during reclamation when soil is re-handled from stockpiles and distributed on regraded areas. Typically, soil loss totals approximately 10 percent as a result of salvage, stockpiling, and replacement on industrial sites.

In graded areas where topsoil is not present, surface and subsurface horizons would be mixed. Mixing causes temporary dilution of organic material and salts which are frequently concentrated in the surface horizon. Mixing could also increase the coarse fragment content of the soil surface and shallow rooting zone. Potential impacts of mixing include reduced retention of soil moisture during dry periods. Potential impacts could also include temporary reductions in salinity and slight armoring of the soil surface against water erosion.

Indirect Impacts

After implementation of the Proposed Action, some areas may be subject to deposition of wind-blown material outside the footprint of construction areas, or loss of soil due to wind erosion. These areas are described in Table D-7, Soil Map Units in Proposed Areas of Disturbance – Vulcan Project Area, and shown on Figure 3-7, Soil Wind Erodibility Group, Vulcan. In addition, construction in areas with seasonal ponding of water could cause soil to have increased moisture on the upgradient side of the constructed feature, and could result in increased soil salinity in areas where ponded or shallow water becomes more isolated and stagnant.

Mitigation and Monitoring Measures

No mitigation or monitoring measures have been identified by BLM. Implementation of reclamation activities and BMPs outlined in the Proposed Action would reduce potential soil loss associated with the proposed Vulcan Project.

Residual Impacts
Residual impacts of soil mixing would include decreased productivity in those locations where organic matter and beneficial microbes were previously concentrated. In contrast, the likelihood of plant establishment would temporarily increase in locations with slightly elevated salt concentrations that become diluted with non-saline underlying soil.

Alternative 1

Direct Impacts
Implementation of Alternative 1 would involve 173 acres of additional temporary disturbance and 75.9 acres of additional permanent disturbance. The direct impacts of Alternative 1 would be similar to those described under the Proposed Action; however, Alternative 1 would extend into additional acreage to the south of the Proposed Action. Soil types associated with this additional acreage is highly susceptible to wind erosion.

Indirect Impacts
Indirect impacts under Alternative 1 would be similar to but greater than those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for Alternative 1 would be the similar to but greater than those outlined for the Proposed Action.

No Action Alternative
The No Action Alternative would have no impacts on soil resources as the power plants and associated facilities would not be developed.

4.6 FARM LANDS (PRIME OR UNIQUE)

This section presents the consequences that the Proposed Actions and Alternatives are likely to have on Prime or Unique Farmlands. Mitigation measures are discussed for reducing any impacts that surface disturbance and constructed features may have to agricultural operations.

Summary

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 Farmland. No potential Prime Farmland is present in the badlands, playas, rocky areas, and salt flats of the Bunejug Mountains and surroundings (Figure 3-9, Prime Farmlands).

The consequences of the project on potential Prime Farmland include temporary disruption of agricultural activities during construction of transmission towers and stringing of transmission lines as well as conversion of land in the footprint of transmission line towers into non-farmland. No areas currently in agricultural use are present in the footprint of proposed wells, pipelines, and power plants.

Assessment Methodology

The acreage of potential Prime Farmlands was determined for each Proposed Action and Alternative. Within the potential Prime Farmland areas, estimates were produced of the following impacts:

- Total acres that would be converted directly to non-farm lands,
- Total acres that would be converted indirectly to non-farm lands through interference with land patterns, and
- Total acres to remain as farmland.

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 (see **Figure 3-9,** Prime Farmlands). The entire Salt Wells Energy Projects Area is located on and borders non-urban land. The northern end of the SPPC Survey Area is within one mile of urban land in the city of Fallon.

Indicators

The previous information is provided to assist with agency completion of Parts I, III, and VI of the Impact Rating Forms obtained from the NRCS for corridor and non-corridor projects (NRCS 2010).

Region of Influence

The ROI for direct and indirect effects on Prime or Unique Farmlands includes areas where soil would be directly disturbed and adjacent areas that may be influenced by wind or water-borne sediment, which includes the SPPC, Ormat, and Vulcan Survey Areas

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 following describes the quantity of potential Prime Farmland to be disturbed or altered in the SPPC Survey Area.

Proposed Action

Direct Impacts

Within the potential Prime Farmland in the vicinity of the SPPC Proposed Action, 370 acres are proposed for temporary disturbance. As shown in **Table**

4-6, Potential Prime Farmlands: Impacted Acreage – SPPC Survey Area, after construction is completed, 1 acre of potential Prime Farmland would be occupied by the footprint of H-frame transmission towers, and would be converted directly to non-farm land.

Table 4-6
Potential Prime Farmlands Impacted Acreage SPPC Survey Area

	Temporary Disturbance	Converted Directly to Non-farm Land*	Land Patterns Disrupted**	Unaffected Farmland After Construction Completed
Proposed Action	370.1	1.1	150.7	218.3
Alternative 1	408.1	1.1	169.6	237.4
Alternative 2	366.9	1.1	149.3	216.5

*Within 40 foot by 10 foot footprint of H-frame transmission towers located one per 1,000 feet of corridor length.

**Area not in footprint of transmission towers, but disrupted by the transmission line ROW.

Indirect Impacts

The Indirect Impact of the Proposed Action is slight disruption of land patterns in the remainder of the permanent ROW (151 acres). Potential Prime Farmland in the area outside the permanent ROW (218 acres) would remain, and be unaffected.

Mitigation Measures

The proposed transmission line corridor would be located generally at the margins of existing property boundaries; adjacent to roadways or canals. SPPC would work directly with landowners along the transmission line route to determine the specifications for post-construction reclamation of compaction or rutting that may occur, in order to return farmland to productivity. Mitigation measures for compaction or rutting may include regrading or chiseling 18 inches deep. SPPC would also work directly with landowners to identify if landowners' communication circuits are disrupted by the project, and would seek to eliminate such disruption.

After construction is complete, SPPC would remove all material that is not an integral part of the installed project, including litter. The footprint of towers would be the only location where SPPC occupancy would not allow agricultural use, and the areas between the towers would be available for continued farming.

Residual Impacts

After mitigation measures are employed, the footprint of transmission towers would be unavailable as farmland, and land patterns would be slightly disrupted in the permanent ROW of the transmission line. The kind and intensity of the

Proposed Action is compatible with agriculture and is not likely to reduce services to potential Prime Farmlands.

Alternative 1

Direct Impacts
Alternative 1 includes twenty-six additional acres of temporary disturbance and a reduction by 13 acres in the permanent ROW as compared to the Proposed Action. Impacts under Alternative 1 would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for Alternative 1 would be the same as those outlined for the Proposed Action.

Alternative 2

Direct Impacts
1.2 miles of the proposed transmission line route are different between Alternative 2 and the Proposed Action. The alternate 2.5 miles reduces the direct impacts, otherwise impacts under Alternative 2 would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 2 would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for Alternative 2 would be the same as those outlined for the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
Impacts under the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts under the Macari Fiber Optic Alternative would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for the Macari Fiber Optic Alternative would be the same as those outlined for the Proposed Action.

No Action Alternative
The No Action Alternative would have no impacts on Prime and Unique Farmlands as the transmission line and associated facilities would not be developed.

Ormat Project Area

Although the Ormat Project is not located in an area of agricultural land use, the majority of the Project Area is on land that has been technically classified as Prime Farmland if reclaimed of salts and sodium. The scale of impacts for the Proposed Action and Alternative 1 are the same, but occur in slightly different locations.

Proposed Action

Direct Impacts
Potential Prime Farmland in the Ormat Survey Area is located mostly in the northern portion of the Survey Area; however 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, of which 193 acres would require abatement of salts and sodium to qualify as Prime Farmland. Under the Proposed Action, all of this acreage would be permanently unavailable as Prime Farmland.

Indirect Impacts
All tracts of land that encounter proposed pipelines would be indirectly affected by disruption of land patterns.

Mitigation and Monitoring
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
No land would remain available as Prime Farmland within the footprint of the Proposed Action; however the current land use in the Ormat Survey Area is not agricultural.

Alternative 1

Direct Impacts
Alternative 1 includes three fewer acres of temporary disturbance and 13 fewer acres of permanent disturbance than the Proposed Action, all of which are on land that is not currently used for agriculture but would qualify as Prime Farmland if abated of salts and sodium. The types of impacts would be same at those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts for Alternative 1 would be the same as those outlined for the Proposed Action.

No Action Alternative
The No Action Alternative would have no impacts on Prime and Unique Farmlands as the power plant and associated facilities would not be developed.

Vulcan Project Area

No Prime or Unique Farmlands are located in the Vulcan Project Area; therefore, and the Proposed Action and Alternatives would not impact Prime or Unique Farmlands.

4.7 WATER QUALITY AND QUANTITY

Summary

This section describes the potential impacts on surface water and groundwater resources that could occur from the Proposed Actions and Alternatives. The geothermal energy source is stored within a basalt-rich volcanic/plutonic aquifer and an ash-flow tuff aquifer underlying the Salt Wells Energy Projects Area (Figure 3-12, Conceptual Hydrologic Block Model Diagram). A near-surface

aquifer complex overlies the basalt aquifer and comprises unconsolidated valley-fill sediments. The valley-fill aquifer is tapped by irrigation and water supply wells. Each of these aquifers could be affected by the Proposed Actions and Alternatives associated with the Ormat and Vulcan projects.

Surface water resources present within or near the Salt Wells Energy Projects Area that could be affected by geothermal development include Carson Lake and surrounding wetland complex, other perennial and seasonal wetlands, the irrigation system north and west of the proposed development area, irrigation and water supply wells, hot and warm springs and seeps, non-thermal springs, ephemeral surface water flow in drainages, and the playas (e.g., Eightmile Flat, Fourmile Flat, Turupah Flat, and Bass Flat).

Assessment Methodology

The assessment for potential impacts on water resources was based on regional and site-specific information presented in **Chapter 3**, Affected Environment. A conceptual hydrologic model was developed using the available information to complete the water resources impact analysis. A description and diagram of the conceptual model are presented in **Section 3.7**, Water Quality and Quantity (Figure 3-12). The model was used as the basis for estimating potential impacts on water resources resulting from the production of geothermal energy within the Projects Area.

Indicators

The following indicators have been identified in order to evaluate potential project impacts on water resources:

- Alteration of surface water drainage patterns, which could result in increases in suspended sediment and turbidity in surface water drainages where the geothermal power plants, transmission lines, substations, and switching stations would be constructed.
- Release of pollutants other than sediment to the environment during construction, operation, and maintenance of the facilities described previously.
- Lowering of groundwater levels due to extraction wells that could affect soils (reduced saturated zones and increased fugitive dust); wetlands and riparian areas (reduced vegetation and source water); springs (reduced flows); changes in wildlife habitat; changes in range/grazing (reduced vegetation and/or water availability); and water rights (depressed groundwater levels in wells; reduced flow in surface water). Reductions in groundwater levels could decrease the volumes of groundwater stored in the various aquifers and reduce yields.
- Mounding of groundwater levels due to injection wells that could affect soil (increased saturated zones); wetlands and riparian areas

(increased water available to wetland areas); springs (increased flows); and groundwater flow patterns. Increases in groundwater elevations could increase the volumes of water in the various aquifers and enhance yields. Water re-injected into the subsurface under the proposed geothermal projects may or may not recharge the aquifer from which it was extracted.

- Changes in flow from springs and in surface water drainages.
- Changes in groundwater and/or surface water temperatures.
- Changes in groundwater and/or surface water quality.
- Changes in source water and vegetation at wetland areas.
- Flash flooding effects on proposed facilities.

Region of Influence

The ROI for water resources is shown on Figure 3-10, Springs, Seeps, and Surface Water Features, and consists of an area bounded by the following features:

- Western edge of the Carson Lake wetlands on the west (boundary between R28E and R29E);
- Eastern edge of Fourmile Flat on the east;
- Fallon, Nevada, on the north; and
- Southern edge of the Vulcan lease boundary.

This ROI was selected because of the expected potential impact area for water resources due to the pumping and reinjection of groundwater at proposed drill pads for geothermal development in the Ormat and Vulcan leases. Water resources within the ROI include springs, seeps, irrigation ditches/canals, Carson Lake, playas, ephemeral surface water flow in drainages, and groundwater supply wells.

SPPC Project Area

Proposed Action

Development of the SPPC project facilities would require approximately 813 acres of temporary ground disturbance and 352 acres of permanent disturbance. Vegetation and topsoil removal and slope grading would be required to complete the project.

Direct Impacts

Potential direct impacts on water resources would coincide with the construction phase of the project and, therefore, would be temporary. Potential direct effects include:

- Accidental release of chemical pollutants to the environment during construction, operation, and maintenance of the facilities described previously. The most likely potential impacts would be from spills of petroleum products on the ground used during construction operations. This could affect surface water and/or shallow groundwater if sufficient product is released.
- Erosion and sedimentation to surface water caused by removal of vegetation and ground disturbance during facility and road construction from heavy equipment and blasting. The most likely changes would be increases in suspended sediment and turbidity in surface water during runoff conditions (e.g., overland flow into ephemeral drainages and wetlands).

Indirect Impacts

Potential indirect impacts on water resources could occur due to removal of vegetation in some of the 813 acres of temporary ground disturbance and 352 acres of permanent disturbance. This could result in changes in rates of evapotranspiration from and recharge to shallow groundwater. These effects would be temporary until disturbed areas are re-vegetated where possible.

Mitigation and Monitoring Measures

As described in **Chapter 2**, Description of the Proposed Action and Alternatives, and **Appendix E**, Environmental Protection Measures and Best Management Practices, SPPC would implement plans for the protection of streams, wetlands, springs, and canals. These plans include BMPs that minimize potential for soil erosion, including a SWPPP. The SWPPP would include measures to prevent erosion of disturbed soil. All areas subject to temporary disturbance would be recontoured, decompacted, and seeded, or left in-place as directed by the BLM or private landowner.

During construction of facilities, designated personnel would visually monitor disturbed areas for evidence of soil erosion and associated impacts on surface water. Appropriate actions would be taken to correct any identified problems such as excessive erosion or accidental spills.

Residual Impacts

No residual impacts on water resources are expected after completing construction of the transmission lines and associated facilities, and implementation of the mitigation and monitoring measures described previously.

Alternatives

Impacts and mitigation and monitoring measures described previously are also applicable to the three Alternatives listed in **Chapter 2**, Description of the Proposed Actions and Alternatives, for the SPPC Transmission Line Corridor. For longer transmission line routes, the potential magnitude of impacts is larger because more area would be disturbed and the construction period would be

longer. The Macari Fiber Optic Alternative would include a 1-mile long trench along Macari Lane to Highway 50. Although the total areas of temporary and permanent disturbance vary among the Alternatives, the affected acreages are not appreciably different. The associated differences in potential impacts associated with implementation of Alternatives are expected to be slight, and effects on water resources are expected to be similar under each Alternative.

Ormat Project Area

Proposed Action

The total estimated areas of temporary and permanent disturbance for the Ormat Proposed Action are approximately 332 acres and 208 acres, respectively.

Wells drilled for the project would be used for geothermal groundwater production, groundwater re-injection, and observation. Target total depths for the production wells range from 1,500 to 10,000 feet bgs, and reinjection well depths are expected to be from 1,500 to 9,500 feet bgs.

Direct Impacts

Direct impacts on water resources associated with construction and operation of the power plant, substation, switching station, transmission lines, pipelines, roads, and well pads would be similar to those discussed previously for the SPPC Project Area. These potential effects include spills of petroleum products on the ground used during construction operations; and erosion or sedimentation from construction activities. These potential impacts on surface water and groundwater resources would be temporary, and would coincide with the construction phase of the project.

Drilling activities require fuels and drilling additives. Spills or releases of petroleum or chemical compounds are potential sources of contamination to surface water and shallow groundwater. All machinery, drilling platforms, and oil and fuel storage areas on the drill pads would have secondary containment capacity of as much as 110 percent of volume and, as a secondary precaution, would drain to the reserve pit. Ormat proposes to dispose of drill cuttings, drilling fluids, storm water runoff, and geothermal water from flow tests into an unlined reserve pit located at each well pad. The pit would be approximately 100 feet long by 300 feet wide by 8 feet deep. The rationale for using unlined pits is that the low-permeability drilling mud would form a low-permeability layer along the bottom of the pit and serve as a liner, preventing or minimizing fluids from infiltrating to the subsurface and possibly to groundwater.

Although the reserve pit design would keep most of the water and other drilling materials in the pit, some of the fluids may percolate through the drilling mud and into the subsurface. Depending on the volume and frequency of fluid discharge to the pits, a large percentage of the fluids would likely evaporate. Quality of fluids that would collect in the reserve pits would vary depending on

the amount of each source (i.e., drilling fluids and additives, storm water, and geothermal water). In general, the fluids are expected to be characterized by high total suspended solids and constituents associated with additives, thickeners, and deflocculants, if used. Geothermal water is characterized by elevated TDS, sodium, chloride, calcium, potassium, fluoride, silica, and sulfate. The solids are composed of sediment and small pieces of broken rock, as well as residual mud and clay from the water-based drilling fluid.

Use of reserve pits to contain fluids and drill cuttings would occur on an infrequent and temporary basis (i.e., during the period of well drilling and testing). Once the wells are finished and put into production or other purposes, the reserve pit would no longer be needed, and the pit would be closed by removing any remaining liquids, and removing or burying the cuttings in accordance with applicable regulations.

Figure 3-12 includes a conceptual depiction of the thermal and non-thermal springs and associated groundwater flow systems in the Project Area. As indicated in **Chapter 3**, Affected Environment, hot and warm springs and seeps are indicators of subsurface geothermal activity (**Figure 3-12**). Extraction and reinjection of geothermal water could impact flows and water quality at these features. Extraction of groundwater from production wells could reduce shallow groundwater levels and interconnected flow to springs/seeps in thermal areas; whereas, reinjection may compensate for such effects. In areas of thermal shallow groundwater, temperatures could be lowered if interconnected flow from deeper zones is reduced. Quality of this shallow groundwater, including springs/seeps, could be improved if high concentrations of some constituents are diluted more by non-thermal shallow groundwater.

Elevated temperature, specific conductance, chloride, and silica concentrations for near-surface groundwater samples collected near the Ormat Project area are indicative of a deep geothermal source (7Q10 2010; Coolbaugh et al. 2006). Elevated silica, sodium, and chloride concentrations detected in samples from springs in the same area indicate the geothermal reservoir is a source of the surface expressions (Huffman and Carpenter 2009b; Coolbaugh et al. 2006). These thermal springs are generally located in the northwestern end of the Salt Wells Basin, which is east-southeast of the Ormat Project Area and within the northeastern part of the Vulcan Project Area (**Figure 3-10**). Seasonal variability in water temperature and quality for the samples from shallow groundwater and the springs indicates that precipitation and non-thermal shallow groundwater also contribute to source water in this area.

Flows at non-thermal springs and seeps are not likely to be affected by geothermal groundwater development because these springs are recharged by shallow groundwater with short flow paths that is recharged primarily from precipitation, irrigation, and runoff in the watersheds in mountain ranges and valley bottoms (BLM 2005). Except where there is an interconnection with deep

groundwater along faults, geothermal extraction and reinjection are not expected to affect water levels in the shallow unconsolidated aquifers because of the depths at which pumping and extraction would occur (i.e., greater than 1,500 feet). The Carson Lake area does not seem to be influenced by shallow thermal water and, therefore, any surface water in the lake area should not be affected.

If lowering of groundwater levels occurs in some areas of the shallow aquifer where there are springs/seeps, it could result in drier soil conditions and reduced vegetative cover (e.g., wetlands), which could result in increased fugitive dust. Wildlife that accesses surface water features may also be affected if flow in these features is affected by the project.

Ormat is proposing a binary power plant system in which most of the extracted groundwater would be returned to the geothermal source aquifer via injection wells (**Figure 3-12**). Therefore, the volume of groundwater in the geothermal source aquifer is not expected to be reduced substantially over the life of the operation. During pumping, however, some groundwater flow paths in the deeper aquifers could be modified.

Long-term pumping of geothermal reservoirs and reductions in temperatures prior to reinjection could reduce pressures within the deeper geothermal system. The magnitude of upward vertical hydraulic gradients could be reduced as a result of depressurization of the system.

Changes in well water levels and flows in springs and other surface water features could impact the ability of water users to exercise their rights. However, as indicated previously, effects on shallow groundwater and springs, if any, would likely occur in the northwestern end of the Salt Wells Basin where these features have been detected. Any water rights for surface water or shallow groundwater as the source outside of this limited area would not likely be affected by the proposed geothermal pumping. Water rights for deeper groundwater in the Ormat Project Area may be affected by the proposed project due to groundwater withdrawals and possible changes in hydraulic head in the extraction zone. The State Engineer and NDWR would be responsible for determining if such adverse impacts are likely for permitting, and also would respond if complaints about impacts are issued to the agency.

Although the binary system is not expected to consume large volumes of geothermal water, a supply of water would be required to cool the power plant components. The rate of water consumption for cooling is expected to range from 2,500 to 3,500 gpm from April to October (proposed annual extraction period). Ormat proposes to obtain cooling water from the Newlands Project canal which extends through the Project Area. The source of water in the canal is Lahontan Reservoir, which is recharged by the Truckee and Carson rivers. Ormat would purchase water rights from an existing canal water right holder

for the necessary amount of consumptive project water. Therefore, no adverse impacts on the water supply are expected from the Ormat project.

Wastewater generated at the power plant would be disposed of via an on-site septic system permitted by the State of Nevada. Wastewater may include sanitary water, storm water, and other unidentified sources. Potential impacts on the shallow groundwater system include increased concentrations of nitrate, phosphate, and total dissolved solids. Proper design and operation of the septic system would prevent adverse impacts on groundwater. Potable water for drinking would be provided by a local bottled water company.

Pentane, a low-toxicity flammable solvent, is proposed as the working fluid at the Ormat Binary Power Plant. Approximately 30,000 gallons of pentane would be circulated through the system, and approximately 7,500 gallons would be stored in an on-site tank. A release from the storage tank or distribution system could impact surface water or shallow groundwater quality. However, the tank and distribution system would be located on concrete or lined pads to prevent infiltration of any releases to the environment.

Indirect Impacts

Indirect impacts on water resources associated with construction and operation of the power plant, substation, switching station, transmission lines, pipelines, roads, and well pads would be an overall change in the water budget for the ROI. This is discussed under Direct Impacts, and could include changes in recharge-discharge, evapotranspiration, and groundwater flow systems. Because of the plan to reinject a major portion of the extracted groundwater, the overall change in water budget for the Project Area is expected to be minor. In addition, the proposed annual extraction period for makeup water would only occur from April to October.

Mitigation and Monitoring Measures

Implementation of a Spill Prevention Contingency and Countermeasure Plan would reduce or eliminate effects of petroleum or chemical releases to the environment. Implementation of a SWPPP would prevent erosion and sedimentation due to storm water effects on disturbed areas. Blow-out prevention equipment would be used to protect the environment during all drilling work.

Mitigation of potential impacts on groundwater, springs, and other surface water features can be addressed by development of monitoring plans for these water resources. The plans would provide for the collection and evaluation of data necessary to document baseline conditions and impacts on the resources (i.e., water quantity, quality, and temperature). Monitoring wells can be installed in different aquifers for measuring water levels and quality characteristics, as necessary or required. Frequency of monitoring would be sufficient to document potential seasonal changes in the resources. Contingencies can be

developed (e.g., modification of geothermal pumping rates) to address any potential impacts that may be documented during the monitoring program.

Reserve pits would be monitored during operations to assure that no leakage is occurring to groundwater or surface water resources. The pits would also be properly closed to prevent release of any contaminants to the environment over time.

Residual Impacts
Residual impacts that may remain after implementation of mitigation measures would be a change in the overall water budget of the Project Area during geothermal pumping, and for a period of time after termination of pumping until the hydrologic system once again stabilizes. Groundwater levels or pressures in the pumped aquifer may be reduced within the ROI during and after the life of the project due to consumptive demand for water.

Alternative 1
This Alternative would provide for increased protection of riparian areas and surface water in or near canals by providing Alternative sites for selected wells and pipeline routes. Areas of disturbance would be slightly higher under this scenario. However, the overall degree of impacts on surface water resources would be lower than under the Proposed Action over the lifetime of the Ormat project. Implementation of Alternative 1 would not affect groundwater beyond that predicted under the Proposed Action. Potential impacts and mitigation and monitoring measures for Alternative 1 would be similar to those discussed for the Proposed Action.

No Action Alternative
Under this scenario, no facilities would be constructed. Therefore, impacts on water resources would not occur, and monitoring and mitigation would not be required.

Vulcan Project Area

Proposed Action
Approximately 1,260 acres of temporary disturbance would be developed, and 760 acres of disturbance would be permanent under the Vulcan Proposed Action.

As many as four binary power plants are proposed at five sites. Eight geothermal production and four reinjection wells are planned per binary power plant. At a groundwater temperature of 127°C, each binary power plant would require 18,000 gpm of geothermal water to run efficiently. If higher groundwater temperatures are available, as many as two of the power plants would be flash power plants. Fourteen geothermal production and seven reinjection wells are planned per flash power plant. Each flash power plant would need a geothermal

groundwater flow rate of approximately 22,000 gpm, assuming a water temperature of 182°C.

Up to 20 water supply wells would be required for construction and operation of all proposed power plants. Operation of the power plants would require cooling water sourced from non-thermal groundwater and/or geothermal water. Most makeup water demand is for cooling water, with some additional water needed for dust control, construction activities, and blow-down water.

Estimated consumption rates for water used for cooling purposes are 3,300 ac-ft per year (2,050 gpm) per binary power plant, and 5,500 ac-ft per year (3,400 gpm) per flash power plant. Maximum total water consumption would be 13,300 ac-ft per year (8,200 gpm) for four binary power plants.

Direct Impacts

Direct impacts on water resources associated with construction and operation of the facilities would be similar to those discussed for the Ormat Project Area. These potential effects include spills of petroleum products on the ground used during construction operations; and erosion or sedimentation from construction activities. These potential impacts on surface water and groundwater resources would be temporary, and would coincide with the construction phase of the project.

Drilling activities require fuels and drilling additives. Vulcan proposes to use on-site fuel tanks with secondary containment at well pads. Spills or releases of petroleum or chemical compounds are potential sources of contamination to surface water and shallow groundwater.

Vulcan proposes to dispose of drill cuttings, drilling fluids, storm water runoff, and geothermal water from flow tests into reserve pits that are lined with local clay material. Each pit would be approximately 200 feet long by 60 feet wide. In addition to the liner of local clay material, the low-permeability drilling mud would form a low-permeability layer along the bottom of the pit, both of which would prevent or minimize fluids from infiltrating to the subsurface and possibly to groundwater.

Although the reserve pit design would keep most of the water and other drilling materials in the pit, some of the fluids may percolate through the clay and mud and into the subsurface. Depending on the volume and frequency of fluid discharge to the pits, a large percentage of the fluids would likely evaporate. Quality of fluids that would collect in the reserve pits would vary depending on the amount of each source (i.e., drilling fluids and additives, storm water, and geothermal water). In general, the fluids are expected to be characterized by high total suspended solids and constituents associated with additives, thickeners, and deflocculants, if used. Geothermal water is characterized by elevated sodium, chloride, calcium, potassium, fluoride, and sulfate. The solids

are composed of sediment and small pieces of broken rock, as well as residual mud and clay from the water-based drilling fluid.

Use of reserve pits to contain fluids and drill cuttings would occur on an infrequent and temporary basis (i.e., during the period of well drilling and testing). Once the wells are finished and put into production or other purposes, the reserve pit would no longer be needed, and the pit would be closed by removing any remaining liquids, and removing or burying the cuttings in accordance with applicable regulations.

Figure 3-12 includes a conceptual depiction of the thermal and non-thermal springs and associated groundwater flow systems in the Project Area. As indicated in **Chapter 3**, Affected Environment, hot and warm springs and seeps are indicators of subsurface geothermal activity (**Figure 3-12**). Extraction and reinjection of geothermal water could impact flows and water quality at these features. Extraction of groundwater from production wells could reduce shallow groundwater levels and interconnected flow to springs/seeps in thermal areas; whereas, reinjection may compensate for such effects. In areas of thermal shallow groundwater, temperatures could be lowered if interconnected flow from deeper zones is reduced. Quality of this shallow groundwater, including springs/seeps, could be improved if high concentrations of some constituents are diluted more by non-thermal shallow groundwater.

Elevated temperature, specific conductance, chloride, and silica concentrations for near-surface groundwater samples collected in and near the Vulcan Project Area are indicative of a deep geothermal source (7Q10 2010; Coolbaugh et al. 2006). Elevated silica, sodium, and chloride concentrations detected in samples from springs in the same area indicate that the geothermal reservoir is a source of water in the surface expressions (Huffman and Carpenter 2009b; Coolbaugh et al. 2006). These thermal springs are generally located in the northwestern end of the Salt Wells Basin, which is within the northeastern part of the Vulcan Project Area (**Figure 3-10**). Seasonal variability in water temperature and quality for the samples from shallow groundwater and the springs indicates that precipitation and non-thermal shallow groundwater also contribute to source water in this area.

Flows at non-thermal springs and seeps would likely not be affected by geothermal groundwater development because these springs are recharged by shallow groundwater with short flow paths that is recharged primarily from precipitation, irrigation, and runoff in the watersheds in mountain ranges and valley bottoms (BLM 2005). Except where there is an interconnection with deep groundwater along faults, geothermal extraction and reinjection are not expected to affect water levels in the shallow unconsolidated aquifers because of the depths at which pumping and extraction would occur (i.e., greater than 1,500 feet). The Carson Lake area does not seem to be influenced by shallow

thermal water and, therefore, any surface water in the lake area would likely not be affected.

If lowering of groundwater levels occurs in some areas of the shallow aquifer where there are springs/seeps, it could result in drier soil conditions and reduced vegetative cover (e.g., wetlands), which could result in increased fugitive dust. Wildlife that accesses surface water features may also be affected if flow in these features is affected by the project.

Vulcan is proposing two types of power plants: binary system and flash system. However, the flash system design would only be used if sufficient quantity of high temperature geothermal water is available. Each binary power plant would require 18,000 gpm of geothermal water; whereas, each flash power plant would use approximately 22,000 gpm. Wells drilled for flash power plant use would be deeper than those completed for binary power plants. A greater amount of pumped groundwater would be reinjected for the binary system as compared to the flash system. Groundwater reinjection wells may be drilled to recharge the aquifer at depths other than those from which the water was obtained.

As indicated previously, water consumption rates for cooling are approximately 3,300 ac-ft per year (2,050 gpm) per binary power plant, and 5,500 ac-ft per year (3,400 gpm) per flash power plant. Up to 20 wells would supply cooling water; one potential groundwater source is a zone of cold water documented at 750 feet bgs near exploration well 58-9 which is located in the Vulcan lease area (Sec. 9, T17N, R30E) (**Chapter 2**). Vulcan may also use water purchased from the irrigation district or from private parties to supplement water needs.

As a result of water consumption, the volume of groundwater in the geothermal source aquifer would be reduced over the life of the operation. Greater water consumption would occur with the flash system. In addition, some groundwater flow paths in the deeper aquifers could be modified during pumping.

Long-term pumping of geothermal reservoirs and reductions in temperatures prior to reinjection could reduce pressures within the deeper geothermal system. Magnitude of upward vertical hydraulic gradients could be reduced as a result of depressurization of the system.

Changes in well water levels and flows in springs and other surface water features could affect the ability of water users to exercise their rights. However, as indicated previously, effects on shallow groundwater and springs, if any, would likely occur in the northwestern end of the Salt Wells Basin where these features have been detected. Any water rights for surface water or shallow groundwater as the source outside of this limited area would not likely be affected by the proposed geothermal pumping. Water rights for deeper groundwater in the Vulcan Project Area may be affected by the proposed project due to groundwater withdrawals and possible changes in hydraulic head

in the extraction zone. The State Engineer and NDWR would be responsible for determining if such adverse impacts are likely for permitting, and also would respond if complaints about impacts are issued to the agency.

Wastewater generated at the power plants would likely be disposed of via an on-site septic system permitted by the State of Nevada. Wastewater may include sanitary water, storm water, and other unidentified sources. Potential impacts on the shallow groundwater system include water quality changes such as increased concentrations of nitrate, phosphate, and TDS. Proper design and operation of the septic system would prevent adverse impacts on groundwater.

Indirect Impacts

Indirect impacts on water resources associated with construction and operation of the power plants, substations, switching station, transmission lines, pipelines, roads, and well pads would be an overall change in the water budget for the ROI. This is discussed under Direct Impacts, and could include changes in recharge-discharge, evapotranspiration, and groundwater flow systems. Because of the plan to reinject a major portion of the extracted groundwater, the overall change in water budget for the Project Area is expected to be minor.

Mitigation and Monitoring Measures

Implementation of a Spill Prevention Contingency and Countermeasure Plan would reduce or eliminate effects of petroleum or chemical releases to the environment. Blow-out prevention equipment would be used to protect the environment during all drilling work. Implementation of a SWPPP would prevent erosion and sedimentation due to storm water effects on disturbed areas. Berms would be constructed around all drill pads to prevent runoff from leaving the site.

Mitigation of potential impacts on groundwater, springs, and other surface water features can be addressed by development of monitoring plans for these water resources. The plans would provide for the collection and evaluation of data necessary to document baseline conditions and impacts on the resources (i.e., water quantity, quality, and temperature). Monitoring wells can be installed in different aquifers for measuring water levels and quality characteristics, as necessary or required. Frequency of monitoring would be sufficient to document potential seasonal changes in the resources. Contingencies can be developed (e.g., modification of geothermal pumping rates) to address any potential impacts that may be documented during the monitoring program.

Reserve pits would be monitored during operations to be sure that no leakage is occurring to groundwater or surface water resources. The pits would also be properly closed to prevent release of any contaminants to the environment over time.

Residual Impacts

Residual impacts that may remain after implementation of mitigation measures would be a change in the overall water balance of the Project Area during geothermal pumping, and for a period of time after termination of pumping until the hydrologic system once again stabilizes. Groundwater levels or pressures in the pumped aquifer would be reduced within the ROI during and after the life of the project due to consumptive use of water.

Alternative 1

This Alternative would cause an additional 173 acres of temporary disturbance and 76 acres of permanent disturbance due to construction of a switching station and extension of a power transmission line. If this Alternative is implemented, the types of impacts and mitigation and monitoring measures would be similar to those discussed for the Proposed Action.

No Action Alternative

Under this scenario, no facilities would be constructed. Therefore, impacts on water resources would not occur, and monitoring and mitigation would not be required.

4.8 FLOODPLAINS, WETLANDS AND RIPARIAN ZONES

Summary

Assessment Methodology

As described in **Section 3.8**, a wetland delineation was conducted for the Eightmile Flat portion of the Vulcan Project Area (Huffman and Carpenter 2009), and a wetland assessment was completed for the Ormat Project Area (Great Basin Ecology 2008). In addition, the BLM conducted a field visit to determine the extent of riparian vegetation adjacent to the irrigation canal within the Ormat Project Area. Data from these assessments were used to determine the extent of floodplains, wetlands, and riparian areas present in the Project Areas and potentially impacted by the Proposed Actions or Alternatives.

Indicators

Indicators for effects on floodplains, wetlands, and riparian zones include the following:

- Acres of playas and seasonal wetlands located within the Salt Wells Energy Projects Area that may be disturbed by the Proposed Actions and Alternatives;
- Projected frequency, extent, and duration of flooding as a result of storm water runoff; or
- Alteration of surface water or stormwater flows.

It is assumed that the acres of seasonal wetlands that may be disturbed and the alteration of surface water are likely tied to variations in subsurface water levels.

Region of Influence

The ROI for direct effects includes the SPPC, Ormat, and Vulcan Project Area, and for indirect effects includes the Carson Lake Area and the Salt Wells Basin.

SPPC Project Area

Proposed Action

Direct Impacts

Acres of wetland vegetation that would be affected by the SPPC Project are presented in **Table 4-7**, Comparison of Perennial Wetland Impacts by SPPC Alternative. The SPPC Proposed Action crosses wet meadows west of the L-12 canal. Construction of a transmission line in these areas could cause direct effects on wetland areas including permanent removal of wetland vegetation. Vegetation clearing could decrease the suitability of the wet meadow areas for wildlife, and ground disturbance could increase erosion and sedimentation to nearby canals and other wetland areas, such as the Carson Lake and Pasture. Spills of hazardous construction materials could contaminate the wetland, killing the vegetation and lowering the water quality.

Table 4-7
Comparison of Perennial Wetland Impacts by SPPC Alternative

	Proposed Action	Alternative 1	Alternative 2	Macari Fiber Optic Alternative
Temporary Impacts	37	98	32	0
Permanent Impacts	14	39	13	0

Calculations assume acreages and ROW widths as described for temporary and permanent impacts in Chapter 2.
Sources: SWReGAP 2010, BLM 2010

SPPC would minimize development in and near wet meadows to the extent feasible. Furthermore, a Stream, Wetland, Well, Spring, and Canal Protection Plan, Spill Prevention Control Plan, and Erosion Control Plan would be developed and implemented as part of the POD.

A portion of the proposed SPPC Project Area is within the 100-year floodplain. Neither the Proposed Action nor any of the Alternatives would alter the boundaries of the 100-year floodplain or change elevations that would affect flooding. SPPC would take all possible steps to avoid placing transmission towers within areas prone to flash floods. In areas where placing transmission towers in the floodplain or in flash flood areas is unavoidable, SPPC would

retain a geotechnical engineer to design appropriate protective measures for towers at risk. Examples of such protective measures include reinforcing the tower bases and constructing earthen berms to divert water around the towers.

Indirect Impacts
Vegetation removal in the wet meadow areas could allow for the introduction or spread of invasive, nonnative species, causing impacts as described in **Section 4.10**, Invasive, Nonnative Species.

Mitigation and Monitoring Measures
Implementation of the POD and associated protection plans as well as Environmental Protection Measures for facilities within the floodplain would reduce impacts on wetlands, riparian zones, and floodplains (**Appendix E**). Additional mitigation measures would be necessary to reduce impacts:

A wetland delineation of wet meadows associated with the Newlands canals would be conducted to determine the boundaries, acreage, and types of wetlands that could be affected by the Proposed Action. The project proponent would comply with any mitigation measures determined by the USACE to ensure no net loss of wetlands.

Sediment and erosion control BMPs would be implemented in accordance with state and local guidelines, including filter fencing, coir logs, etc., as needed;

Construction within any wet meadow areas would be conducted when relatively dry conditions exist, in order to minimize soil erosion and potential impacts on vegetation and wildlife;

There would be the ability to deploy standby sediment control BMPs, as needed, to protect all exposed portions of the site within 48 hours of a predicted storm event (a predicted storm event is defined as a National Weather Service forecasted, 50 percent chance of rain);

Slopes along the roadways would be revegetated with native or suitable species as appropriate; and

The SPPC would obtain and comply with provision of a State of Nevada Section 401 Water Quality Certification permit.

Residual Impacts
Residual impacts on wetlands, riparian zones, or floodplains are not expected with implementation of the Proposed Action.

Alternative 1

Direct Impacts
The types of direct impacts on wetlands, riparian zones, and floodplains from Alternative 1 would be similar to those described for the Proposed Action. However, Alternative 1 would cause permanent impacts on over two and a half times more perennial wetland compared to the Proposed Action.

Indirect Impacts
Indirect impacts on wetlands, riparian zones, and floodplains from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures described for the Proposed Action would be needed for Alternative 1 to reduce impacts on wetlands, riparian zones, and floodplains.

Residual Impacts
Residual impacts on wetlands, riparian zones, or floodplains are not expected with implementation of Alternative 1.

Alternative 2

Direct Impacts
The types and size of direct impacts on wetlands, riparian zones, and floodplains from Alternative 2 would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts on wetlands, riparian zones, and floodplains from Alternative 2 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures described for the Proposed Action would be needed for Alternative 2 to reduce impacts on wetlands, riparian zones, and floodplains.

Residual Impacts
Residual impacts on wetlands, riparian zones, or floodplains are not expected with implementation of Alternative 2.

Macari Fiber Optic Alternative

Direct Impacts
Due to its small acreage and lack of wetlands, riparian zones, and floodplains within the footprint, direct impacts on wetlands, riparian zones, and floodplains are not expected as a result of the Macari Fiber Optic Alternative.

Indirect Impacts
Due to its small acreage and distance from wetlands, riparian zones, and floodplains, indirect impacts on wetlands, riparian zones, and floodplains are not expected as a result of the Macari Fiber Optic Alternative.

Mitigation and Monitoring Measures
Mitigation and monitoring measures are not needed to reduce impacts on wetlands, riparian zones, and floodplains for the Macari Fiber Optic Alternative.

Residual Impacts
Residual impacts on wetlands, riparian zones, and floodplains are not expected as a result of the Macari Fiber Optic Alternative.

No Action Alternative
No impacts on wetlands, riparian zones, or floodplains would occur with implementation of the No Action Alternative.

Ormat Project Area

Proposed Action

Direct Impacts
Acres of wetland vegetation that would be affected by the Ormat Project are presented in **Table 4-8**, Comparison of Wetland Impacts by Ormat Alternative. The Ormat Project could affect seasonal wetlands, including wet meadows and playas. Vegetation removal is less of a concern with playa wetlands, as they are sparsely vegetated. However, building in these areas could make them less suitable for wildlife use both temporarily and permanently. Ground disturbance could cause erosion and sedimentation into nearby wetlands. Spills of hazardous construction materials could contaminate the playa and lower the water quality. The pipeline crossing of the canal along Macari Lane would avoid the toe on either side of the canal and would be high enough to allow for continued Reclamation operation and maintenance activities.

Table 4-8
Comparison of Wetland Impacts by Ormat Alternative

Wetland Type	Temporary Impacts (acres)		Permanent Impacts (acres)	
	Proposed Action	Alternative 1	Proposed Action	Alternative 1
Perennial wetland	38	25	18	9
Playa	50	62	31	41

Calculations assume acreages and ROW widths as described for temporary and permanent impacts in Chapter 2.
Source: SWReGAP 2010, BLM 2010

Ormat would minimize development in and near playas to the extent feasible. Furthermore, a Stream, Wetland, Well, Spring, and Canal Protection Plan, Erosion Control Plan, and Spill Prevention Control Plan would be developed and implemented as part of the POU.

A portion of the proposed Ormat Project is within the 100-year floodplain. The project would not alter the boundaries of the 100-year floodplain or change elevations that would affect flooding. Ormat would take all possible steps to avoid placing facilities within areas prone to flash floods. In areas where placing facilities in the floodplain or in flash flood areas is unavoidable, Ormat would retain a geotechnical engineer to design appropriate protective measures for facilities at risk. Examples of such protective measures include reinforcing transmission tower bases and constructing earthen berms to divert water around facilities.

No direct effects on riparian zones are expected from the Ormat Project.

Indirect Impacts
The proposed wells U and V, as well as the associated pipeline, are within perennial wetlands along the L-12 canal. Construction of these wells could cause erosion and subsequent sedimentation of the nearby wetland. Ormat would develop and implement an erosion control plan as part of the POU to reduce impacts.

Mitigation and Monitoring Measures
The mitigation measures described for the SPPC Project would be adapted and implemented for the Ormat Project to reduce impacts on wetlands, riparian zones, and floodplains. In addition, water monitoring plans would be implemented.

Residual Impacts
Residual impacts on wetlands, riparian zones, or floodplains are not expected with implementation of the Proposed Action.

Alternative 1

Direct Impacts
The types of direct impacts on wetlands, riparian zones, and floodplains from Alternative 1 would be similar to those described for the Proposed Action. Under Alternative 1, wells U and V and the associated pipeline are outside of wetland vegetation, causing nine fewer acres of permanent impacts on perennial wetlands compared to the Proposed Action. However, Alternative 1 would cause an additional ten acres of permanent impacts on seasonal playa wetlands.

Indirect Impacts
Although wells U and V and the associated pipeline would be outside of perennial wetlands, Alternative 1 could still have indirect effects on nearby

wetlands. As such, indirect impacts on wetlands from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures described for the Proposed Action would be needed for Alternative 1 to reduce impacts on wetlands, riparian zones, and floodplains.

Residual Impacts
Residual impacts on wetlands, riparian zones, or floodplains are not expected with implementation of Alternative 1.

No Action Alternative
No impacts on wetlands, riparian zones, or floodplains would occur with the No Action Alternative.

Vulcan Project Area

Proposed Action

Direct Impacts
Impacts on playas from the Vulcan Project would be similar to those described under the Ormat Project. A greater acreage of playa would be affected by the Vulcan Project. Acres of wetlands that would be impacted by the Vulcan Project are presented in **Table 4-9**, Comparison of Wetland Impacts by Vulcan Alternative.

Table 4-9
Comparison of Wetland Impacts by Vulcan Alternative

Wetland Type	Temporary Impacts (acres)		Permanent Impacts (acres)	
	Proposed Action	Alternative 1	Proposed Action	Alternative 1
Seasonal wetland	11	11	7	7
Playa	203	221	120	128

Calculations assume acreages and ROW widths as described for temporary and permanent impacts in Chapter 2.
Source: SWReGAP 2010, Huffman and Carpenter 2009

Vulcan would minimize development in and near playas to the extent feasible. Furthermore, a Stream, Wetland, Well, Spring, and Canal Protection Plan, Erosion Control Plan, and Spill Prevention Control Plan would be developed and implemented as part of the POU/POD.

No direct effects are on floodplains or riparian zones are expected from the Vulcan Project.

Indirect Impacts

Operation of the Vulcan Project would use geothermal waters that likely recharge the thermal springs within the Vulcan Project Area. The project could impact flows and water quality in these areas, as described in **Section 4.7**, Water Quality and Quantity. Seasonal and perennial wetlands associated with these springs and water sources could be affected. Without this source of water, seasonal and perennial wetlands could become drier or completely dry, and thus would not be able to support the wetland vegetation established in these areas. Over time, vegetation composition would likely change to correspond with the reduction in water. In addition, a change in water quality could affect the composition of the vegetation community, potentially allowing the continued conversion to nonnative species, such as canary reedgrass and tamarisk.

In addition, fill of playa wetlands for roads and well pads could alter the flow of water across Eightmile Flat. Since the main source of water for this area comes from precipitation, and water generally does not infiltrate well, there is a lot of runoff, particularly through ephemeral drainages. Filling these drainages and the associated playa could alter how water flows across the site over time and change the hydrological characteristics of portions of Eightmile Flat.

Mitigation and Monitoring Measures

Except for the wetland delineation requirement and water monitoring plan, mitigation measures described for the SPPC Project would be adapted and implemented for the Vulcan Project to reduce impacts on wetlands, riparian zones, and floodplains. Since the wetlands within the Vulcan Project Area are considered isolated and not Waters of the US, a wetland delineation and permit from the USACE would not be required for this project.

Residual Impacts

Potential permanent loss of perennial and seasonal wetlands associated with dewatering of springs would be a residual impact of the Vulcan Project.

Alternative 1

Direct Impacts

The types of direct impacts on wetlands, riparian zones, and floodplains from Alternative 1 would be similar to those described for the Proposed Action. Impacts on seasonal wetlands (dominated by salt grass) would be the same as those for the Proposed Action. However, Alternative 1 would cause permanent impacts on 7 percent more playa compared with the Proposed Action.

Indirect Impacts

Indirect impacts on wetlands, riparian zones, and floodplains from Alternative 1 would be similar to those described for the Proposed Action. Indirect impacts on Eightmile Flat could be greater for Alternative 1 due to the larger extent of temporary and permanent impacts on playa wetlands.

Mitigation and Monitoring Measures
Mitigation measures described for the Proposed Action would be needed for Alternative 1 to reduce impacts on wetlands, riparian zones, and floodplains.

Residual Impacts
Residual impacts on wetlands, riparian zones, or floodplains from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative
No impacts on wetlands, riparian zones, or floodplains would occur with the No Action Alternative.

4.9 VEGETATION

Summary

Assessment Methodology
Characterization of the vegetation communities was based on surveys conducted of the Salt Wells Energy Projects Area during May and June 2010 (**Figures 3-18** through **3-20**) and on the SWReGAP data.

Indicators
Indicators for vegetation resources focus on the acreage of vegetative community disturbance and include the following:

- Effect on a plant species, habitat, or plant community recognized for ecological, scientific, recreational, or commercial importance;
- Effect on a species, habitat, or plant community that is specifically recognized as biologically significant in local, state, or federal policies, statues, or regulations; or
- Destruction or extensive alteration of habitats or vegetation communities in such a way that would render them uninhabitable to native species.

Region of Influence
The ROI for direct and indirect effects on vegetation includes the biological survey area for each project. This includes the defined project footprint of each project facility as well as a minimum 300-foot buffer, in some cases expanded to 500 feet if a facility was not well defined.

SPPC Project Area

Proposed Action

Direct Impacts

The SPPC Project would cause the permanent removal of vegetation during construction associated with the Bass Flat and Pony Express Switching Stations, structures associated with the 22 miles of transmission lines and electric line folds, and the Greenwave Substation (**Table 4-10**, Comparison of Temporary Disturbance to Vegetation by SPPC Alternative, and **Table 4-11**, Comparison of Permanent Disturbance to Vegetation by SPPC Alternative). Temporary removal of vegetation would occur during construction associated with temporary access roads, stringing sites, and staging areas. To reduce the likelihood of permanent impacts, vegetation would be cut at ground level to leave the root systems of existing vegetation intact; this would improve soil stabilization and regrowth. Areas with temporary impacts would be recontoured, decompacted, and seeded, if necessary, using a BLM-approved seed mix. Furthermore, the project proponent would create a Reclamation and Habitat Restoration plan to ensure revegetation of temporarily impacted areas. A worker environmental awareness program would be implemented to educate on-site workers on how to protect vegetation.

Table 4-10
Comparison of Temporary Disturbance to Vegetation by SPPC Alternative[1]

Vegetation Community[2]	Proposed Action (acres)	Alternative 1 (acres)[3]	Alternative 2 (acres)	Macari Fiber Optic Alternative (acres)
Greasewood flat	160	174 (+9%)	159 (-1%)	1
Mixed salt desert scrub	213	223 (+5%)	213 (0%)	0
Playa	6	6 (0%)	6 (0%)	0
Emergent marsh and wet meadow	37	98 (+165%)	32 (-14%)	0
Agriculture and developed	388	322 (-17%)	393 (+1%)	0
Invasive	1	4 (+400%)	1 (0%)	0

[1] Total acreages may not match those stated in Chapter 2 due to inaccuracies within the SWReGAP data.
[2] Note that riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.
[3] Percentages indicate the percent change compared to the Proposed Action.
Calculations assume acreages and ROW widths as described for temporary and permanent impacts in Chapter 2.
Source: SWReGAP 2010, BLM 2010

Table 4-11
Comparison of Permanent Disturbance to Vegetation by SPPC Alternative[1]

Vegetation Community[2]	Proposed Action (acres)	Alternative 1 (acres)[3]	Alternative 2 (acres)	Macari Fiber Optic Alternative (acres)
Greasewood flat	63	80 (+27%)	74 (+17%)	1
Mixed salt desert scrub	95	100 (+5%)	95 (0%)	0
Playa	2	2 (0%)	2 (0%)	0
Emergent marsh and wet meadow	14	39 (+179%)	13 (-7%)	0
Agriculture and developed	165	134 (-19%)	165 (0%)	0
Invasive	0	2 (+200%)	0 (0%)	0

[1] Total acreages may not match those stated in Chapter 2 due to inaccuracies within the SWReGAP data.
[2] Note that riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.
[3] Percentages indicate the percent change compared to the Proposed Action.
Calculations assume acreages and ROW widths as described for temporary and permanent impacts in Chapter 2.
Source: SWReGAP 2010, BLM 2010

No direct effects on vegetation are anticipated from operation and maintenance of the SPPC Project.

Indirect Impacts

Soil disturbance, such as from grading and plant removal, could facilitate the introduction or spread of invasive, nonnative species, including noxious weeds. Invasive, nonnative species could out-compete native species for resources such as water, nutrients, light, and space. This could result in a change in the vegetation structure and ecological function of a vegetation community. Invasive, nonnative species can also increase fire frequency, which would eliminate fire-intolerant vegetation and allow for the continued spread of invasive, nonnative species. These types of impacts would be permanent. Indirect effects from operation and maintenance of the SPPC Project would be less than those from construction. Even so, workers and vehicles accessing the site could introduce or spread invasive, nonnative species into the area over time. Impacts from invasive, nonnative species are described in greater detail in **Section 4.10**, Invasive, Nonnative Species.

Soil disturbance could also cause the loss of soil nutrients and topsoil through erosion. This could make on-site revegetation with native species unsuccessful and increase the likelihood that invasive nonnative species could invade and

spread. Furthermore, soil compaction caused by vehicles and workers on site could reduce water infiltration and make revegetation efforts unsuccessful. Effects would be permanent and would be exacerbated by the disturbances to biological soil crusts, which are widespread in the SPPC Project Area along the east side of the Bunejug Mountains. Biological soil crusts are known to have many important ecological functions, such as stabilizing soils, increasing water filtration, increasing soil carbon and nitrogen fixation, improving germination of native species, limiting germination of invasive, nonnative species, and increasing plant survival and nutrient content (US DOI 2001). While biological soil crusts can recover to some extent several years after disturbance, the full recovery rate is unknown but could take several hundred years (US DOI 2001). As a result, disturbance to biological soil crusts could have wide-ranging effects on vegetation communities over time.

Dust during construction could cover existing vegetation, which could affect plant photosynthesis and respiration. Impairment of these functions could lower plant vigor, growth rate, and increase a plant's susceptibility to disease, causing permanent effects.

An invasive, nonnative species management plan and dust control plan would be developed as part of the POD and would help minimize indirect impacts on vegetation. Furthermore, since dust storms are common in the area, the temporary impacts from project construction may not be greater than the existing conditions. Areas with temporary impacts would be decompacted to improve water infiltration and revegetation efforts. Applicable BMPs (**Appendix E**) include measures to set aside topsoil, reduce soil compaction, prevent the spread or introduction of invasive, nonnative species, and minimize impacts on sensitive vegetation, such as perennial or seasonal wetlands. In addition, the worker environmental awareness program would educate on-site workers regarding how to prevent the introduction and spread of invasive, nonnative species.

Mitigation and Monitoring Measures

Given the difficulty of revegetation in the desert, regular vegetation monitoring and adaptive management measures would be included as part of the revegetation plan. In addition, while the boundary of wetland vegetation associated with Newlands canals was determined, a formal wetland delineation has not been conducted. As such, a wetland delineation of wet meadows associated with the Newlands canals would be conducted to determine the boundaries, acreage, and types of wetlands that could be affected by the proposed project. The SPPC Project would comply with any mitigation measures determined by the USACE to ensure no net loss of wetlands.

No additional mitigation would be necessary, since revegetation, invasive, nonnative species management, and dust control plans would be implemented as part of the POD.

Impact Summary

Vegetation communities affected by the project are locally and regionally common. Most impacts would occur on agricultural lands, which contain low species diversity and few native plants. However, the Proposed Action would remove wet meadow vegetation, which is less common and regionally important; implementation of the mitigation measure would reduce this impact. Temporary removal of other native vegetation communities such as greasewood flat and mixed salt desert scrub would not make them permanently uninhabitable to native species since impacted areas would be revegetated after construction is complete. Agricultural and developed communities would readily be restored and would likely be in production within one year of construction.

Residual Impacts

After revegetation and with implementation of plans in the POD, residual impacts on vegetation would be temporary until the affected vegetation communities become reestablished. If revegetation efforts were unsuccessful, this would be a permanent residual impact.

Alternative 1

Direct Impacts

Direct impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause an additional 25 acres of temporary and 10 acres of permanent disturbance to vegetation compared to the Proposed Action (Tables 4-10 and 4-11).

Indirect Impacts

Indirect impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures

Mitigation measures under Alternative 1 would the same as under the Proposed Action.

Residual Impacts

Residual impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action.

Alternative 2

Direct Impacts

Direct impacts on vegetation from Alternative 2 would be the same as those described for the Proposed Action. (Tables 4-10 and 4-11).

Indirect Impacts

Indirect impacts on vegetation from Alternative 2 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures under Alternative 2 would the same as under the Proposed Action.

Residual Impacts
Residual impacts on vegetation from Alternative 2 would be similar to those described for the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
The types of direct impacts on vegetation from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited area of temporary (7 acres) and permanent (5 acres) disturbance, direct impacts would be minimal.

Indirect Impacts
The types of indirect impacts on vegetation from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited area of temporary and permanent acreage that would be disturbed, indirect impacts would be minimal.

Mitigation and Monitoring Measures
No mitigation measures would be needed for vegetation under the Macari Fiber Optic Alternative.

Residual Impacts
Residual impacts on vegetation from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts on vegetation would not occur.

Ormat Project Area

Proposed Action

Direct Impacts
The Proposed Action for the Ormat Project would cause the permanent removal of vegetation during construction associated with the Macari Switching Station, structures associated with the 200-foot transmission line and 6.5 mile pipeline, 13 possible well pads, and access roads (**Table 4-12**, Comparison of Vegetation Disturbance by Ormat Alternative). The Carson Lake Binary Power Plant and Substation would be located on disturbed land, dominated by invasive species. Operation of the pipeline would cause permanent disturbance to vegetation due to the footings, which would require vegetation removal, the pipeline's low stature, which would hinder vegetation regrowth, and the need

for constant maintenance, which would continually disrupt vegetation over the life of the project. Temporary removal of vegetation would occur during construction associated with temporary access roads and staging areas. Most temporary and permanent impacts would occur in the greasewood flat community, with fewer impacts in the mixed salt desert scrub and playa communities. Two proposed wells and an associated portion of the pipeline would be located within wet meadow habitat. Measures for reducing direct impacts on vegetation would be the same as those described previously for the SPPC Project.

Table 4-12
Comparison of Vegetation Disturbance by Ormat Alternative[1]

Vegetation Community[2]	Temporary Impacts (acres)		Permanent Impacts (acres)	
	Proposed Action	Alternative 1 (acres)[3]	Proposed Action	Alternative 1 (acres)[2]
Greasewood flat	234	212 (-9%)	162	139 (-14%)
Mixed salt desert scrub	19	15 (-21%)	13	11 (-15%)
Playa	50	62 (+24%)	31	41 (+32%)
Invasive	5	5 (0%)	0	0 (0%)

[1] Total acreages may not match those stated in Chapter 2 due to inaccuracies within the SWReGAP data.
[2] Note that riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.
[3] Percentages indicate the percent change compared to the Proposed Action.
Calculations assume acreages and ROW widths as described for temporary and permanent impacts in Chapter 2.
Source: SWReGAP 2010, BLM 2010

There would be no direct effects on vegetation from operation and maintenance of the Ormat Project.

Indirect Impacts
Indirect impacts on vegetation from the Ormat Project would be similar to those described previously for the SPPC Project.

Mitigation and Monitoring Measures
To address the difficulty of revegetation in the desert, regular vegetation monitoring and adaptive management measures would be included as part of the revegetation plan. Mitigation for impacts on vegetation would be the same as those described previously for the SPPC Project.

Impact Summary
In general, vegetation communities affected by the Ormat Project are locally and regionally common. However, the Proposed Action would remove wet meadow vegetation, which is less common and regionally important. Implementation of the mitigation measure would reduce impacts on wet meadow vegetation. Direct removal of native vegetation would not likely alter vegetation communities in the area to make them uninhabitable to native species, since impacted areas would be revegetated after construction is complete.

Residual Impacts
Residual impacts on vegetation would be the same as those described previously for the SPPC Project.

Alternative 1

Direct Impacts
Direct impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause three fewer acres of temporary and two fewer acres of permanent disturbance to vegetation compared to the Proposed Action, particularly to the wet meadow vegetation associated with the Newlands canal (L-12 canal) (**Table 4-12**).

Indirect Impacts
Indirect impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for vegetation under Alternative 1 would be the same as those recommended for the Proposed Action.

Residual Impacts
Residual impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts on vegetation would not occur.

Vulcan Project Area

Proposed Action

Direct Impacts
The Proposed Action for the Vulcan Project would cause the permanent removal of vegetation during construction associated with the four possible power plants, substations, structures associated with the 8 mile transmission line and 19 mile pipeline, 26 possible well pads, and access roads (**Table 4-13**, Comparison of Vegetation Disturbance by Vulcan Alternative). Impacts from the

pipeline would be similar to those described for the Ormat Project, but the Vulcan pipeline would be longer, causing greater impacts. Temporary removal of vegetation would occur during construction associated with temporary access roads and staging areas. Most temporary and permanent impacts would occur in the mixed salt desert scrub community, with fewer impacts in the greasewood flat and playa communities. Measures for reducing direct impacts would be the same as those described previously for the SPPC Project.

Table 4-13
Comparison of Vegetation Disturbance by Vulcan Alternative[1]

Vegetation Community[2]	Temporary Impacts (acres)		Permanent Impacts (acres)	
	Proposed Action	Alternative 1 (acres)[3]	Proposed Action	Alternative 1 (acres)[2]
Greasewood flat	412	448 (+9%)	252	267 (+6%)
Mixed salt desert scrub	757	885 (+17%)	432	488 (+13%)
Playa	203	221 (+9%)	120	128 (+7%)
Seasonal wetland	11	11 (0%)	7	7 (0%)

[1] Total acreages may not match those stated in Chapter 2 due to inaccuracies within the SWReGAP data.
[2] Note that riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.
[3] Percentages indicate the percent change compared to the Proposed Action.
Calculations assume acreages and ROW widths as described for temporary and permanent impacts in Chapter 2.
Source: SWReGAP 2010, Huffman and Carpenter 2009

Operation of the Vulcan Project would use geothermal waters that likely recharge the thermal springs within the Vulcan Project Area. The project could impact flows and water quality in these areas, as described in **Section 4.7**, Water Quality and Quantity. Seasonal and perennial wetlands associated with these springs and water sources could be affected. Without this source of water, seasonal and perennial wetlands could become drier or completely dry, and thus would not be able to support the wetland vegetation established in these areas. Over time, vegetation composition would likely change to correspond with the reduction in water. In addition, a change in water quality could affect the composition of the vegetation community, potentially allowing the continued conversion to nonnative species, such as canary reedgrass and tamarisk.

Indirect Impacts

Indirect impacts on vegetation from the Vulcan Project would be similar to those described previously for the SPPC Project.

Mitigation and Monitoring Measures

To address the difficulty of revegetation in the desert, regular vegetation monitoring and adaptive management measures would be included as part of the revegetation plan. No additional mitigation would be necessary, since revegetation, invasive, nonnative species management, and dust control plans would be implemented as part of the POU. Since the wetlands within the Vulcan Project Area are isolated and are not Waters of the US, a wetland delineation and permit from the USACE are not required.

Impact Summary

Vegetation communities affected by the Vulcan Project are locally and regionally common. Direct removal of native vegetation would not likely alter vegetation communities in the area to make them uninhabitable to native species, since impacted areas would be revegetated once construction is complete.

Residual Impacts

Residual impacts on vegetation within the Vulcan Project would be the same as those described previously for the SPPC Project.

Alternative 1

Direct Impacts

Direct impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause an additional 173 acres of temporary and 76 acres of permanent disturbance to vegetation compared to the Proposed Action. This additional disturbance would be associated with the construction of the Bass Flat switching station and the 4-mile transmission line extension to this switching station (Table 4-13).

Indirect Impacts

Indirect impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures

Mitigation and monitoring measures for vegetation under Alternative 1 would be the same as those described under the Proposed Action.

Residual Impacts

Residual impacts on vegetation from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative

Under the No Action Alternative, impacts on vegetation would not occur.

4.10 INVASIVE, NONNATIVE SPECIES

Summary

Assessment Methodology

Identification of invasive, nonnative species, including noxious weeds, was based on surveys conducted of the Salt Wells Energy Projects Area during May and June 2010 (Figures 3-18 through 3-20). Noxious weeds were identified according to the Nevada Department of Agriculture noxious weed list. Impacts were analyzed according to the baseline of existing invasive, nonnative species present within the Projects Area.

Indicators

Indicators for invasive, nonnative species focus on the acreage of disturbed areas and the proximity of existing invasive, nonnative species to the disturbance areas. Indicators to assess potential impacts include the following:

- Invasive, nonnative species and/or noxious weed populations are established or increased; or
- Habitats or vegetation communities are destroyed or altered in such a way that would render them uninhabitable to native species.

Region of Influence

The ROI for direct and indirect effects on invasive, nonnative species includes the three project areas.

SPPC Project Area

Proposed Action

Direct Impacts

As described previously in **Section 4.9**, Vegetation, soil disturbance and plant removal during construction activities could lead to the introduction and spread of invasive, nonnative species, including noxious weeds. All ground-disturbing activities could facilitate the invasion and spread of invasive, nonnative species. Furthermore, humans and vehicles can inadvertently carry invasive, nonnative seeds on their clothing, shoes, tires, and on the undercarriage of vehicles. Impact acreage for each project is presented in **Table 4-14**, Temporary and Permanent Impact Acreages for Each Project.

Invasive, nonnative species could out-compete native vegetation for resources such as light, water, nutrients, and space, and change the fire regime. They generally lower biological diversity and provide lower quality habitat for wildlife. Invasive, nonnative species are of concern within the SPPC Project Area since the transmission line is linear and extends for 22 miles; as a result, invasive,

Table 4-14
Temporary and Permanent Impact Acreages for Each Proposed Project

Project Name	Temporary Impacts (acres)	Permanent Impacts (acres)
SPPC Energy Project	813	352
Ormat Energy Project	321	197
Vulcan Energy Project	1,254	750

Calculations assume acreages and ROW widths as described for temporary and permanent impacts in Chapter 2.
Source: EMPSi 2010

nonnative species could spread over this entire area. Tamarisk grows near canals, ditches, and perennial wetlands in the SPPC Project Area and is highly tolerant of high salinity soils, low water tables, wildfires, livestock browsing, and conventional weed controls. It has few natural insect or plant pathogens in the Project Area. While it can provide habitat for wildlife, even BLM-designated sensitive species (e.g., Swainson's hawk), it is considered to be lower quality habitat and a type of undesirable vegetation. Along with Russian knapweed and perennial pepperweed, it is a Nevada noxious weed that occurs in the SPPC Project Area. Given the current establishment of these plants in the area and the extent of the transmission line, disturbance during construction could facilitate their spread. Other invasive, nonnative species, such as cheatgrass or halogeton, could also spread.

Introduction and spread of invasive, nonnative species would be less likely during operation and maintenance of the SPPC Project, but with increased vehicle and human use of the area, invasive, nonnative species would still be a concern.

As part of the POD, an invasive, nonnative species management plan would be implemented to reduce the likelihood for invasion and spread of invasive, nonnative species. The invasive, nonnative species management plan would include prevention measures such as cleaning vehicles at designated wash stations before they are used in the Project Area. In addition, materials free of invasive, nonnative species would be used during construction. Furthermore, a revegetation plan would be implemented to help re-establish native species and eliminate the opportunity for the introduction or spread of invasive, nonnative species. Vegetation removal would be restricted to the minimum amount necessary so as to lessen impacts, and a worker environmental awareness program would be implemented to focus on invasive, nonnative species introduction and spread.

Indirect Impacts
No indirect impacts on invasive, nonnative species are expected from construction, operation, and maintenance of the SPPC Project.

Mitigation and Monitoring Measures
No additional mitigation measures are necessary with implementation of the invasive, nonnative species management plan and revegetation plan.

Impact Summary
With implementation of the revegetation and invasive, nonnative species management plans, construction, operation, and maintenance of the SPPC Project would be unlikely to establish or increase invasive, nonnative species, and would not destroy or alter habitats to render them uninhabitable to native species.

Residual Impacts
No residual impacts are expected from construction, operation, and maintenance of the SPPC Project.

Alternative 1

Direct Impacts
Direct impacts on invasive, nonnative species from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause an additional 25 acres of temporary and 10 acres of permanent disturbance compared to the Proposed Action causing a slightly greater likelihood for introduction or spread of invasive, nonnative species.

Indirect Impacts
Indirect impacts on invasive, nonnative species from Alternative 1 are not expected to occur.

Mitigation and Monitoring Measures
No additional mitigation measures are necessary under Alternative 1 with implementation of the invasive, nonnative species management plan and revegetation plan.

Residual Impacts
No residual impacts are expected from construction, operation, and maintenance of Alternative 1.

Alternative 2

Direct Impacts
Direct impacts on invasive, nonnative species from Alternative 2 would be to the same as those described for the Proposed Action..

Indirect Impacts
Indirect impacts on invasive, nonnative species from Alternative 2 are not expected to occur.

Mitigation and Monitoring Measures
No additional mitigation measures are necessary under Alternative 2 with implementation of the invasive, nonnative species management plan and revegetation plan.

Residual Impacts
No residual impacts are expected from construction, operation, and maintenance of Alternative 2.

Macari Fiber Optic Alternative

Direct Impacts
The types of direct impacts on invasive, nonnative species from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited temporary (7 acres) and permanent (5 acres) disturbance, direct impacts would be minimal.

Indirect Impacts
The types of indirect impacts on invasive, nonnative species from the Macari Fiber Optic Alternative are not expected to occur.

Mitigation and Monitoring Measures
No additional mitigation measures are necessary under the Macari Fiber Optic Alternative with implementation of the invasive, nonnative species management plan and revegetation plan.

Residual Impacts
No residual impacts are expected from construction, operation, and maintenance of the Macari Fiber Optic Alternative.

No Action Alternative
Under the No Action Alternative, impacts on invasive, nonnative species would not occur.

Ormat Project Area

Proposed Action

Direct Impacts
Direct impacts on invasive, nonnative species from the Ormat Project would be similar to those described previously for the SPPC Project. Vegetation disturbance along the pipeline, as described in **Section 4.9**, Vegetation, would increase the likelihood for the introduction and spread of invasive, nonnative

species in this area. The Ormat Project Area is more discrete, so invasive, nonnative species would be less likely to spread over a large area. However, the Ormat Project Area has many known invasive, nonnative species, so further spread of these species or introduction of new invasive, nonnative species is a concern. As described for the SPPC Project, an invasive, nonnative species management plan would reduce the likelihood for the introduction and spread of invasive, nonnative species, and a revegetation plan would help to re-establish native species.

Indirect Impacts
No indirect impacts on invasive, nonnative species are expected from construction, operation, and maintenance of the Ormat Project.

Mitigation and Monitoring Measures
No additional mitigation measures are necessary with implementation of the invasive, nonnative species management plan and revegetation plan.

Impact Summary
With implementation of the revegetation and invasive, nonnative species management plans, construction, operation, and maintenance of the Ormat Project would be unlikely to establish or increase invasive, nonnative species, and would not destroy or alter habitats to render them uninhabitable to native species.

Residual Impacts
No residual impacts on invasive, nonnative species are expected from construction, operation, and maintenance of the Ormat Project.

Alternative 1

Direct Impacts
Direct impacts on invasive, nonnative species from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause three fewer acres of temporary and two fewer acres of permanent disturbance to vegetation, causing a slightly lower likelihood for the introduction or spread of invasive, nonnative species.

Indirect Impacts
Indirect impacts on invasive, nonnative species from Alternative 1 are not expected to occur.

Mitigation and Monitoring Measures
No additional mitigation measures are necessary under Alternative 1 with implementation of the invasive, nonnative species management plan and revegetation plan.

Residual Impacts
Residual impacts on invasive, nonnative species from Alternative 1 are not expected to occur.

No Action Alternative
Under the No Action Alternative, impacts on invasive, nonnative species would not occur.

Vulcan Project Area

Proposed Action

Direct Impacts
Direct impacts on invasive, nonnative species from the Vulcan Project would be similar to those described previously for the Ormat Project. Some of the Vulcan Project Area is within undisturbed vegetation communities, including those with biotic crusts, and the Vulcan Project would impact more acres of land, increasing the risk for the introduction of invasive, nonnative species. As described for the SPPC Project, an invasive, nonnative species management plan would reduce the likelihood for the introduction and spread of invasive, nonnative species, and a revegetation plan would help to re-establish native species.

Indirect Impacts
No indirect impacts on invasive, nonnative species are expected from construction, operation, and maintenance of the Vulcan Project.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as those described for the SPPC Project.

Impact Summary
With implementation of the revegetation and invasive, nonnative species management plans, construction, operation, and maintenance of the Vulcan Project would be unlikely to establish or increase invasive, nonnative species, and would not destroy or alter habitats to render them uninhabitable to native species.

Residual Impacts
No residual impacts on invasive, nonnative species are expected from construction, operation, and maintenance of the Vulcan Project.

Alternative 1

Direct Impacts
Direct impacts on invasive, nonnative species from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause

an additional 173 acres of temporary and 76 acres of permanent disturbance associated with the construction of the Bass Flat Switching Station and the associated 4-mile transmission line extension to this switching station. This would increase the likelihood of invasive, nonnative species introduction and spread.

Indirect Impacts
Indirect impacts on invasive, nonnative species from Alternative 1 are not expected to occur.

Mitigation and Monitoring Measures
No additional mitigation measures are necessary under Alternative 1 with implementation of the invasive, nonnative species management plan and revegetation plan.

Residual Impacts
Residual impacts on invasive, nonnative species from Alternative 1 are not expected to occur.

No Action Alternative
Under the No Action Alternative, impacts on invasive, nonnative species would not occur.

4.11 WILDLIFE

Summary

Assessment Methodology
Assessment of wildlife and potential habitat was based on surveys conducted of the Salt Wells Energy Projects Area between May and July 2010 (Figures 3-18 through 3-20) and on the SWReGAP data, NNHP data, and NDOW comment letters and communication.

The construction and operation of the Salt Wells Energy Projects may impact wildlife and their habitat through direct and indirect disturbance and habitat fragmentation. This may affect migratory patterns of game species, habitat use by wildlife populations, and cause permanent degradation of habitat values. Other direct impacts could result from project components, such as power lines that may change patterns of avian movement to and from Carson Lake and Pasture, increase risk of collision with power lines and increase predation by providing more perching opportunities.

Indicators
The following indicators were developed to evaluate potential impacts on wildlife:

- Effect on a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self-sustaining levels, or causing a substantial loss or disturbance to habitat;
- Interference with the movement of any resident wildlife species, with resident or migratory wildlife corridors, or with the use of native wildlife nursery sites; or
- Conflict with the habitat management strategies of the BLM.

Region of Influence

The ROI for direct and indirect effects on wildlife includes the biological survey area for each project. This includes the defined project footprint of each project facility as well as a minimum 300-foot buffer, in some cases expanded to 500 feet if a facility was not well defined.

SPPC Project Area

Proposed Action

Overall, the SPPC Project could cause death or injury to wildlife; disturb species due to lighting, noise, and human presence; degrade, fragment, or convert wildlife habitats; or provide habitat for predators.

Direct Impacts

Construction activities, heavy equipment, and vehicle use on site during construction could directly kill or injure a variety of wildlife species, especially slower-moving species, small animals, species that have subsurface burrows, or ground or shrub-nesting birds. Impacts on birds are described in **Section 4.12**, Migratory Birds.

Mortality or injury from collision with vehicles could occur during operation and maintenance, but this is less likely than during construction, as fewer vehicles would be accessing the site during operation and maintenance. In addition, operation and maintenance activities would occur in areas previously disturbed during construction, making them less likely to serve as wildlife habitat. A wildlife protection plan would be prepared as part of the POD to reduce direct and indirect impacts on wildlife where feasible during construction and operation of the project.

Construction activities could cause temporary noise disturbance or visual impacts associated with construction noise, human presence, vehicles on site, and night lighting. The effects would occur within and adjacent to the SPPC Project Area. Construction disturbance of wildlife varies by species and by whether wildlife is habituated to particular noises, movements, or other anthropogenic disturbance. For instance, wildlife utilizing the transmission line near the agricultural areas would be more likely habituated to human activities than the transmission line on the northeast side of the Bunejug Mountains (Figure 2-1). Nesting birds, bats, and reptiles are particularly sensitive to human

presence and noise. Visual and noise disturbances could cause wildlife to alter their foraging, migration, wintering, and breeding behaviors and avoid suitable habitat within or near the Project Area. In the most extreme case, disturbances could cause animals to abandon their nests, roosts, or territories. Displacement of individuals could increase competition for resources in adjacent habitats, which may or may not be able to support more wildlife. Any change in wildlife behavior associated with visual or noise disturbance could have an energetic cost, making animals more susceptible to disease, predation, or unsuccessful reproductive or foraging efforts.

Construction noise has been documented to cause physiological effects such as increased heart rate, altered metabolism, and a change in hormone balance (Radle 2007). Determining the effect of noise has been complicated because different species and individuals have varying responses (Radle 2007), but it is assumed that at least some species would be impacted. Since construction would occur in small areas over time, not over the entire transmission line at the same time, impacts would be temporary and localized. Animals displaced during construction would be able to return to the area once construction is complete.

Habitat quality could decline through loss, fragmentation, and degradation (e.g., introduction or spread of invasive, nonnative species) caused by project construction. Wildlife would be permanently displaced from the Project Area, preventing them from using the site for foraging, breeding, wintering, and shelter. Acres of temporary and permanent habitat loss are presented in Tables 4-10 and 4-11. Habitat fragmentation is the disruption of large, continuous blocks of habitat into less continuous habitat, for example, by clearing land and converting vegetation from one type to another. These effects generally have less of an impact on wide-ranging species, such as pronghorn antelope, than on species with a small geographic home range, such as ground squirrels. Continuous tracts of fragmented habitat could lead to separating wildlife into smaller populations, potentially making them more vulnerable to predation, drought, or disease, and potentially limiting genetic diversity. While most suitable habitat is a mosaic of vegetation communities and habitat features, fragmentation would create more edge habitat, which increases predation and the likelihood of invasive, nonnative species invasion, thus lowering the habitat value of the Project Area.

An invasive, nonnative plant species management plan would be implemented to reduce the likelihood for introduction and spread of invasive, nonnative plant species. A majority of the habitats within the SPPC Project Area are already fragmented and disturbed, as most of the acreage that would be impacted is agricultural lands. Even so, wildlife use these agricultural areas as well as the native habitats within the Project Area. Most habitat disturbance would be small compared to the amount of suitable, similar, surrounding habitat.

Lighting and/or noise from operation of the project, particularly the substation and switching stations, could cause wildlife to avoid the Project Area and surrounding areas permanently. If species were to avoid adjacent habitats, actual permanent habitat loss would be greater than the direct loss of habitat caused by the project footprint. Lights would be shielded downward to reduce impacts on the surrounding lands.

Available information is inadequate to predict the extent of impacts on any one species inhabiting areas near the transmission corridor. It is likely that impacts could extend beyond the project footprint due to the extent of the project components (22-mile transmission line and switching stations). However, approximately 50 percent of the proposed facilities would be in agriculturally disturbed areas, with the remaining portion in relatively undisturbed mixed salt desert scrub and greasewood flat vegetation communities.

Indirect Impacts

The proposed transmission line could provide perching and nesting habitat for corvids or raptors. Over time, this could increase predation on small mammals, reptiles, or other bird species, particularly shorebirds and waterfowl using the nearby Carson Lake and Pasture area. This potential mortality would not be expected to cause any one species to drop below self-sustaining numbers. Impacts on birds are described in **Section 4.12**, Migratory Birds.

Mitigation and Monitoring Measures

Impacts on wildlife would be reduced through implementation of BMPs. Mitigation measures for birds are described in **Section 4.12**, Migratory Birds. Mitigation measures to reduce wildlife impacts, where feasible, would be detailed in the POD, which would include development of a wildlife protection plan, invasive, nonnative plant species management plan, and revegetation plan.

Impact Summary

Available information is inadequate to predict the extent of impacts on any one species inhabiting areas near the transmission corridor. Nevertheless, it is unlikely that impacts from the construction, operation, and maintenance of the SPPC Project would cause substantial habitat loss, substantial restriction of wildlife movement, or a substantial increase in predation leading to the reduction in abundance of any one species such that the population would drop below self-sustaining numbers. This is because approximately 50 percent of the project facilities would be located in agriculturally disturbed areas and relatively few acres of native habitat would be lost. Furthermore, mitigation measures would be detailed in the wildlife, invasive, nonnative plant species, and revegetation plans that would be detailed in the POD. The POD would be finalized before issuing the condition of approval to proceed with the final project.

Residual Impacts
Residual impacts on wildlife could include potential permanent avoidance of the Project Area by individuals due to increased development, human presence, and background noise. Furthermore, there could be a permanent increase in predation on small mammals, reptiles, or birds, caused by the addition of potential perching and nesting habitat for corvids and raptors. However, with implementation of mitigation measures contained in plans within the POD, no residual impacts leading to substantial population declines for any one species are expected.

Alternative 1

Direct Impacts
Direct impacts on wildlife from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause an additional 25 acres of temporary and 11 acres of permanent disturbance to wildlife habitat.

Indirect Impacts
Indirect impacts on wildlife from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for wildlife under Alternative 1 would be the same as those recommended for the Proposed Action.

Residual Impacts
Residual impacts on wildlife from Alternative 1 would be similar to those described for the Proposed Action.

Alternative 2

Direct Impacts
Direct impacts on wildlife from Alternative 2 would be to the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts on wildlife from Alternative 2 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures for wildlife under Alternative 2 would be similar to those described for the Proposed Action.

Residual Impacts
Residual impacts on wildlife from Alternative 2 would be similar to those described for the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
Direct impacts on wildlife from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited area of temporary (7 acres) and permanent (5 acres) disturbance, direct impacts would be minimal compared with the other Alternatives.

Indirect Impacts
Indirect impacts on wildlife from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited temporary and permanent disturbance acreage, indirect impacts would be minimal compared with the other Alternatives.

Mitigation and Monitoring Measures
Mitigation and monitoring measures for wildlife under the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

Residual Impacts
Residual impacts on wildlife from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts on wildlife would not occur.

Ormat Project Area

Proposed Action

Direct Impacts
Direct impacts on wildlife from the Ormat Project would be similar to those described previously for the SPPC Project. Impacts within the Ormat Project Area would be more concentrated; despite covering a smaller acreage, these impacts would occur closer together geographically. Acres of temporary and permanent habitat loss are presented in Table 4-12. Pipelines could alter movement for some wildlife species, although most species would likely be able to fly over or pass under them, as the top of the pipelines would be approximately three feet above ground, with a diameter of 12 to 28 inches and leaving 8 to 24 inches of clearance underneath. The pipelines would hiss, which could disrupt some species over its 6.5 mile length. Lighting and noise from project operation could displace individuals inhabiting the areas around the wells (13 possible well pads), power plant, substation, and switching station.

Low-level noise from power plant operation could have permanent effects on wildlife, causing them to avoid the area, or potentially putting chronic stress on animals, affecting their energy budget, reproduction, and long-term survival (Radle 2007). Acoustical cues play a dominant role in sexual communication,

territory defense, habitat quality assessment, and predator-prey interactions (Barber et al. 2009a), and may be impacted by low-level noise. Studies have documented substantial changes in foraging and anti-predator behavior, reproductive success, density, and community structure in response to noise (Barber et al. 2009b). However, given the existing noise levels in the area, such as those contributed by roadways, agricultural activities, and NAS Fallon, it is likely that most species in the area are habituated to some amount of chronic noise disturbance.

Indirect Impacts

Indirect impacts from construction, operation and maintenance of the Ormat Project would be similar to those described previously for the SPPC Project. Increased raptor and corvid predation would be less of a concern, since the transmission line for the Ormat Project would be only 200 feet long.

Mitigation and Monitoring Measures

Impacts on wildlife would be reduced through implementation of BMPs. Mitigation measures to reduce wildlife impacts, where feasible, would be detailed in the POU, which would include development of a wildlife protection plan, invasive, nonnative plant species management plan, and revegetation plan.

Impact Summary

Available information is inadequate to predict the extent of impacts on any one species inhabiting areas near the proposed facilities. Nevertheless, it is unlikely that impacts from the construction, operation, and maintenance of the Ormat Project would cause substantial habitat loss, substantial restriction of wildlife movement, or a substantial increase in predation leading to the reduction in abundance of any one species such that the population would drop below self-sustaining numbers. This is because, in comparison to the availability of surrounding suitable habitat, relatively few acres of native habitat would be permanently lost. Furthermore, mitigation measures would be detailed in the wildlife, invasive, nonnative plant species, and revegetation plans that would be detailed in the POU. The POU would be finalized before issuing the condition of approval to proceed with the final project.

Residual Impacts

Residual impacts on wildlife would be similar to those described for the SPPC Project. However, with implementation of mitigation measures contained in plans within the POU, no residual impacts leading to substantial population declines for any one species are expected.

Alternative 1

Direct Impacts

Alternative 1 proposes to locate wells U and V farther away from wetland vegetation that exists next to the canal and the wildlife that this habitat type supports. Therefore, this alternative may incur fewer overall effects from

construction activities such as noise and human presence when compared to the Proposed Action. Alternative 1 would cause three fewer acres of temporary and two fewer acres of permanent disturbance to vegetation compared to the Proposed Action. Other impacts would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts on wildlife from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for wildlife under Alternative 1 would be the same as those recommended for the Proposed Action.

Residual Impacts
Residual impacts on wildlife from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts on wildlife would not occur.

Vulcan Project Area

Proposed Action

Direct Impacts
In general, direct impacts would be similar to those described previously for the SPPC Project, but the primary habitats affected from the Vulcan Project would be mixed salt desert scrub, greasewood flat, and playa, along with the typical wildlife that these vegetation communities support. The size of the Vulcan Project is large enough (4 possible power plants, 8 miles of transmission lines, 19 miles of pipeline, and 26 possible well pads) that it would temporarily and permanently impact a large amount of native habitat (Table 4-13). Individuals of particular species may be differentially affected.

In particular, pronghorn movement could be affected by the pipelines, due to the pipelines' height (three feet), noise (hissing), temperature (the pipelines are hot), length (19 miles), and spatial distribution (widespread). While the Proposed Action is not located in a pronghorn movement corridor, some pronghorn do use the area, likely moving from the Carson Lake and Pasture to locations northeast of the Vulcan Project Area. Presence of the pipelines could cause pronghorn to permanently alter their preferred movement route, which would likely affect individuals but would not likely impact the entire local pronghorn population.

Furthermore, impacts on playa habitat from pipeline footings, well pads, and access roads could alter drainage patterns, water flow, and infiltration. If this

were to change the acreage of seasonal wetlands, wildlife that use this habitat, particularly shorebirds, could be affected because there would be less available habitat. Impacts on wetlands are described in greater detail in **Section 4.8**, Floodplains, Wetlands, and Riparian Zones.

Operation of the Vulcan Project would extract and reinject geothermal water that likely recharges the thermal springs within the Vulcan Project Area. While reinjection is assumed to recharge the springs and cause no net loss to springs and wetlands, the project could impact flows and water quality in these areas, as described in **Section 4.7**, Water Quality and Quantity. Seasonal and perennial wetlands associated with these springs and water sources could be affected. If vegetation composition were to change, a different suite of species would likely utilize affected areas. In addition, a change in water quality could affect vegetation, making the area inhospitable to certain species.

Indirect Impacts

Indirect impacts on wildlife from the Vulcan Project would be similar to those described previously for the SPPC Project.

Mitigation and Monitoring Measures

Impacts on wildlife would be reduced through implementation of BMPs. Mitigation measures to reduce wildlife impacts, where feasible, would be detailed in the POU, which would include development of a wildlife protection plan, invasive, nonnative plant species management plan, and revegetation plan.

Impact Summary

Available information is inadequate to predict the extent of impacts on any one species inhabiting areas near the proposed facilities. Nevertheless, it is unlikely that impacts from the construction, operation, and maintenance of the Vulcan Project would cause substantial habitat loss, substantial restriction of wildlife movement, or a substantial increase in predation leading to the reduction in abundance of any one species such that the population would drop below self-sustaining numbers. This is because, in comparison to the availability of surrounding suitable habitat, relatively few acres of native habitat would be permanently lost. Furthermore, mitigation measures would be detailed in the wildlife, invasive, nonnative plant species, and revegetation plans that would be detailed in the POU. The POU would be finalized before issuing the condition of approval to proceed with the final project.

Residual Impacts

Residual impacts on wildlife would be similar to those described for the SPPC Project. However, with implementation of mitigation measures contained in plans within the POU, no residual impacts leading to substantial population declines for any one species are expected.

Alternative 1

Direct Impacts
Direct impacts on wildlife from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause an additional 173 acres of temporary and 76 acres of permanent disturbance to wildlife habitat associated with the construction of the Bass Flat Switching Station and the associated 4-mile transmission line extension to this switching station. The transmission line extension could provide additional perching habitat for corvids and raptors, thus increasing predation on their prey species.

Indirect Impacts
Indirect impacts on wildlife from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for wildlife under Alternative 1 would be the same as those recommended for the Proposed Action.

Residual Impacts
Residual impacts on wildlife from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts on wildlife would not occur.

4.12 MIGRATORY BIRDS

Summary

Assessment Methodology
Assessment of migratory birds and potential habitat was based on surveys conducted of the Salt Wells Energy Projects Area in May through July 2010 (Figures 3-18 through 3-20) and on the SWReGAP data, NNHP data, and NDOW comment letters and communication. BLM-designated sensitive bird species are discussed in this section.

Indicators
The following indicators have been developed to assess potential impacts on migratory birds:

- Causing a substantial reduction in a population's numbers, causing a migratory bird population to drop below self-sustaining levels, or causing a substantial loss or disturbance to habitat;

- Violations of the Bald and Golden Eagle Protection Act, MBTA, or applicable BLM guidance (e.g., IM 2010-156 or IM 2008-050) or regulations (BLM Manual 6840); or
- Interference with the movement of any migratory bird, or impeding the use of native wildlife nursery sites.

Region of Influence

The ROI for direct and indirect effects on migratory birds includes the biological survey area for each project. This includes the defined project footprint of each project facility, as well as a minimum 300-foot buffer, in some cases expanded to 500 feet if a facility was not well defined.

SPPC Project Area

Proposed Action

Direct Impacts

In general, direct impacts on migratory birds would be similar to those described in **Section 4.11**, Wildlife. Mortality or injury to birds could occur from construction activities or collisions, especially for ground- and shrub-nesting birds. Take of migratory birds could occur if nesting birds were disturbed.

Bird mortality and/or injury could occur during operation of the SPPC Project due to collision or electrocution with the transmission line. Bird collisions may occur when a transmission line transects a daily flight path used by a concentration of birds or when migrants are traveling at reduced altitudes and encounter tall structures in their path. These collisions generally occur during inclement weather or low light levels, and are more common with waterfowl, shorebirds, and other large species with low maneuverability (APLIC 2006, Faanes 1987). To reduce the risk of bird collisions, construction would conform to those practices described in the document "Mitigating Bird Collisions with Power Lines: The state of the art in 1994" (APLIC 1994).

Electrocution occurs when a perching bird simultaneously contacts two energized phase conductors or an energized conductor and grounded hardware. This can occur when horizontal separation is less than the wrist-to-wrist (flesh-to-flesh) distance of a bird's wingspan or when vertical separation is less than a bird's length from head to foot. Raptors are usually more at risk of this type of electrocution because of their size, distribution, and behavior. However, raptor electrocution on the 230-kV transmission lines would be unlikely, due to the larger distance between conductor and shield wires. Furthermore, guidelines have been developed to reduce avian electrocution risk (APLIC 2006). Substations also may pose electrocution hazards for some birds, since the wires, bus work, and support structures can provide potential roosting, perching, and nesting sites. Birds may be electrocuted when making conductor-to-conductor

or conductor-to-ground contact with uninsulated equipment. However, high voltage components of the SPPC substation would provide sufficient conductor clearance to minimize bird electrocutions.

Of particular concern are: 1) the Project's proximity to existing power lines and trees, which are current barriers to bird movement that resident birds may have adapted to, and 2) the Project's proximity to the Carson Lake and Pasture, which is used by many bird species (see **Section 3.12**) that could be affected by nearby transmission lines as they fly between water sources. If the SPPC transmission line was sited in areas with existing power lines and trees, such as Macari Lane, and as far away from the Carson Lake and Pasture as feasible, then impacts on bird movement would be minimized. The proposed project follows Macari Lane, which has both trees and an existing power line, for over two miles. Furthermore, the proposed project crosses through low quality habitat (e.g., agricultural areas). However, the proposed project follows the Carson Lake and Pasture title transfer boundary for approximately 0.5 mile, siting the transmission line close to migratory bird habitat and posing a flight hazard to birds on the north side of the Carson Lake and Pasture.

Noise and visual disturbance during construction could lead to nest abandonment and chick mortality, as well as physiological effects such as those described previously for wildlife. Nesting raptors may be disturbed as far as 0.5 mile from construction activities. In addition migrating birds that depend on the Carson Lake and Pasture as a stopover location could potentially avoid the area during construction, particularly the wetlands in and near the Project Area, during construction due to noise disturbance and human presence. It is possible that birds would still use suitable habitat to the south and west of the proposed project within the Carson Lake and Pasture, as these areas would be far enough away to avoid noise and human disturbances. There could be increased competition for resources in this area, which may or may not be able to support more birds.

The proposed project would result in 352 acres of permanent habitat loss within the Lahontan Valley Wetlands IBA. This IBA supports foraging, sheltering, and nesting habitat. However, much of the transmission line would be in agriculturally disturbed lands which do not provide nesting habitat for ground- or shrub-nesting birds. This represents approximately 0.08 percent of the IBA. As such, the amount of migratory bird habitat affected by the Proposed Action would remain small compared to the amount of comparable habitat present on surrounding lands. Bird habitat could become less suitable if invasive, nonnative species were to be introduced or spread, as a major bird food source is seeds from native grasses and shrubs. Most impacts would occur on agricultural lands, with fewer impacts on the greasewood flat, emergent marsh, playa, and mixed salt desert scrub communities (Tables 4-10 and 4-11). Migratory birds typical of these communities, as described in **Section 3.12**, Migratory Birds, would be affected.

Indirect Impacts

As described previously for wildlife, the proposed transmission line could provide perching or nesting habitat to corvids or raptors, which could allow them to prey upon other bird species. The agricultural areas provide substantive habitat for a variety of raptors, including excellent foraging grounds. However, perch deterrents would be installed where feasible and appropriate along power line sections near the Carson Lake and Pasture, which is considered high value habitat and supports a large prey base for raptors in the area. Perch deterrents have been demonstrated to minimize raptor and common raven activity on recently constructed transmission lines (Slater and Smith 2010).

BLM-Designated Sensitive Bird Species-Specific Impacts

Golden eagle. While no nests occur in the SPPC Project Area, foraging may occur, especially along the proposed transmission line section along the northeast side of the Bunejug Mountains (Figure 2-1). Construction activities associated with installation of the 230-kV transmission line may cause eagles to forage elsewhere in during construction and permanently avoid the immediate corridor area. Electrocution would be avoided by following guidelines to reduce avian electrocution risk (APLIC 2006). In order to comply with the Bald and Golden Eagle Protection Act and BLM's IM 2010-156, an avian protection plan would be developed utilizing these recommendations and in consultation with the USFWS to reduce the risk of "take" for golden eagles and to reduce the likelihood of population-level impacts. The avian protection plan measures would be incorporated into the POD.

Swainson's hawk. During the site survey, Swainson's hawks were plentiful in the area, and an occupied nest was located near the proposed alignment along Macari Lane. The agricultural areas nearby provide ample foraging habitat for this species. The proposed project could disturb nesting Swainson's hawk if construction activities occurred while a nest is occupied. Furthermore, the proposed project could result in take of Swainson's hawk if occupied nesting habitat were removed. It is likely that, while Swainson's hawks may avoid the area due to construction noise, they would recolonize the area in over time. Permanent habitat loss associated with the proposed project would be small relative to the total amount of foraging habitat in the region, and so there would be no likely permanent population-level effects on the species due to habitat loss. The proposed transmission line towers could provide additional perching opportunities, which might be used by Swainson's hawks while foraging.

Other BLM-Designated Sensitive Species. Loggerhead shrike and long-billed curlew have been observed within the SPPC Project Area. Long-billed curlew were observed in a wet meadow adjacent to the proposed alignment where it follows Macari Lane. Furthermore, while not observed during surveys, potential habitat does occur for burrowing owl and short-eared owl, both BLM-designated sensitive. The Project Area provides potential nesting habitat for all

of these species. Direct impacts from construction of the proposed project could result in take of these species, if occupied nesting habitat were removed. Furthermore, these species may be temporarily displaced from the Project Area due to construction-related activities, but are likely to recolonize the area over time, reducing the likelihood of population-level effects. Indirect impacts could result from increased predation by corvids and raptors hunting from the transmission line towers. This potential mortality would not be expected to cause any one species to drop below self-sustaining numbers.

USFWS Birds of Conservation Concern

Sage sparrow has been observed within the SPPC Project Area, and the Project Area provides potential nesting habitat for this species. Impacts would be similar to those described previously for other BLM-designated Sensitive species.

Game Birds Below Desired Condition

Both mourning dove and mallard were observed within the SPPC Project Area, and potential nesting habitat exists. Impacts would be similar to those described for the other BLM-designated sensitive species.

Mitigation and Monitoring Measures

Impacts on wildlife would be reduced through implementation of BMPs. Mitigation measures to reduce migratory bird impacts, where feasible and appropriate, would be detailed in the POD, which would include development of a wildlife protection plan, invasive, nonnative plant species management plan, and revegetation plan as well as an avian protection plan for golden eagles. These measures would likely prevent take of migratory bird species, as defined by the MBTA, and would reduce the likelihood of population-level effects.

Impact Summary

Available information is inadequate to predict the extent of impacts on any one migratory bird species inhabiting areas near the transmission corridor. Nevertheless, it is unlikely that impacts from the construction, operation, and maintenance of the SPPC Proposed Action would cause substantial habitat loss, substantial restriction of migratory bird movement, or a substantial increase in predation leading to the reduction in abundance of any one species such that the population would drop below self-sustaining numbers. This is because approximately 50 percent of the project facilities would be located in agriculturally disturbed areas, and relatively few acres of native habitat would be lost. Furthermore, mitigation measures would be detailed in the wildlife, invasive, nonnative plant species, and revegetation plans that would be detailed in the POD. The POD would be finalized before issuing the condition of approval to proceed with the final project.

Residual Impacts

Residual impacts on individuals resulting from construction, operation, and maintenance would include potential bird collisions associated with the presence of new transmission lines. However, with implementation of mitigation

measures contained in plans within the POD, no residual impacts leading to substantial population declines for any one species are expected.

Alternative 1

Direct Impacts

Direct impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause an additional 2 acres of temporary and 13 fewer acres of permanent disturbance to habitat that birds may use for feeding, sheltering, or nesting compared with the Proposed Action. Furthermore, Alternative 1 would permanently impact more native habitat, including two and a half times the acreage of emergent marsh and wet meadow habitat (Tables 4-10 and 4-11). Alternative 1 would also be more likely to impact bird movement, e.g., cause bird collisions, as it would follow Macari Lane for a shorter distance (over one mile), and would follow the Carson Lake and Pasture on its north side for a longer distance (approximately three miles). As a result, this Alternative would pose a greater obstacle to bird movement in areas where power lines and trees do not exist. Due to its proximity to Carson Lake and Pasture, noise from construction associated with Alternative 1 would be more likely to disturb birds using that habitat.

Indirect Impacts

Indirect impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action. Due to its proximity to Carson Lake and Pasture, the transmission line may attract more corvids or raptors that would prey upon shorebirds using the Carson Lake and Pasture.

Mitigation and Monitoring Measures

Mitigation measures for migratory birds under Alternative 1 would be the same as those recommended for the Proposed Action.

Residual Impacts

Residual impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action.

Alternative 2

Direct Impacts

Direct impacts on migratory birds from Alternative 2 would be similar to those described for the Proposed Action. Alternative 2 would cause 24 fewer acres of temporary and 23 fewer acres of permanent disturbance to bird habitat compared with the Proposed Action (Tables 4-10 and 4-11). Alternative 2 would be the least likely Alternative to affect bird movement, as it follows Macari Lane for a longer distance than the Proposed Action (approximately three miles), and would as such be sited the farthest from the Carson Lake and Pasture.

Indirect Impacts
Indirect impacts on migratory birds from Alternative 2 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures for migratory birds under Alternative 2 would be similar to those described for the Proposed Action.

Residual Impacts
Residual impacts on migratory birds from Alternative 2 would be similar to those described for the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
The types of direct impacts on migratory birds from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited temporary (7 acres) and permanent (5 acres) disturbance, direct impacts would be minimal.

Indirect Impacts
The types of indirect impacts on migratory birds from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited temporary and permanent disturbance acreage, indirect impacts would be minimal.

Mitigation and Monitoring Measures
Mitigation and monitoring measures for migratory birds under the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

Residual Impacts
Residual impacts on migratory birds from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts on migratory birds would not occur.

Ormat Project Area

Proposed Action

Direct Impacts
Direct impacts on migratory birds from the Ormat Project would be similar to those described previously for the SPPC Project. Impacts from operation of the Ormat transmission line would be fewer, since it would only be 200 feet long. Furthermore, there would be fewer impacts on migratory birds which utilize

agricultural areas, since this habitat type would not be affected by the Ormat Project.

The Ormat Proposed Action would have permanent effects on 208 acres of habitat in the Lahontan Valley Wetlands IBA, or approximately 0.05 percent of the IBA. As such, the amount of migratory bird habitat affected by the project actions would remain small compared to the amount of comparable habitat present on surrounding lands. Most impacts would occur in the greasewood flat community, with fewer impacts in the playa and mixed salt desert scrub communities (Table 4-12). Migratory birds typical of these communities, as described in **Section 3.12**, Migratory Birds, would be affected.

Indirect Impacts

Indirect impacts on migratory birds would be similar to those described previously for the SPPC Project. Impacts from operation of the Ormat transmission line would be fewer, since it would only be 200 feet long.

BLM-Designated Sensitive Bird Species

Golden eagle. Golden eagle is known to occur in the Ormat Project Area, and an active nest is located approximately 1.5 miles from proposed well locations, east of Highway 50. The proposed project would cause the permanent loss of approximately 208 acres of foraging habitat, caused by construction of the power plant, 6.5-mile pipeline, access roads, and 13 possible well pads; however, the Project Area does not provide suitable nesting habitat for golden eagles. Golden eagles would avoid the area during construction activities. Over time, golden eagles would likely return to the restored Project Area for foraging, reducing the likelihood of population-level effects. The active golden eagle nest located near Highway 50 would not likely be disturbed from construction or operation of the Ormat Project.

Prairie falcon. Prairie falcons use similar foraging and nesting habitat as golden eagles. Prairie falcons were not observed within the Ormat Project Area, but nesting habitat is located within 1 mile, and the Project Area has suitable foraging habitat. Impacts would be similar to those described for golden eagles.

Swainson's hawk. A Swainson's hawk occupied nest was located within the Ormat Project Area along the Newlands canal (L-12 canal) near proposed well site Y. The agricultural areas nearby provide ample foraging habitat. The proposed project could disturb nesting Swainson's hawk if construction activities occurred while a nest is occupied. Furthermore, the proposed project could result in take of Swainson's hawk if occupied nesting habitat were removed. It is likely that, while Swainson's hawks may avoid the area during construction activity, they would return to forage or nest within the area over time. Foraging habitat that would be permanently lost associated with the proposed project would be small relative to the amount of foraging habitat in

the region; therefore, permanent population-level effects on the species due to habitat loss are not likely to occur.

Other BLM-Designated Sensitive species. Loggerhead shrike and long-billed curlew have been observed within the Ormat Project Area. A long-billed curlew nest was observed in a wet meadow west of the proposed well site U. Furthermore, while not observed during surveys, potential nesting habitat does occur for snowy plover and short-eared owl. The Project Area provides potential nesting and foraging habitat for all of these species. Construction of the proposed project could result in take of these species, if occupied nesting habitat were removed. Furthermore, these species may avoid the Project Area during construction activity, but are likely to return to the area over time, reducing the likelihood of population-level effects.

USFWS Species of Conservation Concern

The Ormat Project Area provides potential nesting habitat for Brewer's sparrow and sage sparrow. Neither of these species was observed within the Project Area, but both were observed nearby. Impacts would be similar to those described previously for the BLM-designated sensitive species.

USFWS Game Birds Below Desired Condition

Both mourning dove and mallard were observed within the Ormat Project Area, and potential nesting habitat exists in the area. Potential habitat is also present for canvasback. Impacts would be similar to those described for the other BLM-designated sensitive species.

Mitigation and Monitoring Measures

Mitigation measures for migratory birds would be the same as those described previously for SPPC Project.

Impact Summary

Available information is inadequate to predict the extent of impacts on any one migratory bird species inhabiting areas near the proposed facilities. Nevertheless, it is unlikely that impacts from the construction, operation, and maintenance of the Ormat Project would cause substantial habitat loss, substantial restriction of migratory bird movement, or a substantial increase in predation leading to the reduction in abundance of any one species such that the population would drop below self-sustaining numbers. This is because, in comparison to the availability of surrounding suitable habitat, relatively few acres of native habitat would be permanently lost. Furthermore, mitigation measures would be detailed in the wildlife, invasive, nonnative plant species, and revegetation plans that would be detailed in the POU. The POU would be finalized before issuing the condition of approval to proceed with the final project.

Residual Impacts
Residual impacts would be similar to those described for the SPPC Project. The Ormat Project could have fewer bird collisions, because the transmission line would be shorter. With implementation of mitigation measures contained in plans within the POU, no residual impacts leading to substantial population declines for any one species are expected.

Alternative 1

Direct Impacts
Direct impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause three fewer acres of temporary and two fewer acres of permanent disturbance to bird habitat compared with the Proposed Action (Table 4-12). In addition, two of the well sites and the associated portion of the pipeline would not be located within wet meadow habitat and would be farther from the Carson Lake and Pasture, thus reducing loss of wet meadow habitat and noise disturbance to birds using that area.

Indirect Impacts
Indirect impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for migratory birds under Alternative 1 would be the same as those recommended for the Proposed Action.

Residual Impacts
Residual impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts on migratory birds would not occur.

Vulcan Project Area

Proposed Action

Direct Impacts
Direct impacts on migratory birds from the Vulcan Project would be similar to those described for the SPPC Project. The likelihood for direct impacts would be greater for the Vulcan project due to the larger acreage that would be affected and the larger number of migratory birds that were observed within the Vulcan Project Area. In particular, the playa and seasonal wetland habitat within Eightmile Flat, which provides habitat for shorebirds, would be affected (Table 4-13). The proposed project would have permanent effects on approximately

760 acres of habitat in the Lahontan Valley Wetlands IBA, or approximately 0.17 percent of the IBA.

Most impacts would occur in the mixed salt desert scrub community, with fewer impacts in the playa and greasewood flat communities (Table 4-13). Migratory birds typical of these communities, as described in **Section 3.12**, Migratory Birds, would be affected.

Indirect Impacts
Indirect impacts on migratory birds would be similar to those described for the SPPC Project.

BLM-Designated Sensitive Bird Species

Golden eagle. Golden eagle is known to occur in the Vulcan Project Area, and two unoccupied but relatively active nest locations are within 0.5 mile of Vulcan's proposed wells and transmission line. One nest site has several alternate nests located on a rock outcrop adjacent to Vulcan's proposed transmission line near well pad 30. This nest is located near a private gravel quarry, which likely produces some noise disturbance during intermittent daily operations. A second nest is located near well pad 45 and Power Plant Site 5 and has been more recently used by prairie falcons and may have not been used by golden eagles for a number of years.

Golden eagles are generally considered sensitive to a variety of disturbances, even when these disturbances occur as far as one mile from nest locations. Golden eagles have been documented abandoning nests due to disturbances such as repeated approaches (e.g., recreational activities) adjacent to nest sites during the incubation period. Other disturbances to golden eagles may result in stressed adults spending considerable time away from a nest, resulting in reduced fitness of offspring due to lower food availability, or chick mortality or egg loss due to exposure, predation, or desiccation. Golden eagles only produce one clutch per year and generally never attempt re-nesting after a failed nest. Repeated nest failures can result in nest or territory abandonment (Kochert et al. 2002). Golden eagle nest success also depends on presence of an ample prey base, primarily jackrabbits.

Activities associated with construction of the proposed project, such as human presence, drilling of wells, and construction of pipelines, power plants, and the transmission line, could temporarily displace foraging birds, or could disturb nesting birds, especially nests within one mile of project facilities.

In addition, the proposed project would cause the permanent loss of approximately 760 acres of foraging habitat, caused by the 4 possible power plants, 26 possible well pads, access roads, 19-mile pipeline, and 8-mile transmission line, but the amount of foraging habitat lost would be minimal given the available foraging habitat of Carson Lake and Pasture as well as the

surrounding mixed salt desert scrub habitat. Over time, golden eagles may use portions of the Project Area for foraging, especially if the area is recolonized by its prey species.

Permanent noise associated with power plant operation would not likely be a measurable impact, as the low frequency noise would likely attenuate a short distance from the power plant. Likewise, as stated in **Section 4.12**, Migratory Birds, electrocution from power lines would not likely be a measurable impact. The general increase in human activity associated with the maintenance of pipelines and wells could cause intermittent disruption to nesting birds, and in the most extreme case, could cause nest abandonment.

The proposed Vulcan transmission line is one quarter of a mile from the nesting outcrop and bisects the golden eagle nesting and foraging habitat. The transmission line would create a minor distraction for golden eagles foraging between habitats, although the birds would likely forage farther from the nest than they may have in the past, as they would likely fly over, rather than under, the transmission lines. The transmission towers would provide perch sites for this species, potentially enhancing hunting success. However, the transmission lines may have greater impacts on fledgling golden eagles (Collopy 2010). As a result, the transmission line could cause an increase in collisions with individual birds, particularly newly fledged golden eagles that are not yet strong flyers and would have trouble navigating around the lines.

Prairie falcon. Prairie falcons use similar foraging and nesting habitat as golden eagles. Prairie falcons were not observed within the Vulcan Project Area, but potential nesting and foraging habitat occurs. Impacts would be similar to those described for golden eagles.

Swainson's hawk. Swainson's hawks were observed within the Vulcan Project Area, and were observed nesting nearby. No potential nesting habitat for Swainson's hawks occurs within the Vulcan Project Area. It is likely that, while Swainson's hawks may avoid the area due to construction activities, they would eventually return to foraging habitat in the area. Permanent habitat loss associated with the proposed project would be small relative to the amount of foraging habitat in the region, and so there would be no likely permanent population-level effects on the species due to habitat loss.

Other BLM-Designated Sensitive species. Loggerhead shrike has been observed within the Vulcan Project Area. Furthermore, while not observed during surveys, potential habitat does occur for burrowing owl, long-billed curlew, and snowy plover. The Project Area provides potential nesting habitat for all of these species except long-billed curlew. Construction of the proposed project could result in take of these species, if occupied nesting habitat were removed. Furthermore, these species may avoid the Project Area during construction due to noise, but are likely to return to the area over time, reducing the likelihood of population-level effects. Permanent removal of playa and seasonal wetland

habitat would affect those species that forage in these areas, particularly long-billed curlew and snowy plover.

USFWS Species of Conservation Concern
Brewer's sparrow and sage sparrow were observed within the Vulcan Project Area. Impacts would be similar to those described previously for the BLM-designated sensitive species.

Game Birds Below Desired Condition
Both mourning dove and mallard were observed within the Vulcan Project Area, and potential nesting habitat exists. Impacts would be similar to those described for the other BLM-designated sensitive species.

Mitigation and Monitoring Measures
Mitigation measures for migratory birds would be the same as those described previously for the SPPC Project.

Impact Summary
Available information is inadequate to predict the extent of impacts on any one migratory bird species inhabiting areas near the proposed facilities. Nevertheless, it is unlikely that impacts from the construction, operation, and maintenance of the Vulcan Proposed Action would cause substantial habitat loss, substantial restriction of migratory bird movement, or substantial increase in predation leading to the reduction in abundance of any one species such that the population would drop below self-sustaining numbers. This is because, in comparison to the availability of surrounding suitable habitat, relatively few acres of native habitat would be permanently lost. Furthermore, mitigation measures would be detailed in the wildlife, invasive, nonnative plant species, and revegetation plans that would be detailed in the POU. The POU would be finalized before issuing the condition of approval to proceed with the final project.

Residual Impacts
Residual impacts would be similar to those described for the Ormat Project.

Alternative 1

Direct Impacts
Direct impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause an additional 173 acres of temporary and 76 acres of permanent disturbance to bird habitat compared with the Proposed Action (Table 4-13). Disturbance would be associated with the construction of the Bass Flat Switching Station and the associated 4-mile transmission line extension to this switching station.

Indirect Impacts
Indirect impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for migratory birds under Alternative 1 would be the same as those recommended for the Proposed Action.

Residual Impacts
Residual impacts on migratory birds from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts on migratory birds would not occur.

4.13 BLM-DESIGNATED SENSITIVE SPECIES (ANIMALS AND PLANTS)

Summary

Assessment Methodology
Assessment of BLM-designated sensitive animal and plant species and potential habitat was based on surveys conducted of the Salt Wells Energy Projects Area between May and July 2010 (Figures 3-18 through 3-20) and on the SWReGAP data, NNHP data, correspondence with the USFWS, and NDOW comment letters and communication. BLM-designated sensitive bird species are discussed previously in **Section 4.12**, Migratory Birds.

Indicators
For BLM-designated sensitive plants, indicators focus on the acreage of disturbance of species habitat, as well as the potential for direct impacts on BLM-designated sensitive species.

Potential impacts on BLM-designated sensitive animal species could occur if reasonably foreseeable future actions were to result in the following:

- Effects on any individual or population of BLM-designated sensitive species, such that the project would contribute to the need to list any of them; or
- Substantial effects on the quality or quantity of habitat available for a BLM-designated sensitive species over time.

Region of Influence
The ROI for direct and indirect effects on BLM-designated sensitive species includes the biological survey area for each project. This includes the defined project footprint of each project facility, as well as a minimum 300-foot buffer, in some cases expanded to 500 feet if a facility was not well defined.

SPPC Project Area

Proposed Action

Direct Impacts
Direct impacts on BLM-designated sensitive species would be similar to those described in **Section 4.11**, Wildlife, and **Section 4.12**, Migratory Birds. Birds are the only BLM-designated sensitive species that could be impacted within the SPPC Project Area.

Indirect Impacts
Indirect impacts on BLM-designated sensitive bird species would be similar to those described previously in **Section 4.11**, Wildlife, and **Section 4.12**, Migratory Birds.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as those described in **Section 4.11**, Wildlife, and **Section 4.12**, Migratory Birds. With implementation of mitigation measures, the SPPC Project would not result in take of BLM-designated sensitive bird species' nests and would thus not be in conflict with direction provided in BLM IMs and regulations. Furthermore, the project would not contribute to the need to list any BLM-designated sensitive species.

Impact Summary
Overall impacts from the SPPC Project would be similar to those described previously in **Section 4.12**, Migratory Birds.

Residual Impacts
Residual impacts would be similar to those described in **Section 4.12**, Migratory Birds.

Alternative 1

Direct Impacts
Direct impacts from Alternative 1 would be similar to those described for Alternative 1 in **Section 4.12**, Migratory Birds.

Indirect Impacts
Indirect impacts from Alternative 1 would be similar to those described for Alternative 1 in **Section 4.12**, Migratory Birds.

Mitigation and Monitoring Measures
Mitigation measures under Alternative 1 would be the same as those recommended for Alternative 1 in **Section 4.12**, Migratory Birds.

Residual Impacts
Residual impacts from Alternative 1 would be similar to those described for Alternative 1 in **Section 4.12**, Migratory Birds.

Alternative 2

Direct Impacts
Direct impacts from Alternative 2 would be similar to those described for Alternative 2 in **Section 4.12**, Migratory Birds.

Indirect Impacts
Indirect impacts from Alternative 2 would be similar to those described for Alternative 2 in **Section 4.12**, Migratory Birds.

Mitigation and Monitoring Measures
Mitigation and monitoring measures under Alternative 2 would be similar to those described for Alternative 2 in **Section 4.12**, Migratory Birds.

Residual Impacts
Residual impacts from Alternative 2 would be similar to those described for Alternative 2 in **Section 4.12**, Migratory Birds.

Macari Fiber Optic Alternative

Direct Impacts
Direct impacts from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited temporary (7 acres) and permanent (5 acres) disturbance (Tables 4-10 and 4-11), direct impacts would be minimal.

Indirect Impacts
Indirect impacts from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action. However, due to the limited temporary and permanent disturbance acreage, indirect impacts would be minimal.

Mitigation and Monitoring Measures
Mitigation and monitoring measures under the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

Residual Impacts
Residual impacts from the Macari Fiber Optic Alternative would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts would not occur.

Ormat Project Area

Proposed Action

Direct Impacts
Direct impacts caused by the Ormat Project would be similar to those described for the SPPC Project.

Indirect Impacts
Indirect impacts would be similar to those described previously for the SPPC Project. Collisions and electrocutions with the transmission line would be less of a concern with the Ormat Project, as the transmission line is only 200 feet long compared to 22 miles long for the SPPC Project.

BLM-Designated Sensitive Species-Specific Impacts

BLM-Designated Sensitive Bat Species. There is no roosting habitat within the Ormat Project Area, and use of the habitat in the Project Area by bat species is likely limited to foraging. Loss of foraging habitat would be extremely limited and no population-level effects are anticipated during construction or operation of the proposed project.

Pallid Wood Nymph. Potential habitat exists within the Ormat Project Area for pallid wood nymph, which inhabits alkali meadows. The species was not observed during surveys. Since little is known about the ecology of this species, assessment of impacts is difficult. The proposed project could remove habitat for this species, including host or nectar plants. The species may be very sensitive to noise or human disturbance, and individuals may avoid the area during construction or permanently. In the worst case scenario, the species would be displaced from suitable habitat within the Project Area permanently, but similar habitat adjacent to the Project Area exists within the Carson Lake and Pasture, reducing the likelihood of population-level effects.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as those described in **Section 4.11**, Wildlife, and **Section 4.12**, Migratory Birds.

A pre-construction survey for pallid wood nymph is recommended within the Project Area during the general flight time for butterfly species. If the pallid wood nymph is observed, measures would be implemented to avoid impacts on any populations. Measures could include the installation of fencing around host plants to protect against vehicle and human impacts, or redesigning project features.

Impact Summary
Available information is inadequate to predict the extent of impacts on any one BLM-designated sensitive species inhabiting areas near the proposed facilities.

Nevertheless, it is unlikely that impacts from the construction, operation, and maintenance of the Ormat Project would cause substantial habitat loss, substantial restriction of wildlife movement, or a substantial increase in predation leading to the reduction in abundance of any one species such that the population would drop below self-sustaining numbers. This is because, in comparison to the availability of surrounding suitable habitat, relatively few acres of native habitat would be permanently lost. Furthermore, mitigation measures would be detailed in the wildlife, invasive, nonnative species, and revegetation plans that would be detailed in the POU. The POU would be finalized before issuing the condition of approval to proceed with the final project.

Residual Impacts

Residual impacts would be similar to those described in **Section 4.12**, Migratory Birds. In addition, some BLM-designated sensitive bats would permanently avoid foraging in the area due to increased development, human presence, and background noise. However, with implementation of mitigation measures contained in plans within the POD, no residual impacts leading to substantial population declines for any one species are expected.

Alternative 1

Direct Impacts

Alternative 1 proposes to locate wells U and V farther away from wetland vegetation adjacent to the canal and the wildlife that this habitat type supports. Therefore, this alternative may have diminished overall effects from construction activities such as noise and human presence when compared to the Proposed Action. Alternative 1 would have three fewer acres of temporary and two fewer acres of permanent disturbance to habitat compared with the Proposed Action. Other impacts would be the same as the Proposed Action.

Indirect Impacts

Indirect impacts from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures

Mitigation measures under Alternative 1 would be the same as those recommended for the Proposed Action.

Residual Impacts

Residual impacts from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative

Under the No Action Alternative, impacts on BLM-designated sensitive species would not occur.

Vulcan Project Area

Proposed Action

Direct Impacts
Direct impacts from the Vulcan Project would be similar to those described for the SPPC Project.

Indirect Impacts
Indirect impacts would be similar to those described previously for the SPPC Project.

BLM-Designated Sensitive Species-Specific Impacts

BLM-Designated Sensitive Bat Species. The Project Area provides roosting and foraging habitat for special status bat species. Bats use rock outcrops in the Project Area for roosting, and likely forage in the vegetated areas. A pallid bat roost was located near proposed Power Plant Site 3. Loss of foraging habitat would be a direct effect, although a very small proportion of the total foraging habitat in the region would be removed by the proposed project. Construction noise and human presence could cause bats to temporarily abandon their roosts, especially those that are near proposed project facilities. During operation of the project, bats would not be likely to roost in equipment and structures on site due to noise and human presence. It is possible that bats may permanently avoid roosting or foraging habitat near proposed project facilities. However, permanent habitat loss associated with the proposed project would be small relative to the total amount of foraging and roosting habitat in the region, and so there would be no likely permanent population-level effects on the species due to habitat loss.

Pallid Wood Nymph. Potential habitat exists within the Ormat Project Area for pallid wood nymph, which inhabits alkali meadows. The species was not observed during surveys. Since little is known about the ecology of this species, assessment of impacts is difficult. The proposed project could remove habitat for this species, including host or nectar plants. The species may be very sensitive to noise or human disturbance and may avoid the area during construction or permanently. In the worst case scenario, the species would be permanently displaced from suitable habitat within the Project Area, but similar habitat adjacent to the Project Area exists within Carson Lake and Pasture, reducing the likelihood of population-level effects.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as those described in **Section 4.12**, Migratory Birds, and **Section 4.11**, Wildlife.

Impact Summary

Available information is inadequate to predict the extent of impacts on any one BLM-designated sensitive species inhabiting areas near the proposed facilities. Nevertheless, it is unlikely that impacts from the construction, operation, and maintenance of the Vulcan Project would cause substantial habitat loss, substantial restriction of wildlife movement, or a substantial increase in predation leading to the reduction in abundance of any one species such that the population would drop below self-sustaining numbers. This is because, in comparison to the availability of surrounding suitable habitat, relatively few acres of native habitat would be permanently lost. Furthermore, mitigation measures would be detailed in the wildlife, invasive, nonnative plant species, and revegetation plans that would be detailed in the POU. The POU would be finalized before issuing the condition of approval to proceed with the final project.

Residual Impacts

Residual impacts would be similar to those described for the Ormat Project.

Alternative 1

Direct Impacts

Direct impacts from Alternative 1 would be similar to those described for the Proposed Action. Alternative 1 would cause an additional 173 acres of temporary and 76 acres of permanent disturbance to wildlife habitat compared to the Proposed Action (Table 4-13). Disturbance from Alternative 1 would be associated with the construction of the Bass Flat Switching Station and the associated 4-mile transmission line extension to this switching station. In addition, the transmission line extension provides potential habitat for two BLM-designated sensitive plant species, oryctes and Nevada dune beardtongue. Construction of this Alternative could cause the removal of these plant populations if they occur.

Indirect Impacts

Indirect impacts from Alternative 1 would be similar to those described for the Proposed Action.

Mitigation and Monitoring Measures

Mitigation measures under Alternative 1 would be similar to those recommended for the Proposed Action. In addition, a mitigation measure is recommended to reduce the likelihood for impacts on BLM-designated sensitive plant species.

To prevent impacts on BLM-designated sensitive plant species, a preconstruction survey is recommended. If present, measures would be implemented to avoid impacts on any populations. Measures could include the installation of fencing to protect against vehicle and human impacts, or redesigning project features.

Residual Impacts
Residual impacts from Alternative 1 would be similar to those described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, impacts would not occur.

4.14 CULTURAL RESOURCES

Summary

Assessment Methodology
The analysis of potential impacts on cultural resources is based on a Class I records search of nearly 80,000 acres in and buffering the Salt Wells Energy Projects, on the pedestrian Class III cultural resources archaeological inventory and National Register evaluation of nearly 6,000 acres within the archaeological APE, and on the historical architecture inventory and evaluation of 115 Churchill County APNs within the one-half-mile architectural APE. Determination of National Register eligibility is critical to this assessment and can only be provided by the federal lead agency, the BLM Carson District Office, with concurrence from the Nevada SHPO. If a cultural resource (site, building, or district) is eligible to the NRHP, then it is a historic property warranting protection, avoidance, or mitigation. If a cultural resource is unevaluated for the NRHP, it would be managed as if eligible until a determination can be made. If a cultural resource is ineligible for the NRHP, it would still be avoided if possible, but no further mitigation is warranted.

There are historic properties within the Salt Wells Energy Projects cultural resources APEs and these include buildings, districts, trails, prehistoric, historic-era, and ethnohistoric cultural resources.

Indicators
Indicators developed to assess potential impacts on cultural resources include the following:

- Project components would be located on, over, or near historic properties including prehistoric, historic, and ethnohistoric archaeological sites; trails and roads; districts; buildings including ranches, dairies, farmsteads, and residences; and areas of traditional Native American concern.
- Project components could result in direct physical impacts such as those caused by land disturbances from all project construction activities, including well pad construction, road building, grading, pipelines, and transmission line construction.

- Project components could result in indirect impacts on historic properties through visual effects on standing structures, historic districts, trails and roads.
- Project components would have an adverse effect on historic properties, their settings, or their integrity under Section 106 of the NHPA (36 CFR 800).

Region of Influence

The ROI for cultural resources includes the Salt Wells Energy Projects Area plus a one-mile buffer. The architectural cultural resources ROI is a one-half-mile buffer about the proposed SPPC Project transmission line corridors.

SPPC Project Area

Proposed Action

Direct Impacts

Archaeological and architectural history Class III inventories and NRHP evaluations are ongoing. Preliminary findings indicate historic properties from previous investigations and from the ongoing work may be adversely impacted during any ground disturbing construction activity in the SPPC Project Area. SPPC's use of historic property avoidance and development of treatment plans as specified in the project's Programmatic Agreement (PA) between the BLM, Reclamation, the SHPO and SPPC, Ormat, and Vulcan for unavoidable significant cultural resources would assure mitigation or avoidance occur on all historic properties receiving potential adverse ground disturbing effects (See **Appendix D**, Programmatic Agreement for the Salt Wells Energy Projects.) Impacts on cultural resources often overlap with impacts on Native American religious concern, visual resources, and national historic trails as discussed in **Sections 4.7**, **4.15**, **4.17**, and **4.21**.

Indirect Impacts

The Proposed Actions would change the visual landscape and setting important to integrity of certain historic properties such as unique structures or buildings, ranches, dairies, and farmsteads; historic roads and trails; prehistoric rock art and sacred sites; and historic districts such as the Newlands Project National Register District. Construction and increased access to prehistoric and ethnohistoric sites could result in illicit artifact collecting, an ongoing issue in the BLM and Reclamation managed parts of the Salt Wells Energy Projects. These changes could indirectly affect the integrity of ethnohistoric, sacred, historic, and prehistoric sites, buildings, trails, roads, and districts.

Mitigation and Monitoring Measures

Mitigation and monitoring strategies are detailed in the Programmatic Agreement between the BLM, Reclamation, and SHPO and SPPC, Ormat, and Vulcan (See **Appendix D**). If the Proposed Actions are approved, the PA would

guide all activities concerning cultural resources and historic properties within the Proposed Action from its origin date, October 5, 2010, until the undertaking is completed or until it is terminated by one or more of the signatories. The document includes sections on:

1) Roles and Responsibilities including agreement on the BLM as Lead Federal Agency, and the role of SPPC, Ormat, and Vulcan in covering costs for identification, evaluation, determination of effect, mitigation and monitoring, and responsibility in protecting cultural resources during construction and operation from unauthorized, inadvertent, or negligent actions by any project personnel.
2) Definition of the APE to include all areas containing cultural resources directly, indirectly, and visually impacted by the Proposed Action.
3) The BLM would ensure that all Historic Properties in the APE are identified, evaluated for the NRHP, assessed for effects from the Proposed Action, and avoided through project redesign, or treated through development of Treatment or Data Recovery Plans. Field treatment must be complete on archaeological resources eligible under Criterion D prior to construction.
4) Provisions are detailed for roles and responsibilities during unanticipated discovery situations where subsurface archaeological remains are encountered during construction or operation.
5) Other considerations include roles of cultural resource contractors in training all construction and archaeological personnel to comply with the Archaeological Resources Protection Act of 1979 (16 USC 470) on federal lands and Nevada Revised Statutes (NRS) 381 on private lands, and when dealing with human remains NAGPRA (43 CFR 10) on federal and NRS 383 on private lands.
6) Monitoring of sensitive areas during project construction by a professional archaeologist, and if requested, a tribal representative, both empowered to stop work to protect cultural resources.
7) Notices to Proceed would be issued by the BLM for segments as defined by SPPC, Ormat, and Vulcan in the POD or POU if BLM and SHPO have determined no cultural resources are in the APE; if BLM and SHPO have determined there are no Historic Properties in the APE for a certain segment or location; if the BLM and SHPO have implemented an adequate Treatment Plan for the construction segment or location and fieldwork phase is complete and summarized and approved by BLM, SHPO, and Reclamation; and SPPC, Ormat, and Vulcan have posted a surety bond to cover costs of reporting, analyzing, and curating treated site data or preparing public interpretation projects.

8) Execution and implementation of the project PA would fulfill the signatories responsibilities for Section 106 for all actions associated with the construction and operation of the Salt Wells Energy Projects.

Recommended treatment measures for architectural historic properties are also outlined in treatment plans that help mitigate adverse effects on resources eligible to the NRHP under criteria A, B, and C. These types of treatment measures might include the following:

- Measures would be taken to minimize the visual impact associated with the proposed action. This may take the form of modifying tower placement, selecting paint colors that diminish the visual impact of the towers, the planting of trees that would eventually reduce the visual impact of the towers, and/or other measures that may be identified in the future.
- Photo-documentation would be prepared of pre-disturbance viewsheds from all NRHP-eligible properties within one-half mile of the power line selected for construction. Emphasis would be placed on documenting viewsheds as seen from the resource looking toward the power line. Also, a representative sample of eligible resources from each property type located within one-half mile of the power line selected for construction would be selected for similar photo-documentation of viewsheds. The documentation would be included in a technical report submitted to the BLM and SHPO.
- Visual/video products intended to document a select number of architectural resources would be prepared. The products would incorporate architectural, historical, and family histories in an integrated manner. Draft products would be submitted to the BLM and SHPO for technical review prior to production. Copies of the final products would be provided to BLM and SHPO for distribution.
- To the extent that access can be secured, a selected sample of specific property types based on standards established by the SHPO for properties of local and state significance would be documented. The documentation would be included in a technical report submitted to the BLM and SHPO.
- Two or more professional articles intended for publication in local or state journals would be prepared. The articles would focus on specific property types, historic periods, and/or centennial ranches. The draft articles would be submitted to the BLM and SHPO for technical review prior to publication. Its content would rely heavily on information developed by the other treatment measures.

It should be noted that the exact type and extent of treatment would be determined based on consultation between the BLM and the SHPO.

Residual Impacts
Avoidance or mitigation of historic properties would eliminate or reduce most residual impacts from the Proposed Action. Visual changes in the viewshed surrounding architectural and Newlands Project resources along the proposed transmission line would be permanent and cannot be avoided.

Alternative 1

Direct Impacts
Direct impacts would be the same as identified under the Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the Proposed Action.

Residual Impacts
Residual impacts would be the same as identified under the Proposed Action.

Alternative 2

Direct Impacts
Direct impacts would be the same as identified under the Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the Proposed Action.

Residual Impacts
Residual impacts would be the same as identified under the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
Direct impacts would be the same as identified under the Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the Proposed Action.

Residual Impacts
Residual impacts would be the same as identified under the Proposed Action.

No Action Alternative
Under the No Action Alternative, there would be no adverse impacts on historic properties since the transmission line and its associated facilities would not be constructed.

Ormat Project Area

Proposed Action

Direct Impacts
Direct impacts would be the same as identified under the SPPC Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the SPPC Proposed Action, although visual impacts on buildings are a minor issue with only one architectural historic property in the Ormat Project Area.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the SPPC Proposed Action.

Residual Impacts
Residual impacts would be the same as identified under the SPPC Proposed Action.

Alternative 1

Direct Impacts
Direct impacts would be the same as identified under the SPPC Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the SPPC Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the SPPC Proposed Action.

Residual Impacts
Residual impacts would be the same as identified under the SPPC Proposed Action.

No Action Alternative
Under the No Action Alternative, there would be no adverse impacts on historic properties since the geothermal power plants and their associated facilities would not be constructed. Construction and operation-related impacts would be avoided.

Vulcan Project Area

Proposed Action

Direct Impacts
Direct impacts would be the same as identified under the SPPC Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the SPPC Proposed Action, although visual impacts on buildings are absent since no historical architecture resources are present in the Vulcan Project Area.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the SPPC Proposed Action minus those related to architectural resources.

Residual Impacts
Residual impacts would be the same as identified under the SPPC Proposed Action.

Alternative 1

Direct Impacts
Direct impacts would be the same as identified under the SPPC Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the SPPC Proposed Action and including potential visual impacts on the Pony Express Trail.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the SPPC Proposed Action without those related to architectural resources.

Residual Impacts
Residual impacts would be the same as identified under the SPPC Proposed Action.

No Action Alternative
Under the No Action Alternative, there would be no adverse impacts on historic properties since the geothermal power plants and their associated facilities including new transmission lines would not be constructed. Construction and operation-related impacts would be avoided.

4.15 NATIVE AMERICAN RELIGIOUS CONCERNS

Summary

Assessment Methodology
The analysis of potential impacts on Native American Concerns is based on a review of known tribal interests, traditional cultural places, trust assets/treaty rights resources, and consultation with the potentially affected Tribes (see **Section 3.15**).

- There are potential places of cultural and/or geographic interest to the Tribes within or near the Salt Wells Energy Projects Area.
- Impacts to prehistoric cultural resource sites are disclosed in **Section 4.14**, Cultural Resources.

Indicators
Indicators developed to assess potential impacts on tribal interests or traditional cultural resources include the following:

- Conflict with land uses, management, and economic well-being of adjacent or nearby reservations, trust lands, restricted Indian allotments, and federally tribal-dependent Indian communities;
- Conflict with the exercise of off-reservation treaty and reserved rights, including grazing rights, hunting and fishing rights, gathering rights and interests, and water rights;
- Conflict with federal trust responsibilities to tribes and individual Indians regarding real property, physical assets, or intangible property rights;
- Conflict with existing court decisions, laws, policies, executive orders, and agency agreements with tribes regarding land and resource use;
- Proposed uses that are incompatible with maintaining and identifying cultural resources and their qualities;

- Adverse effect on historic properties or their settings, especially traditional cultural properties and cultural landscapes under Section 106 of the NHPA (36 CFR 800);
- Restricted access to traditionally used hunting, fishing, and gathering areas and species;
- Changed or reduced access to traditionally used or culturally important water sources and hot springs;
- Effects on culturally important trails or trail systems; or
- Effects on sacred sites or their settings, access, or use.

Region of Influence

The ROI for Native American religious concerns is the Salt Wells Energy Projects Area and surrounding lands designated as traditionally important to the local Native American culture.

SPPC Project Area

Proposed Action

Direct Impacts

The Native American consultation process remains ongoing at this time. During consultation for the proposed projects, the following concerns were identified: cultural resources including historic properties; continued access and use of the traditional use sites; and other resources that may be affected by the current project.

Access to or the use of traditional use sites may be temporarily impacted during the construction phase of the project. No direct permanent impacts on access to or the use of traditional use sites within the SPPC Project Area have been identified. Impacts on areas of Native American religious concern often overlap with impacts on, water quantity and quality, cultural resources, visual resources and national and historic trails. Further discussion of impacts on water quality and quantity, cultural resources, visual resources, and national and historic trails are discussed in **Sections 4.7**, **4.14**, **4.17**, and **4.21** respectively.

Indirect Impacts

The Proposed Actions would change vegetation patterns and wildlife distribution within the temporarily and permanently disturbed areas. Such changes could indirectly affect the integrity of ethnohistoric, sacred, and ceremonial sites as well as disrupt the flow of *Spirit Power*.

Mitigation and Monitoring Measures

In order to maintain access to and use of traditional use sites, the proponents would coordinate with local tribes and plan construction activities around

traditional use periods during the construction phase of the project to eliminate any impacts.

Ongoing consultation may result in identification of Native American Religious Concerns which would be reviewed, and, as appropriate and necessary, additional monitoring and mitigation measures would be developed.

Residual Impacts
There would be no residual effects on Native American Religious Concerns resulting from implementation of the Proposed Action. The ongoing consultation process may result in identification of Native American Religious Concerns regarding residual effects of the proposed Project, which would be reviewed and considered during preparation of the ROD.

Alternative 1

Direct Impacts
Direct impacts would be the same as identified under the Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the Proposed Action.

Residual Impacts
Residual Impacts would be the same as identified under the Proposed Action.

Alternative 2

Direct Impacts
Direct impacts would be the same as identified under the Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the Proposed Action.

Residual Impacts
Residual Impacts would be the same as identified under the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
Direct impacts would be the same as identified under the Proposed Action.

Indirect Impacts
The Macari Fiber Optic Alternative would involve construction of a fiber optic line and tie-in at Highway 50, less than 1 mile from the Grimes Point Archaeological Site. The visual integrity of the site could be impacted during construction of the line. Impacts are further discussed in the cultural resources and visual resources sections of this chapter.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the Proposed Action.

Residual Impacts
Residual Impacts would be the same as identified under the Proposed Action.

No Action Alternative
Under the No Action Alternative, the BLM would continue to manage Native American Religious Concerns on its properties, in compliance with federal laws and regulations. Because the transmission line and its associated facilities would not be constructed, construction-related impacts would be avoided.

Ormat Project Area

Proposed Action

Direct Impacts
Direct impacts would be the same as identified under the SPPC Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the SPPC Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the SPPC Proposed Action.

Residual Impacts
Residual Impacts would be the same as identified under the SPPC Proposed Action.

Alternative 1

Direct Impacts
Direct impacts would be the same as identified under the SPPC Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the SPPC Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the SPPC Proposed Action.

Residual Impacts
Residual Impacts would be the same as identified under the SPPC Proposed Action.

No Action Alternative
Under the No Action Alternative, the BLM would continue to manage Native American Religious Concerns on its properties, in compliance with federal laws and regulations. Because the proposed geothermal power plants and their associated facilities would not be constructed, construction and operation-related impacts would be avoided.

Vulcan Project Area

Proposed Action

Direct Impacts
Direct impacts would be the same as identified under the SPPC Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the SPPC Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the SPPC Proposed Action.

Residual Impacts
Residual Impacts would be the same as identified under the SPPC Proposed Action.

Alternative 1

Direct Impacts
Direct impacts would be the same as identified under the SPPC Proposed Action.

Indirect Impacts
Indirect impacts would be the same as identified under the SPPC Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be the same as identified under the SPPC Proposed Action.

Residual Impacts
Residual Impacts would be the same as identified under the SPPC Proposed Action.

No Action Alternative
Under the No Action Alternative, the BLM would continue to manage Native American Religious Concerns on its properties, in compliance with federal laws and regulations. Because the proposed geothermal power plants and their associated facilities would not be constructed, construction and operation-related impacts would be avoided.

4.16 PALEONTOLOGICAL RESOURCES

Summary

Assessment Methodology
Specific paleontological features may have value to scenic, recreational, or cultural resources, and impacts on these resources are discussed in their respective sections. In this section, impacts on paleontological features are evaluated only from the perspective of scientific value (see **Section 3.16**, Paleontological Resources). Effects are quantified where possible; in the absence of quantitative data, best professional judgment was used.

Indicators
The following indicators were developed to evaluate potential impacts of the Salt Wells Energy Projects on paleontological resources:

- Project components would be located on or near paleontological localities. The primary indicators for paleontological localities include the type of parent material (e.g., bedrock), and the number, type, and significance of recorded localities within the Salt Wells Energy Projects Area disturbance footprint.

- Proposed Actions or Alternatives could result in substantial erosion of paleontological localities. The primary indicators for erosion of paleontological localities include landslides, vibration, dust, water vapor and condensation, and subsidence.

SPPC Project Area

Proposed Action

As discussed in **Section 3.15,** Paleontological Resources, it is unlikely that the Proposed Action would affect geologic units that have the potential to contain paleontological resources. Though many of the activities involved with the Proposed Action would result in some degree of ground disturbance, the presence of Quaternary alluvium and playa deposits and Tertiary volcanic deposits have low potential to contain paleontological resources.

Direct Impacts

If paleontological resources are present within the SPPC Project Area, impacts on those resources are more likely to occur where ground disturbance takes place and the work site has not experienced substantial prior disturbance. The greatest concern would be new construction activities, which are likely to occur on previously undisturbed or largely undisturbed parcels. Substantial damage to or destruction of paleontological resources, as defined by BLM, would represent an impact to those resources. In most cases, new minor construction would require preparation of a site-specific paleontological investigation.

Indirect Impacts

No indirect impacts on paleontological resources are expected to result from the continuing operation of the Proposed Action.

Mitigation and Monitoring Measures

Pleistocene and early Holocene surficial deposits, such as alluvium, colluvium, talus, and playa deposits, have a low paleontological sensitivity ranking. Monitoring during construction would not be required, but spot-checking may be conducted in certain areas at the discretion of the BLM Staff Paleontologist. In the case of the Quaternary deposits, this would ensure that any older underlying fossiliferous sediments were not being affected.

If paleontological localities are identified in the SPPC Project Area, the following mitigation and monitoring measures would be implemented:

1. Include site-specific evaluation of paleontological sensitivity for construction or maintenance activities requiring ground disturbance. For any construction or maintenance activity that requires ground disturbance, SPPC would ensure that preconstruction studies include assessment of the site's paleontological sensitivity by a state-registered professional geologist (PG) or qualified professional paleontologist. If the paleontological assessment determines that any

of the substrate units that would be affected by the planned activity are highly sensitive for paleontological resources, the report would also include recommendations for appropriate and feasible procedures to avoid or minimize damage to any resources present, prepared by a qualified professional paleontologist. SPPC would be responsible for ensuring implementation of the measures identified.

The potential for impacts on paleontological resources as a result of construction or maintenance activities is lower because ground disturbance associated with these activities is typically confined to existing ROWs and immediately adjacent areas, which have already undergone some level of disturbance associated with installation and maintenance of existing infrastructure. To ensure that further ground disturbance does not result in additional damage to paleontological resources, SPPC would also implement the following measure for all activities except emergency repairs; note that this measure would also ensure against impacts as a result of any new minor construction not subject to site-specific geotechnical investigation.

2. Stop work if substantial fossil remains are encountered during construction. If substantial fossil remains (particularly vertebrate remains) are discovered during construction or maintenance activities, work on the site would stop immediately until a state-registered PG or qualified professional paleontologist can assess the nature and importance of the find, and a qualified professional paleontologist can recommend appropriate treatment. Treatment may include preparation and recovery of fossil materials so that they can be housed in an appropriate museum or university collection, and may also include preparation of a report for publication describing the finds. SPPC or BLM would be responsible for ensuring that recommendations regarding treatment and reporting are implemented.

If emergency repairs are needed, SPPC would conduct repairs as rapidly as possible to ensure continuity of service and to protect public safety. As a result, it is typically infeasible to implement a stop work order, such as that required under Mitigation Measure 2, during emergency repairs. By their nature, emergency repairs affect existing infrastructure and thus would take place in ROWs and immediately adjacent areas that have already undergone some level of disturbance associated with installation and maintenance of existing utilities infrastructure. Consequently, the potential for impacts as a result of emergency repairs is considered low, but some potential nonetheless remains. Implementation of the following measure would reduce impacts on the extent feasible.

3. Implement follow-up assessment and remediation in the event paleontological resources are discovered during emergency repairs.

If paleontological resources are discovered during emergency repairs, SPPC would ensure that they are evaluated by a state-registered PG or qualified professional paleontologist as soon as practicable following the completion of all necessary and required repair work. If appropriate, a qualified professional paleontologist would develop a remedial treatment plan consistent with the prevailing standard of care for paleontological resources. The treatment plan may provide for any or all of the following: measures to prevent additional damage; recovery excavations; museum curation; preparation of a report documenting the find; and development of public outreach or educational materials or displays. SPPC would be responsible for ensuring that the recommendations of the treatment plan are implemented.

Residual Impacts

Although the transmission line maintenance roadway would not be public and is meant for operation and inspection purposes only, it could be a potential roadway for access to paleontological localities.

Alternative 1

Direct Impacts

Alternative 1 would involve the same or similar direct impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Indirect Impacts

Alternative 1 would involve the same or similar indirect impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Mitigation and Monitoring Measures

Alternative 1 would involve the same or similar direct impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Residual Impacts

Although the transmission line roadway would not be public and is meant for operation and inspection purposes only, it could be a potential roadway for access to paleontological localities.

Alternative 2

Direct Impacts
Alternative 2 would involve the same or similar direct impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 2 as those described for the Proposed Action, and the same mitigation strategy would apply.

Indirect Impacts
Alternative 2 would involve the same or similar indirect impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 2 as those described for the Proposed Action, and the same mitigation strategy would apply.

Mitigation and Monitoring Measures
Alternative 2 would involve the same or similar direct impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 2 as those described for the Proposed Action, and the same mitigation strategy would apply.

Residual Impacts
Although the transmission line roadway would not be public and is meant for operation and inspection purposes only, it could be a potential roadway for access to paleontological localities.

Macari Fiber Optic Alternative

Direct Impacts
The Macari Fiber Optic Alternative would involve the same or similar direct impacts as those described for the Proposed Action.

Indirect Impacts
The Macari Fiber Optic Alternative would involve the same or similar indirect impacts as those described for the Proposed Action.

Mitigation and Monitoring Measures
Impacts on paleontological resources would essentially be the same under the Macari Fiber Optic Alternative as those described for the Proposed Action, and the same mitigation strategy would apply.

Residual Impacts
No residual impacts are expected under the Macari Fiber Optic Alternative.

No Action Alternative

Under the No Action Alternative, the BLM would continue to manage paleontological resources in compliance with federal laws and regulations.

Because the Proposed Action would not be constructed, construction-related impacts would be avoided.

Ormat Project Area

Proposed Action

As discussed in **Section 3.15,** Paleontological Resources, it is unlikely that the Proposed Action would affect geologic units that have the potential to contain paleontological resources. Though many of the activities involved with the Proposed Action would result in some degree of ground disturbance, the presence of Quaternary alluvium and playa deposits and Tertiary volcanic deposits have low potential to contain paleontological resources.

Direct Impacts

If paleontological resources are present within the Ormat Project Area, impacts on those resources are more likely to occur where ground disturbance takes place and the work site has not experienced substantial prior disturbance. The greatest concern would be new construction activities, which are likely to occur on previously undisturbed or largely undisturbed, parcels. Substantial damage to or destruction of paleontological resources, as defined by BLM, would represent an impact to those resources. In most cases, new minor construction would require preparation of a site-specific paleontological investigation.

Indirect Impacts

No indirect impacts on paleontological resources are expected to result from the continuing operation of the Proposed Action.

Mitigation and Monitoring Measures

Pleistocene and early Holocene surficial deposits, such as alluvium, colluvium, talus, and playa deposits, have a low paleontological sensitivity ranking. Monitoring would not be required, but spot-checking may be conducted in certain areas at the discretion of the BLM Staff Paleontologist. In the case of the Quaternary deposits, this would ensure that any older underlying fossiliferous sediments were not being affected.

If paleontological localities are identified in the Ormat Project Area the following mitigation and monitoring measures would be implemented:

1. Include site-specific evaluation of paleontological sensitivity for construction or maintenance activities requiring ground disturbance. For any construction or maintenance activity that requires ground disturbance Ormat would ensure that preconstruction studies include assessment of the site's paleontological sensitivity by a state-registered PG or qualified professional paleontologist. If the paleontological assessment determines that any of the substrate units that would be affected by the planned activity are highly sensitive for paleontological resources, the report would also

include recommendations for appropriate and feasible procedures to avoid or minimize damage to any resources present, prepared by a qualified professional paleontologist. Ormat would be responsible for ensuring implementation of the measures identified.

The potential for impacts on paleontological resources as a result of construction or maintenance activities is lower because ground disturbance associated with these activities is typically confined to existing ROWs and immediately adjacent areas, which have already undergone some level of disturbance associated with installation and maintenance of existing infrastructure. To ensure that further ground disturbance does not result in additional damage to paleontological resources, Ormat would also implement the following measure for all activities except emergency repairs; note that this measure would also ensure against impacts as a result of any new minor construction not subject to site-specific geotechnical investigation.

2. Stop work if substantial fossil remains are encountered during construction. If substantial fossil remains (particularly vertebrate remains) are discovered during construction or maintenance activities, work on the site would stop immediately until a state-registered PG or qualified professional paleontologist can assess the nature and importance of the find and a qualified professional paleontologist can recommend appropriate treatment. Treatment may include preparation and recovery of fossil materials so that they can be housed in an appropriate museum or university collection, and may also include preparation of a report for publication describing the finds. Ormat or the BLM would be responsible for ensuring that recommendations regarding treatment and reporting are implemented.

If emergency repairs are needed, Ormat would conduct repairs as rapidly as possible to ensure continuity of service and to protect public safety. As a result, it is typically infeasible to implement a stop work order, such as that required under Mitigation Measure 2, during emergency repairs. By their nature, emergency repairs affect existing infrastructure and thus would take place in ROWs and immediately adjacent areas that have already undergone some level of disturbance associated with installation and maintenance of existing utilities infrastructure. Consequently, the potential for impacts as a result of emergency repairs is considered low, but some potential nonetheless remains. Implementation of the following measure would reduce impacts on the extent feasible.

3. Implement follow-up assessment and remediation in the event paleontological resources are discovered during emergency repairs. If paleontological resources are discovered during emergency repairs, Ormat would ensure that they are evaluated by a state-

registered PG or qualified professional paleontologist as soon as practicable following the completion of all necessary and required repair work. If appropriate, a qualified professional paleontologist would develop a remedial treatment plan consistent with the prevailing standard of care for paleontological resources. The treatment plan may provide for any or all of the following: measures to prevent additional damage; recovery excavations; museum curation; preparation of a report documenting the find; and development of public outreach or educational materials or displays. Ormat would be responsible for ensuring that the recommendations of the treatment plan are implemented.

Residual Impacts

Although the well pads, associated pipelines, the Carson Lake Binary Power Plant and Substation, transmission line roadway, and access roads associated with the Proposed Action would not be public and are meant for operation and inspection purposes only, these operations could provide potential roadways for access to paleontological localities.

Alternative 1

Direct Impacts

Alternative 1 would involve the same or similar direct impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Indirect Impacts

Alternative 1 would involve the same or similar indirect impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Mitigation and Monitoring Measures

Alternative 1 would involve the same or similar direct impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Residual Impacts

Although the transmission line roadway would not be public and is meant for operation and inspection purposes only, it could be a potential roadway for access to paleontological localities.

No Action Alternative

Under the No Action Alternative, the BLM would continue to manage paleontological resources in compliance with federal laws and regulations.

Because the Proposed Action would not be constructed, construction-related impacts would be avoided.

Vulcan Project Area

Proposed Action

As discussed in **Section 3.15,** Paleontological Resources, it is unlikely that the Proposed Action would affect geologic units that have the potential to contain paleontological resources. Though many of the activities involved with the Proposed Action would result in some degree of ground disturbance, the presence of Quaternary alluvium and playa deposits and Tertiary volcanic deposits have low potential to contain paleontological resources.

Direct Impacts

If paleontological resources are present within the Vulcan Project Area, impacts on those resources are more likely to occur where ground disturbance takes place and the work site has not experienced substantial prior disturbance. The greatest concern would be new construction activities, which are likely to occur on previously undisturbed or largely undisturbed parcels. Substantial damage to or destruction of paleontological resources, as defined by BLM, would represent an impact to those resources. In most cases, new minor construction would require preparation of a site-specific paleontological investigation.

Indirect Impacts

No indirect impacts on paleontological resources are expected to result from the continuing operation of the Proposed Action.

Mitigation and Monitoring Measures

Pleistocene and early Holocene surficial deposits, such as alluvium, colluvium, talus, and playa deposits, have a low paleontological sensitivity ranking. Monitoring would not be required, but spot-checking may be conducted in certain areas at the discretion of the BLM Staff Paleontologist. In the case of the Quaternary deposits, this would ensure that any older underlying fossiliferous sediments were not being affected.

If paleontological localities are identified in the Vulcan Project Area the following mitigation and monitoring measures would be implemented:

1. Include site-specific evaluation of paleontological sensitivity for construction or maintenance activities requiring ground disturbance. For any construction or maintenance activity that requires ground disturbance Vulcan would ensure that preconstruction studies include assessment of the site's paleontological sensitivity by a state-registered PG or qualified professional paleontologist. If the paleontological assessment determines that any of the substrate units that would be affected by the planned activity are highly sensitive for paleontological resources, the report would also

include recommendations for appropriate and feasible procedures to avoid or minimize damage to any resources present, prepared by a qualified professional paleontologist. Vulcan would be responsible for ensuring implementation of the measures identified.

The potential for impacts on paleontological resources as a result of construction or maintenance activities is lower, because ground disturbance associated with these activities is typically confined to existing ROWs and immediately adjacent areas, which have already undergone some level of disturbance associated with installation and maintenance of existing infrastructure. To ensure that further ground disturbance does not result in additional damage to paleontological resources, Vulcan would also implement the following measure for all activities except emergency repairs; note that this measure would also ensure against impacts as a result of any new minor construction not subject to site-specific geotechnical investigation.

2. Stop work if substantial fossil remains are encountered during construction. If substantial fossil remains (particularly vertebrate remains) are discovered during construction or maintenance activities, work on the site would stop immediately until a state-registered PG or qualified professional paleontologist can assess the nature and importance of the find and a qualified professional paleontologist can recommend appropriate treatment. Treatment may include preparation and recovery of fossil materials so that they can be housed in an appropriate museum or university collection, and may also include preparation of a report for publication describing the finds. Vulcan or the BLM would be responsible for ensuring that recommendations regarding treatment and reporting are implemented.

If emergency repairs are needed, SPPC would conduct repairs as rapidly as possible to ensure continuity of service and to protect public safety. As a result, it is typically infeasible to implement a stop work order, such as that required under Mitigation Measure 2, during emergency repairs. By their nature, emergency repairs affect existing infrastructure and thus would take place in ROWs and immediately adjacent areas that have already undergone some level of disturbance associated with installation and maintenance of existing utilities infrastructure. Consequently, the potential for impacts as a result of emergency repairs is considered low, but some potential nonetheless remains. Implementation of the following measure would reduce impacts on the extent feasible.

3. Implement follow-up assessment and remediation in the event paleontological resources are discovered during emergency repairs. If paleontological resources are discovered during emergency repairs, Vulcan would ensure that they are evaluated by a state-

registered PG or qualified professional paleontologist as soon as practicable following the completion of all necessary and required repair work. If appropriate, a qualified professional paleontologist would develop a remedial treatment plan consistent with the prevailing standard of care for paleontological resources. The treatment plan may provide for any or all of the following: measures to prevent additional damage; recovery excavations; museum curation; preparation of a report documenting the find; and development of public outreach or educational materials or displays. Vulcan would be responsible for ensuring that the recommendations of the treatment plan are implemented.

Residual Impacts

Although power plant access routes would not be public and are meant for operation and inspection purposes only, these operations could provide potential roadways for access to paleontological localities.

Alternative 1

Direct Impacts

Alternative 1 would involve the same or similar direct impacts as those described for the Proposed Action and for the action proposed by SPPC for the Bass Flat Switching Station. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Indirect Impacts

Alternative 1 would involve the same or similar indirect impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Mitigation and Monitoring Measures

Alternative 1 would involve the same or similar direct impacts as those described for the Proposed Action. Consequently, impacts on paleontological resources would essentially be the same under Alternative 1 as those described for the Proposed Action, and the same mitigation strategy would apply.

Residual Impacts

Although the transmission line roadway would not be public and is meant for operation and inspection purposes only, it could be a potential roadway for access to paleontological localities.

No Action Alternative

Under the No Action Alternative, the BLM would continue to manage paleontological resources in compliance with federal laws and regulations.

Because the Proposed Action would not be constructed, construction-related impacts would be avoided.

4.17 VISUAL RESOURCES

Summary

Assessment Methodology

Potential impacts on visual resources are analyzed by assessing direct and indirect impacts from actions that would change the visual resources and scenic quality by either introducing intrusions into the landscape or, conversely, protecting the landscape from such visual intrusions.

The BLM VRM Class Objectives are used in analyzing impacts on visual resources. These objectives provide a baseline for determining how much a proposed action would affect visual resources and scenic quality, as well as determining the level of disturbance an area can support while still meeting visual resource objectives. The BLM VRM Class Objectives and descriptions are described in detail in BLM Handbook H-8431-1, Visual Resource Contrast Rating (BLM 1986).

The criteria for analysis are the number of acres proposed for designation under the VRM classes and the level of impacts and surface disturbances permitted under each class. At the broad-scale level, analysis of the impacts on visual resources is discussed in terms of the number of acres in each VRM class, because the proposed actions would be required to comply with the designated VRM Class Objectives within the Stillwater Field Office area.

Impacts occur if actions result in not meeting the objectives of the designated VRM class. The land directly associated with the proposed project has been classified as Class III by the BLM. Class III objectives are to partially retain the existing character of the landscape. The level of change to the landscape is determined by the BLM contrast rating system, which is described in BLM Handbook H-8431-1, Visual Resource Contrast Rating (BLM 1986).

The contrast rating process includes obtaining a project description, verifying VRM objectives, selecting Key Observation Points (KOPs), preparing visual simulations, and completing the contrast rating from those key observation points. This rating was completed in the field by a team trained and qualified in the BLM VRM process. The degree of contrast can be rated as none, weak, moderate, or strong. Factors taken into consideration when making this rating are viewing distance, angle, relative size, or scale, and spatial relationships. The Proposed Action and Alternatives are rated against the existing landscape for form, line, color, and texture.

Indicators

Potential visual impacts associated with the project are identified and assessed according to criteria listed previously. The primary indicators of visual impacts would be the visual simulations and contrast ratings worksheets that were completed at key observation points. These define visual resources impacts.

Immediate and cumulative visual impacts would be considered when assessing environmental consequences. Since the Proposed Action includes infrastructure and there is an existing geothermal facility in place and several more proposed for the area, the cumulative impacts of these developments would be evaluated together.

Indicators include:

- Views of the project from key observation points, which include Grimes Point Lookout, the Pony Express National Historic Trail, and Highway 50. The level of viewer exposure measured in time from Highway 50 would be considered.
- Views of the project from area roadways, and viewing areas from the perspective of hunters, OHVs, and general recreationists on public lands.
- Views of the project from sensitive receptors, such as schools.
- Projected contrast to the existing landscape as a result of the Proposed Action and Alternatives. This would include consideration of the design color and site locations of plants and associated structures, lighting and security fencing, and the placement of access roads.

Region of Influence

The ROI for visual resources is the viewshed surrounding the SPPC, Ormat, and Vulcan Project Areas.

SPPC Project Area

Proposed Action

Where the transmission line would follow roads, generally from the Greenwave Substation to the Macari Switching Station, the single-pole structures used for the transmission line, the visual impacts would be more apparent since they are more heavily traveled. Along roads where poles would be visible, the transmission line corridor is on land not owned by BLM, but there are some points along the corridor that include BLM and Reclamation land.

The proposed 60-kV electric line fold across the street from the new Greenwave Substation would fold into an existing line runs along Sheckler Road and approximately 200 feet from the Lahontan Elementary School campus. Since

the electric line fold is tying into existing poles along two transmission lines, it would not be visible to the casual observer from the road or the school. The four new single-pole angle structures across Sheckler Road would be visible from the road but would be close enough to the existing poles that there would not be much of a change in the visual character of the area. The new poles would not be visible or barely visible from the school, as there is a vegetated buffer along the edge of the school property and the poles are more than 0.5 mile away.

The two proposed switching stations, the Bass Flat Switching Station and Pony Express Switching Station, would be built immediately adjacent to existing structures on BLM land. The Greenwave Substation would be on privately owned land. The substation would be larger than the two switching stations, and would cover more land area. The switching stations and substation would be visible from the existing structures in the immediate area.

Direct Impacts

The visual contrast rating stage (described in BLM Handbook H-8431-1, Visual Resource Contrast Rating, BLM 1986) involves determining whether potential visual impacts from the Proposed Action or Alternatives would conform to management objectives established for the area or whether design adjustments would be required. Foreseeable direct impacts were determined after reviewing contrast rating worksheets and producing visual simulations from KOPs. Figures in **Appendix J**, Visual Simulations, show the existing and simulated views at KOPs for the Proposed Action. **Figures J-1** through **J-10** are relevant to the SPPC Project Area.

Figures J-1, Observation Point 1, Exiting View and **J-2**, Simulated View of Proposed Action, show a northwestern view from Highway 50. The transmission line would barely be visible from this distance, but appears in the distant middle ground, between three to five miles away. There would be a faint view of the transmission line from this distance.

Figures J-3, Key Observation Point 2, Existing View and **J-4**, Simulated View of Proposed Action, show a southwestern view from the Grimes Point Lookout. Viewers from this lookout point represent sensitive receptors. The proposed transmission line would be visible in the middle ground, between 0.5 to five miles away, from the lookout. The Macari Switching Station would also be slightly visible from the point. Naval Air Station Fallon, industrial, and residential structures are also currently visible in the middle ground from the lookout point. The transmission line and substation would require some mitigation measures to reduce visual impacts.

Figures J-5, Key Observation Point 3, Existing View and **J-6**, Simulated View of Proposed Action, show a southward view from across Sheckler Road. The simulation depicts a view of the proposed Greenwave Substation. The substation would be a visual change for the site, as it is an undeveloped field.

Night lighting would not be used during the normal operation of the substation, and would be limited to emergency maintenance or repairs, so there would be minimal change in regard to lighting aesthetics. The new single-pole structures would also be a visual change, but the new poles would not alter the visual character of the area. There would also be visual impacts along Macari Lane and Highway 95. The area surrounding the proposed substation and electric line fold is developed with transmission lines, buildings, paved roads, and another substation approximately 0.75 mile away. The proposed substation would be a visible cultural modification and permanent change that would require mitigation.

Figures J-7, Key Observation Point 4, Existing View and **J-8**, Simulated View of Proposed Action, show a western view towards the existing ENEL Geothermal Power Plant. The SPPC proposed transmission line would be visible. This simulation shows the H-frame structures that would be used in rural areas along the 230-kV transmission line. This expanse is rural in character, and H-frame structures would only be accessible by remote and rarely used roads (often unpaved). Due to the remote nature of the land and the dark color of the H-frame structures, the transmission line would be visible to very few people. The poles would be wood and would blend in with the colors of the hills and background landscape. The proposed transmission line may be visible to people using off-road vehicles and OHVs for recreational purposes in the area. These uses are only intermittent and the visual impacts would be temporary.

Figures J-9, Key Observation Point 5, Exiting View and **J-10**, Simulated view of Proposed Action show a northwestern view from Macari Lane. The proposed SPPC transmission line would connect into the proposed Carson Lake Binary Power Plant and would continue east and south from privately owned land onto BLM land. There is an existing transmission line along the road. The Proposed Action would result in a visual impact for the area, but most of the impacts are associated with the power plant and not the transmission line. The proposed transmission line would impact the view; however the road already has cultural modifications in view including transmission lines, industrial structures, and Naval Air Station Fallon.

In sparsely developed and undeveloped areas, the poles, lines, switching station, and substations would be too distant to see from most areas frequented by the public. The new structures would at times be obstructed by hills, only visible for limited viewing times, or would be constructed in an existing utility corridor. This would result in temporary impacts. However, there would be locations where more apparent impacts on visual resources would occur. The Proposed Greenwave Substation on Sheckler Road would be an impact on the existing visual landscape. The Sheckler Road area is not BLM land but is well traveled, and the visual properties of the area would be changed. The proposed transmission line would be visible at some points along both Sheckler Road and Highway 95. In all of the instances where there would be visual impacts, there

are other cultural modifications in the area or surrounding. The overall visual impact of the Proposed Action would vary along the highway.

There would also be various temporary direct impacts during construction of the transmission line. SPPC would require a 300-foot-wide ROW for the transmission line. Each transmission structure would require temporary work pads. Numerous stringing sites, three staging areas of approximately 5 acres, and access roads would also be needed during construction. All of these temporary areas, including access roads, would be recontoured, decompacted, and seeded or left in place as directed by the BLM or landowner. These visual impacts would be temporary.

Indirect Impacts

Reasonably foreseeable indirect impacts that may or may not occur are an increase in development, if the project is built, or an increase in OHV use and visual land alteration due to access roads associated with the project. It is possible that if the Proposed Action or any of the project Alternatives are constructed, more development, such as other energy, infrastructural, industrial, commercial, or residential projects would be built in the same area. This may or may not result in a visual change in landscape character. Another indirect impact would be possible increased OHV and vehicle use along access roads associated with project infrastructure. This would result in an increase in ground scarring and leave a visible disturbance on the ground surface, vegetation, and color.

Mitigation and Monitoring Measures

Transmission line poles and cross arms similar in color to surrounding landscapes would be used whenever possible. The H-frame structures and steel single-pole structures would be aesthetically and structurally similar to existing poles. Substation and switching station design would use low profile components. Screening berms or landscaping would surround the substation whenever feasible to make it less visible from Sheckler Road and Highway 95. The fencing materials and structures associated with the substation would be nonreflective when possible. Also, equipment would be painted a BLM-approved color to blend in with predominant vegetation and soil whenever feasible. Existing vegetation on the substation site would be preserved to the extent possible and disturbed areas would be revegetated wherever possible.

Residual Impacts

This level of change, after including mitigation measures, to visual resources from the Proposed Action would conform to changes allowed in areas with a Class III VRM designation.

Alternative 1

Alternative 1 would avoid bisecting or bordering existing conservation easements, which have 80-foot height restrictions and have restrictions that uses must support agriculture. Constructing the transmission line in this configuration would have approximately the same amount of visibility as the

Proposed Action, as the roads are similar in traffic flow. The southern portion of the transmission line would run approximately 0.5 miles further south than the Proposed Action, which would make the line slightly less visible from Macari Lane.

Direct Impacts
Views from KOPs 1, 2, 3, 4, and 5 would be the same as the Proposed Action. Alternative 1 would have visual impacts similar to the Proposed Action as they both are located with distance from well-traveled roads and places that would be most visible to the public.

Indirect Impacts
Indirect impacts from Alternative 1 would be the same as the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for Alternative 1 would be the same as the Proposed Action.

Residual Impacts
This level of change, after including mitigation measures, to visual resources from Alternative 1 would conform to changes allowed in areas with a Class III VRM designation.

Alternative 2
Alternative 2 would have very similar impacts on the Proposed Action except would be more visible along Macari Lane. Macari Lane does have existing transmission lines, so the new transmission line would not change visually.

Direct Impacts
Views from KOPs 1, 2, 3, 4, and 5 would be the same as the Proposed Action. Alternative 2 would be slightly more visible than the Proposed Action, but only along Macari Lane.

Indirect Impacts
Indirect impacts from Alternative 2 would be the same as the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for Alternative 1 would be the same as the Proposed Action.

Residual Impacts
This level of change, after including mitigation measures, to visual resources from Alternative 2 would conform to changes allowed in areas with a Class III VRM designation.

Macari Fiber Optic Alternative

In this Alternative, the transmission line route would be the same as for the Proposed Action or chosen Alternative. The Alternative then includes a fiber optic cable going east-west along Macari Lane that would be routed in an underground trench. The cable pulling vaults on either side of the Fallon Canal and highway crossings would allow the cable to run above ground across the canal and highways and would be visible.

Direct Impacts

This Alternative would have slightly more visual impacts than the Proposed Action and Alternatives since the underground cable would not be visible above ground but the crossings would be visible.

Indirect Impacts

Indirect impacts from the Macari Fiber Optic Alternative would be the same as the Proposed Action.

Mitigation and Monitoring Measures

Mitigation measures for the transmission line would be the same as for the Proposed Action and Alternatives. The materials and components associated with the fiber optic line would be low-profile whenever possible. Also, equipment would be painted a BLM-approved color to blend in with predominant vegetation and soil whenever feasible. Existing vegetation on the substation site would be preserved to the extent possible and disturbed areas would be revegetated wherever possible.

Residual Impacts

This level of change, after including mitigation measures, to visual resources from the Macari Fiber Optic Alternative would conform to changes allowed in areas with a Class III VRM designation.

No Action Alternative

Under the No Action Alternative, none of the transmission lines, substations, or associated structures would be built and there would be no impact on visual resources.

Ormat Project Area

Proposed Action

The binary power plant structures would consist of structures that range from 35 to 52 feet. During times of high humidity, there would be some water vapor released from the cooling tower that would be visible. The power plant would be visible from Macari Lane (KOP 5) and visible from the Grimes Point Lookout (KOP 2). The power plant is located adjacent to BLM land, so it would be visible from public land.

The Carson Lake Binary Power Plant and Substation and Macari Switching Station would be visible from Macari Lane (KOP 5) but barely visible from the Grimes Point Lookout (KOP 2).

The 200-foot 230-kV transmission line connecting the Carson Lake Substation to the Macari Switching Station would be visible from Macari Lane (KOP 5) but barely visible from Grimes Point Lookout (KOP 2).

Insulated pipelines would also be required as part of the Proposed Action. These pipelines would be located on mostly BLM lands. The pipeline system would vary in diameter from 20 to 30 inches and would be 19.2 miles in length. The top of pipes would be approximately three feet high. The proposed pipelines connecting the wells would be visible from area roads. Approximately 4.6 miles of access roads would be constructed adjacent to pipeline corridors. Pipelines would generally follow proposed access roads, but could also be located within any areas identified in Figure 2-7, Ormat Proposed and Alternative Project Facilities. The pipeline and road corridors would be slightly visible in the distant middle ground from the Grimes Point Lookout. Road crossings and irrigation canal crossings would be developed to provide sufficient vertical clearance and would follow the Bureau of Reclamation Design Engineering and O&M Guidelines for crossings. The crossings would be approximately 20 feet in height and would be visible on BLM land and slightly visible from Grimes Point Lookout.

The well pads and production, injection, or observation wells would be most visible from area roads and only slightly from the Grimes Point Lookout.

Direct Impacts

The visual contrast rating stage (described in BLM Handbook H-8431-1, Visual Resource Contrast Rating, BLM 1986) involves determining whether potential visual impacts from the Proposed Action or Alternatives would conform to management objectives established for the area or whether design adjustments would be required. Foreseeable direct impacts were determined after reviewing contrast rating worksheets and producing visual simulations from KOPs. Figures in **Appendix J** show the existing and simulated views at KOPs for the Proposed Action. **Figures J-1**, **J-2**, **J-3**, **J-4**, **J-9** and **J-10** are relevant to the Ormat Project Area.

Figures J-3, Key Observation Point 2, Existing View and **J-4**, Simulated View of Proposed Action, show a southwestern view from Grimes Point Lookout. Viewers from this lookout point represent sensitive receptors. The Carson Lake Binary Power Plant and associated structures would be visible in the middle ground, between 0.5 to five miles away, from the lookout. Naval Air Station Fallon, industrial, and residential structures are also currently visible in the middle ground from the lookout point. The power plant would require some mitigation measures to reduce visual impacts.

Figures J-9, Key Observation Point 5, Existing View and, **J-10**, Simulated View of Proposed Action, show a northwestern view from Macari Lane. The Carson Lake Binary Power Plant and associated structures are visible and represent a change from existing conditions. The area is currently an undeveloped field on private land and is directly adjacent to BLM land. Macari Lane has a low flow of traffic and NAS Fallon is visible in the middle ground, or less than five mile viewshed. The power plant and associated structures would be visible in the foreground, or less than 0.5 mile, from Macari Lane and would require mitigation measures to reduce visual impacts.

The Ormat Proposed Action would have visual impacts on public land. Viewsheds from Grimes Point Lookout and Macari Lane would be affected, however, the Proposed Action would meet VRM Class III standards. There is some development in the Macari Lane area, but the Carson Lake Binary Power Plant and associated structures, well pads, and pipelines would be a noticeable change to the visual features and character of the rural area. The power plant, in particular, is visible and a very noticeable change. The Grimes Point Archaeological Site is a sensitive receptor, and the power plant area would be visible and may be disruptive to recreational visitors and sightseers. The pipeline corridor and 26 possible well pads would also be a noticeable change to the area, and would be most apparent from area roads. The overall visual impact from the Proposed Action would vary in different areas. There would be a visual impact on views from Grimes Point Lookout and on BLM land east of Macari Lane.

There would also be various temporary direct impacts during construction of the Proposed Action. Grading and filling would be required for the site and would take 3-4 weeks. Equipment would be delivered to the site on trucks from US Highway 50 via Macari Lane. Construction of the substation, switching station, and transmission line would be similar to the process described under the SPPC Proposed Action. Construction of the pipeline corridor would require additional access roads and structural supports over the entire length of the corridor. These temporary construction activities would not likely impact visual resources since the area is rural.

Indirect Impacts

Reasonably foreseeable indirect impacts that may or may not occur are an increase in development if the project is built, or an increase in OHV use and visual land alteration due to access roads associated with the project. It is possible that if the Proposed Action or the project Alternative is constructed, more development, such as other energy, infrastructural, industrial, commercial, or residential projects would be built in the same area. This would result in a visual change in landscape character, since the present state of the Project Area is rural and fairly remote. Another indirect impact would be possible increased OHV and vehicle use along access roads associated with project infrastructure.

This would result in an increase in ground scarring and leave a visible disturbance on the ground surface, vegetation, and color.

Mitigation and Monitoring Measures

All equipment would be painted a BLM-approved color to blend in with predominant vegetation and soil whenever feasible. Screening berms or landscaping would surround the power plant site and well sites whenever feasible to make them less visible from Macari Lane and Grimes Point Lookout. The fencing materials and structures associated with the power plant site and associated structures would be nonreflective when possible. Substation, switching station, and pipeline design would use low profile components. Transmission line poles and cross arms similar in color to surrounding landscapes would be used whenever possible. The pole structures would be aesthetically and structurally similar to existing poles in the area. Existing vegetation on the substation site would be preserved to the extent possible and disturbed areas would be revegetated wherever possible.

Residual Impacts

The Ormat Project Area Proposed Action would have visual impacts in certain areas, however, it would meet BLM VRM Class III objectives. These areas include viewsheds from Grimes Point Lookout and BLM land east of Macari Lane. Assuming all structures follow mitigation measures, these impacts would be reduced.

Alternative 1

An Alternative to the Proposed Action relocates two well sites and that portion of the pipeline. This Alternative would have the same visual impact as the Proposed Action. The relocated well sites and pipeline would be approximately the same distance from traveled roads, recreational areas, and sensitive receptors.

Direct Impacts

Views from KOPs 2 and 5 would be the same as the Proposed Action. There would be a visual impact on views from Grimes Point Lookout and on BLM land east of Macari Lane.

Indirect Impacts

Indirect impacts from Alternative 1 would be the same as the Proposed Action.

Mitigation and Monitoring Measures

Mitigation measures for Alternative 1 would be the same as the Proposed Action.

Residual Impacts

This Alternative would have the same visual impacts as the Proposed Action. In certain areas, Alternative 1 would not meet BLM Class III objectives. These areas include viewsheds from Grimes Point Lookout and BLM land east of

Macari Lane. Assuming all structures follow mitigation measures, the remaining portions of the project would meet BLM Class III management objectives.

No Action Alternative

Under the No Action Alternative, none of the Ormat Project Area Proposed Action would be built, and there would be no impact on visual resources.

Vulcan Project Area

Proposed Action

Vulcan proposes to utilize Power Plant Sites 3 and 5 for potential flash power plant facilities. Flash power plants have more of a visual impact as they release steam. Flash power plants would be visible further away than binary power plants. Power Plant Site 5 and associated structures would be visible from the Pony Express National Historic Trail.

Direct Impacts

The visual contrast rating stage (described in BLM Handbook H-8431-1, Visual Resource Contrast Rating, BLM 1986) involves determining whether potential visual impacts from the Proposed Action or Alternatives would conform to management objectives established for the area or whether design adjustments would be required. Foreseeable direct impacts were determined after reviewing contrast rating worksheets and producing visual simulations from KOPs. Figures in **Appendix J** show the existing and simulated views at KOPs for the Proposed Action. **Figures J-1**, **J-2**, and **J-11** through **J-17** are relevant to the Vulcan portion of the project.

Figures J-1, Key Observation Point 1, Exiting View and **J-2**, Simulated View of Proposed Action, show a northwestern view from Highway 50. The project is barely visible from this distance, but the faint outline of two of the power plants may appear in the horizon.

Figures J-11 through **J-15**, Key Observation Point 6, show a northern view from the Pony Express National Historic Trail in which power plant 5 would be visible. This may be a flash or a binary power plant. Either power plant would have a visual impact, but a flash power plant would have more effects than a binary power plant. The steam released from a flash power plant would be visible from further away and cause more of a visual disturbance than a binary power plant. An Alternative includes a transmission line that intersects the Pony Express National Historic Trail, which would be visible from this Key Observation Point. These impacts would occur even though the area has low accessibility and is very remote. Mitigation measures would be required to reduce impacts on the viewshed from the Pony Express National Historic Trail.

Figures J-16, Key Observation Point 7, Exiting View and **J-17**, Simulated View of Proposed Action show a western view from Highway 50. Power Plant Sites 1 and 4, several well pads, and the pipeline corridor are visible from this point.

The power plants are visible and Highway 50 is a well-traveled road. The existing viewshed is only slightly developed by existing geothermal infrastructure and would be disrupted by the proposed project. These proposed modifications would result in a visual change and would require mitigation.

Viewsheds from Highway 50 and the Pony Express National Historic Trail would be affected by the Vulcan Proposed Action. There is very little development visible surrounding Highway 50 southeast of Fallon, although the existing ENEL Geothermal Power Plant and several transmission lines are visible. The four proposed power plants and associated structures, well pads, and pipelines would be a noticeable change to the visual features and character of the mostly undeveloped area. Power Plant Sites 1 and 4, in particular, are visible from the highway and a noticeable change. The pipeline corridor and 26 possible well pads would also be a noticeable change to the area, and would also be somewhat visible from Highway 50. The Pony Express National Historic Trail area is a sensitive receptor and the binary or flash power plant, associated structures, and Alternative transmission line would be visible and may be disruptive to recreational visitors and sightseers. The overall visual impact of the Proposed Action would vary. There would be visual impacts from the Pony Express National Historic Trail and some points along Highway 50.

There would also be various temporary direct impacts during construction of the Proposed Action. Grading and filling would be required for the site and would take 3-4 weeks. Equipment would be delivered to the site on trucks from US Highway 50 via Macari Lane. Construction of the substation, switching station, and transmission line would be similar to the process described under the SPPC Proposed Action. Construction of the pipeline corridor would require additional access roads and structural supports over the entire length of the corridor. These temporary construction activities would not impact visual resources since the area is primarily undeveloped.

Indirect Impacts

Reasonably foreseeable indirect impacts that may or may not occur are an increase in development if the project is built, or an increase in OHV use and visual land alteration due to access roads associated with the project. It is possible that if the Proposed Action or the project Alternative is constructed, more development, such as other energy, infrastructural, industrial, commercial, or residential projects would be built in the same area. This would result in a visual change in landscape character, since the present state of the Project Area is rural and fairly remote. Another indirect impact would be possible increased OHV and vehicle use along access roads associated with project infrastructure. This would result in an increase in ground scarring and leave a visible disturbance on the ground surface, vegetation, and color.

Mitigation and Monitoring Measures

All equipment would be painted a BLM-approved color to blend in with predominant vegetation and soil whenever feasible. Screening berms or landscaping would surround the power plant site and well sites whenever feasible to make them less visible from Macari Lane. The fencing materials and structures associated with the power plant site and associated structures would be nonreflective when possible. Substation, switching station, and pipeline design would use low profile components. Transmission line poles and cross arms similar in color to surrounding landscapes would be used whenever possible. The pole structures would be aesthetically and structurally similar to existing poles in the area. Existing vegetation on the substation site would be preserved to the extent possible and disturbed areas would be revegetated wherever possible.

Residual Impacts

In some areas, the Proposed Action would not meet BLM Class III objectives. These areas of visual impact are portions of the project that can be seen from the Pony Express National Historic Trail and some parts of Highway 50. The visual changes proposed by Vulcan are compatible with BLM objectives for a Class III VRM area, provided that mitigation measures are included.

Alternative 1

An Alternative to the Proposed Action would happen if SPPC elects not to build the proposed project. In this event, Vulcan would build the Bass Flat Switching Station. The proposed interconnection transmission line would then be extended from Power Plant Site 5 to that switching station. The transmission line would be constructed adjacent to an existing road and the switching station would be constructed in similar to the ones described under the SPPC project.

Direct Impacts

Figure J-12, Key Observation Point 6, Simulated View of Proposed Action with Binary Plant, a simulation of this Alternative, is a northward view from the Pony Express National Historic Trail. The proposed transmission line is visible and a noticeable change from existing conditions. The proposed flash power plant is also visible in the middle ground, and has a visual impact.

The Pony Express National Historic Trail is a sensitive receptor and the proposed transmission line would be a highly visible change in the foreground viewshed from the trail.

Indirect Impacts

Indirect impacts from Alternative 1 would be the same as the Proposed Action.

Mitigation and Monitoring Measures

Transmission line poles and cross arms similar in color to surrounding landscapes would be used whenever possible. The pole structures would be aesthetically and structurally similar to existing poles in the area. Existing

vegetation on the substation site would be preserved to the extent possible and disturbed areas would be revegetated wherever possible.

Residual Impacts
Alternative 1 would not meet BLM Class III objectives. The visual impact from the proposed transmission line would be a highly noticeable change from the Pony Express National Historic Trail, a sensitive receptor.

No Action Alternative
Under the No Action Alternative, no part of Vulcan Project Area Proposed Action or its Alternative would be built and there would be no visual impacts.

4.18 LIVESTOCK GRAZING

Summary

Assessment Methodology
Grazing allotments overlapping the Salt Wells Energy Projects Area and the level of use, or AUMs, were identified using GIS data, BLM and Reclamation records and are outlined in **Section 3.18**, Livestock Grazing. The following steps were taken to analyze impacts on livestock grazing:

- Review Sierra Front-Northwestern Great Basin Standards and Guidelines for Rangeland Health;
- Using GIS technology, determine the approximate total area of land that would be lost to forage production within allotments due to construction and/or operation of the Project in both temporary and permanent time frames;
- Determine the number of AUMs lost in each affected allotment; and
- Determine any springs, water holes or other range improvements that would be affected by this action.

Indicators
The following indicators have been identified in order to evaluate potential project impacts on livestock grazing:

- Number of BLM and Reclamation livestock grazing allotments that have one or more elements of the project within them;
- The numbers of livestock currently using, or approved to use, these areas; and
- Locations of watering holes, springs, and other range improvements in relation to the direct effects area.

In order to compare effects associated with the Proposed Actions and Alternatives, these indicators were considered both independently and in conjunction with one another.

Region of Influence

The ROI for impacts on livestock grazing includes the BLM grazing allotments and Reclamation pastures that overlap with the Salt Wells Energy Projects Area.

SPPC Project Area

Proposed Action

Direct Impacts

The SPPC Proposed Action overlaps with two BLM grazing allotments and the Carson Lake Pasture in two areas.

Direct impacts include temporary loss of forage during construction (see **Table 4-15**, Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the SPPC Proposed Action and Alternatives). A portion of the forage base would be revegetated following construction of the transmission line. A smaller permanent loss of forage would occur in the footprint of the transmission poles and switching station sites, affecting less than 1 percent of available grazing acreage within the Rock Springs and Bass Flat Allotments. No AUMs would be lost resulting from the small amount of acreage removed from grazing under the Proposed Action.

Harassment and displacement of cattle could also occur during the construction phase of the project. A variety of range improvements may also be found on land that the transmission line may follow. Range improvements include, but are not limited to, water sources, fences, and gates. In areas where construction of the transmission line and improvements coincide, sections may need to be removed or opened to accommodate construction traffic.

The Greenwave Substation would be located on private land and not impact public livestock grazing.

Indirect Impacts

Dust created from project construction could indirectly affect forage palatability by coating vegetation in the area adjacent to the Proposed Action. This indirect impact would be localized and temporary.

Mitigation and Monitoring Measures

BLM rangeland management specialist and SPPC would coordinate with the permittees to locate range improvements within the Proposed Action and Alternatives areas of disturbance. SPPC would ensure that all temporary road

Table 4-15
Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the SPPC Proposed Action and Alternatives

Allotment/ Pasture	Temporary Disturbance (Acres)*	Permanent Disturbance (Acres)*
Proposed Action		
Rock Springs	224.75	96.75
Bass Flat	5.75	5.75
Alternative 1		
Rock Springs	224.75	96.75
Bass Flat	5.75	5.75
Alternative 2		
Rock Springs	224.75	96.75
Bass Flat	5.75	5.75
Macari Fiber Optic Alternative		
None		

*Includes transmission lines, switching stations, and substation disturbances on public land (if applicable).

or fence removal creating openings would have barriers across them to prevent the movement of livestock off range. SPPC would repair all damaged or removed range improvements after completion of construction activities.

Residual Impacts
No residual impacts are anticipated as a result of the Proposed Action and its mitigation measures.

Alternative 1

Direct Impacts
The SPPC Alternative 1 overlaps with two BLM grazing allotments. Alternative 1 overlaps with the Carson Lake and Pasture on Reclamation lands. Direct impacts would be the same as identified under the Proposed Action Alternative.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures would be the same as identified under the Proposed Action.

Residual Impacts
No residual impacts are anticipated as a result of Alternative 1 and its mitigation measures.

Alternative 2

Direct Impacts
The SPPC Alternative 1 overlaps with two BLM grazing allotments. Alternative 2 does not overlap with any pastures on Reclamation lands. Direct impacts would be the same as identified under the Proposed Action Alternative.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures would be the same as identified under the Proposed Action.

Residual Impacts
No residual impacts are anticipated as a result of Alternative 2 and its mitigation measures.

Macari Fiber Optic Alternative

Direct Impacts
The SPPC Macari Fiber Optic Alternative does not overlap with any BLM grazing allotments or pastures on Reclamation lands.

Indirect Impacts
No indirect impacts have been identified.

Mitigation and Monitoring Measures
No Mitigation measures would be needed.

Residual Impacts
No residual impacts are anticipated as a result of the Macari Fiber Optic Alternative and its mitigation measures.

No Action Alternative
Under the No Action Alternative, temporary and permanent impacts on grazing acreage and grazing improvements would not occur.

Ormat Project Area

Proposed Action

Direct Impacts

The Ormat Proposed Action overlaps with three pastures on Reclamation lands. The Proposed Action does not overlap with any BLM grazing allotments. Direct impacts would be similar to those identified under the SPPC Proposed Action. Less than one percent of available forage within the Carson Lake and Pasture would be permanently lost to livestock grazing operations under the Proposed Action. Three percent of available forage within Grimes Point Pasture would be permanently lost to livestock grazing operations under the Proposed Action (see **Table 4-16**, Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Ormat Proposed Action and Alternative). The loss of permanent forage would not necessitate reduction in AUMs or removal of any cattle.

Table 4-16
Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Ormat Proposed Action and Alternative*

Allotment/ Pasture	Temporary Disturbance (Acres)	Permanent Disturbance (Acres)
Proposed Action		
Grimes Point	105	61
Carson Lake and Pasture	147	92
Alternative		
Grimes Point	105	60
Carson Lake and Pasture	136	89

*Includes pipeline, well pad, substation, interconnect transmission line, switching station, and power plant disturbances on public land (if applicable)

Indirect Impacts

The possible reduction in water quantity due to reduction in groundwater levels or pressures in springs or seasonal wetlands (see Section 4.7) could affect livestock grazing on the Rock Springs Allotment, causing a greater concentration of cattle in other areas.

Mitigation and Monitoring Measures

Mitigation measures would be the same as identified under the SPPC Proposed Action.

Residual Impacts
Residual impacts would be the same as identified under indirect impacts. Alternative 1

Direct Impacts
The Ormat Alternative 1 overlaps with two pastures on Reclamation lands. Direct impacts would be the same as identified under the Proposed Action Alternative.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action Alternative.

Mitigation and Monitoring Measures
Mitigation measures would be the same as identified under the Proposed Action.

Residual Impacts
No residual impacts are anticipated as a result of Ormat's Alternative and its mitigation measures.

No Action Alternative
Under the No Action Alternative, temporary and permanent impacts on grazing acreage and grazing improvements would not occur.

Vulcan Project Area

Proposed Action

Direct Impacts
The Vulcan Proposed Action overlaps with two BLM grazing allotments and one pasture on Reclamation lands (see **Table 4-17**, Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Vulcan Proposed Action and Alternative). Direct impacts would be similar to those identified under the SPPC Proposed Action. Rock Springs Grazing Allotment would permanently lose 1.2 percent of forage under the Proposed Action. Less than one percent of forage would be permanently lost within the Bass Flat Grazing Allotment and the Carson Lake and Pasture under the Proposed Action. This permanent loss of forage would not necessitate a reduction of AUMs or removal of cattle.

Indirect Impacts
Indirect impacts would be the same as identified under the Ormat Proposed Action.

Table 4-17
Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Vulcan Proposed Action and Alternative

Allotment/ Pasture	Temporary Disturbance (Acres)	Permanent Disturbance (Acres)
Proposed Action		
Rock Springs	892	518
Bass Flat	93	59
Carson Lake and Pasture	113	61
Alternative		
Rock Springs	892	518
Bass Flat	271	136
Carson Lake and Pasture	112.6	60.6

*Includes pipeline, well pad, substation, interconnect transmission line, switching station, and power plant disturbances on public land (if applicable).

Mitigation and Monitoring Measures
Mitigation measures would be the same as identified under the SPPC Proposed Action.

Residual Impacts
Residual impacts would be the same as identified under indirect impacts.

Alternative 1

Direct Impacts
The Vulcan Alternative 1 overlaps with two BLM grazing allotments and one pasture on Reclamation lands. Direct impacts would be the same as identified under the Proposed Action Alternative.

Indirect Impacts
Indirect impacts would be the same as identified under the Proposed Action Alternative.

Mitigation and Monitoring Measures
Mitigation measures would be the same as identified under the Proposed Action.

Residual Impacts
No residual impacts are anticipated as a result of Vulcan's proposed Alternative and its mitigation measures.

No Action Alternative

Under the No Action Alternative, temporary and permanent impacts on grazing acreage and grazing improvements would not occur.

4.19 RECREATION

Summary

Assessment Methodology

Recreation uses and access were discussed in **Section 3.19, Recreation**. The analysis of potential impacts was based on the recreational use within and adjacent to the Salt Wells Energy Projects Area and existing access routes.

Indicators

Impacts on recreation use and access caused by the Proposed Actions or Alternatives were evaluated by determining the potential for:

- Changes in access to, or visitor satisfaction with, existing recreation areas or sites, or
- Modifications to existing routes of travel or courses for motorized recreational users.

Region of Influence

The ROI for impacts on recreation is the Salt Wells Energy Projects Area.

SPPC Project Area

Proposed Action

The SPPC Proposed Action facilities would be located primarily on private land and along existing easements and ROWs. The portion of the SPPC Project that includes the 230-kV transmission line from the Macari Switching Station to the Pony Express Switching Station would be constructed on lands administered by Reclamation and the BLM. In addition, SPPC proposes construction of the Pony Express and the Bass Flat Switching Stations on lands administered by the BLM. Existing access roads would be used for construction of the transmission line and switching stations to the extent feasible. Temporary centerline and spur roads would be constructed for use during construction of the transmission line. After construction has been completed all temporary access and spur roads would be recontoured, decompacted, and seeded. SPPC would attempt to close or restrict vehicle access to areas that have been reclaimed and seeded until the reclamation success criteria have been achieved.

Direct Impacts

During construction of the transmission line, temporary access and centerline roads would be constructed and could result in increased OHV use of the areas until the roads are reclaimed. Construction could also result in temporary

access restrictions for recreational users on the Reclamation- or BLM-administered lands; however, these impacts would be localized and temporary. The current VORRA race route runs parallel to a portion of the proposed SPPC Project Area along Salt Wells Road, less than 0.5 mile to the east of the transmission line corridor and then cross the transmission line corridor approximately 3 miles northwest of the proposed Pony Express Switching Station location. The route then follows the gas pipeline road adjacent to the proposed Bass Flat Switching Station. The exact locations of the proposed transmission line poles are not known; however, there could be conflicts with the VORRA race route if the poles are located within or adjacent to the route, potentially creating a safety hazard. Construction could also result in temporary access restrictions to the VORRA race route. Although the Vegas-to-Reno race route runs parallel to the proposed Bass Flat Switching Station site, the site is surrounded by existing facilities including the Austin to Fort Churchill 230-kV transmission line. No impacts on the race or the route are anticipated.

The SPPC Proposed Action route would not result in direct impacts on recreation at the Pony Express Trail, Grimes Point Archaeological Site, or Hidden Cave due to the distance from these areas. The Proposed Action route is not near the Carson Lake and Pasture and would not result in modifications to access in that area; therefore, there would be no direct impacts on hunting or wildlife viewing from the Proposed Action.

Indirect Impacts

Visual impacts from the transmission line could have indirect impacts on recreation at Grimes Point Archaeological Site and Hidden Cave. Visual impacts associated with the Proposed Action are discussed in **Section 4.17**. Noise emitted by the 230-kV transmission line and Bass Flat Switching Station may also have indirect impacts on recreation in the area. Noise impacts are discussed in detail in **Section 4.22**.

Mitigation and Monitoring Measures

Potential safety hazards for the VORRA race route would be mitigated by working with the race coordinators and locating power poles a safe distance from the race route where feasible. Use or construction conflicts with the race would be mitigated by timing the transmission line construction to avoid the annual VORRA race.

Residual Impacts

No residual impacts would remain after the described mitigation measures are implemented.

Alternative 1

Direct Impacts

Impacts under Alternative 1 are the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts from Alternative 1 would be the same as the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for Alternative 1 would be the same as the Proposed Action.

Residual Impacts
No residual impacts would remain after the spur and centerline roads are reclaimed and mitigation measures are implemented.

Alternative 2

Direct Impacts
Impacts under Alternative 2 are the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts from Alternative 2 would be the same as the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for Alternative 2 would be the same as the Proposed Action.

Residual Impacts
No residual impacts would remain after the spur and centerline roads are reclaimed and mitigation measures are implemented.

Macari Fiber Optic Alternative

Direct Impacts
Impacts under the Macari Fiber Optic Alternative are the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts from the Macari Fiber Optic Alternative would be the same as the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for the Macari Fiber Optic Alternative would be the same as the Proposed Action.

Residual Impacts
No residual impacts would remain after the spur and centerline roads are reclaimed and mitigation measures are implemented.

No Action Alternative

Under the No Action Alternative, no changes to the existing recreation levels or uses would occur. No new access roads would be constructed; and no temporary access restrictions would result.

Ormat Project Area

Proposed Action

As discussed in **Section 3.19**, there are no OHV race routes within the Ormat Project Area but the Project Area is adjacent to the Carson Lake and Pasture and Grimes Point Archaeological Site.

Direct Impacts

During construction of the wells pads and pipelines, temporary access and spur roads would be constructed and could result in increased OHV use of the areas until the roads are reclaimed. Construction could also result in temporary access restrictions for recreational users on the Reclamation or BLM-administered lands; however, these impacts would be localized and temporary. Pipeline roads would be constructed for use during construction and maintenance of the pipelines. These roads would not modify or restrict current access to the Carson Lake and Pasture area; therefore there would be no permanent impacts on hunting or wildlife viewing in this area.

Indirect Impacts

The Proposed Action could result in indirect impacts on recreation at Grimes Point Archaeological Site due to visual and noise impacts during construction; however, the construction impacts would be temporary. Visual impacts from the power plant are addressed in **Section 4.17**. Noise impacts associated with the Proposed Action are discussed in **Section 4.22**.

Mitigation and Monitoring Measures

Construction of the wells and pipelines on the eastern boundary of the Carson Lake and Pasture resulting in access restrictions for the public would be timed to avoid the peak hunting and wildlife viewing seasons, as outlined in the POU, to minimize impacts on hunting and wildlife viewing activities in that area.

Residual Impacts

No residual impacts would remain after temporary access roads are reclaimed and mitigation measures are implemented.

Alternative 1

Direct Impacts

Impacts under Alternative 1 are the same as those described under the Proposed Action.

Indirect Impacts
Indirect impacts from Alternative 1 would be the same as the Proposed Action.

Mitigation and Monitoring Measures
Mitigation measures for Alternative 1 would be the same as the Proposed Action.

Residual Impacts
No residual impacts would remain after temporary access roads are reclaimed and mitigation measures are implemented.

No Action Alternative
Under the No Action Alternative, no changes to the existing recreation levels or uses would occur. No new access roads would be constructed and no temporary access restrictions would result.

Vulcan Project Area

Proposed Action
As discussed in **Section 3.19**, there are OHV race routes that traverse the southern and eastern portions of the Vulcan Project Area. In addition, the Project Area is adjacent to the Carson Lake and Pasture and near the Pony Express National Historic Trail.

Direct Impacts
During construction of the well pads and pipelines, temporary access and spur roads would be constructed and could result in increased OHV use of the areas until the roads are reclaimed. Construction could also result in temporary access restrictions for recreational users; however, these impacts would be localized and temporary. Pipeline roads would be constructed for use during construction and maintenance of the pipelines. These roads would not modify or restrict current access to the Carson Lake and Pasture area; therefore there would be no permanent impacts on hunting or wildlife viewing in this area.

The current VORRA race route crosses the Vulcan Project Area just east of proposed Power Plant Site 1 and well pad 24. As currently proposed the Vulcan pipeline route would cross the VORRA race route at Salt Wells Road and again to the west as the trail turns back to the south. The SPPC Proposed Action route would not result in direct impacts on recreation at the Pony Express National Historic Trail, Grimes Point Archaeological Site, or Hidden Cave due to the distance from these areas. The Proposed Action route is not near the Carson Lake and Pasture and would not result in modifications to access in that area; therefore, there would be no direct impacts on hunting or wildlife viewing from the Proposed Action.

Indirect Impacts

Visual impacts from a power plant at Power Plant Site 5 could have indirect impacts on recreational use of the Pony Express National Historic Trail. The Proposed Action could also result in indirect impacts on recreation due to visual and noise impacts during construction; however, the construction impacts would be temporary. Visual impacts from the power plant are addressed in **Section 4.17**. Noise impacts associated with the Proposed Action are discussed in **Section 4.22.**

Mitigation and Monitoring Measures

Construction of the wells and pipelines on the eastern boundary of the Carson Lake and Pasture resulting in access restrictions for the public would be timed to avoid the peak hours for hunting during the hunting season.

Potential use conflicts and safety hazards for the VORRA race route would be mitigated by coordinating with BLM to locate project facilities a safe distance from the race route where feasible. If necessary the VORRA route may be modified to avoid project facilities as was done to address safety concerns for the ENEL Geothermal Power Plant. In other areas, use or construction conflicts with the race would be mitigated by timing the transmission line construction to avoid the annual VORRA race.

Residual Impacts

No residual impacts would remain after the described mitigation measures are implemented.

Alternative 1

The VORRA race route runs along most of Vulcan's Alternative 230-kV corridor. In addition, the Vegas to Reno race route runs parallel to the existing Austin to Fort Churchill 230-kV transmission line and the Bass Flat Switching Station site.

Direct Impacts

Impacts under Alternative 1 would include those described for the Proposed Action. In addition, since the exact locations of the power poles are not known, there could be conflicts with the VORRA race route. If the poles are located within or adjacent to the route, this could create a safety hazard. Construction could also result in temporary access restrictions to the VORRA race route. Although the Vegas to Reno race route runs parallel to the proposed Bass Flat Switching Station site, the site is surrounded by existing facilities including the Austin to Fort Churchill 230-kV transmission line, and no impacts on the race or the route are anticipated.

Indirect Impacts

Indirect impacts under Alternative 1 would include those described for the Proposed Action. However, additional impacts on recreation could result from

noise emitted by the 230-kV transmission line and Bass Flat Switching Station. Noise impacts are discussed in detail in **Section 4.22**.

Mitigation and Monitoring Measures
Mitigation measures for Alternative 1 would include those outlined under the Proposed Action as well as additional measures. Potential safety hazards for the VORRA race route would be mitigated by locating power poles a safe distance from the race route as determined by the BLM and outlined in the POU/POD. Use or construction conflicts with the race would be mitigated by timing the transmission line construction to avoid the annual VORRA race.

Residual Impacts
No residual impacts would remain after temporary access roads are reclaimed and mitigation measures are implemented.

No Action Alternative
Under the No Action Alternative, no changes to the existing recreation levels or uses would occur. No new access roads would be constructed and no temporary access restrictions would result.

4.20 NATIONAL SCENIC AND HISTORIC TRAILS

Summary

Assessment Methodology
The locations of the trails were determined based on GIS data and USGS topographic maps for the area and are shown on **Figure 3-21**. As discussed in **Section 3.21**, the Pony Express National Historic Trail is located near and within the Salt Wells Energy Projects Area and several proposed project components cross the trail. Potential impacts on the viewshed for the trails are evaluated in the visual resources **Section 4.17**. Potential impacts on the historical and cultural aspects of the trail are evaluated in **Section 4.14**.

Indicators
Indicators used to evaluate the potential impacts on National Scenic and Historic Trails include the following:

- Conflict with management goals and objectives set forth by the agency or agencies responsible for trail-wide management and by the BLM or National Park Service with on-site jurisdiction in order to sustain these resources and their visual or historic qualities;
- Result in proposed uses that are incompatible with maintaining and identifying National Scenic and Historic Trails and their qualities within and adjacent to their boundaries;
- Utilize all or any portion of a National Scenic and Historic Trail during any phase of project activities; or

- Install facilities or transmission lines within a National Scenic and Historic Trail's historic landscape.

Region of Influence

The ROI for National Scenic and Historic Trails is the Salt Wells Energy Projects Area.

SPPC Project Area

Proposed Action

Direct Impacts

The SPPC Proposed Action would not directly cross any National Scenic and Historic Trails, including the Pony Express National Historic Trail. The Pony Express Switching Station is adjacent to the existing ENEL Geothermal Power Plant and no additional impacts on the viewshed of the Pony Express National Historic Trail would occur. Therefore, the Proposed Action would not have any direct effects on National Scenic and Historic Trails.

Indirect Impacts

The Pony Express and Bass Flat Switching Stations would potentially be visible from a portion of the Pony Express National Historic Trail over time, although due to their small size, location adjacent to the existing ENEL Geothermal Power Plant, and distance from the trail, viewshed impacts are unlikely (see **Section 4.17**, Visual Resources).

Mitigation and Monitoring Measures

Mitigation and monitoring measures are not needed for the SPPC Proposed Action to reduce impacts on National Scenic and Historic Trails.

Residual Impacts

Residual impacts on National Scenic and Historic Trails are not anticipated from the SPPC Proposed Action.

Alternative 1

Direct Impacts

As described for the Proposed Action, direct impacts are not anticipated under Alternative 1.

Indirect Impacts

Indirect impacts on National Scenic and Historic Trails under Alternative 1 would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures

Mitigation and monitoring measures are not needed for Alternative 1 to reduce impacts on National Scenic and Historic Trails.

Residual Impacts
Residual impacts on National Scenic and Historic Trails are not anticipated from Alternative 1.

Alternative 2

Direct Impacts
As described for the Proposed Action, direct impacts are not anticipated under Alternative 2.

Indirect Impacts
Indirect impacts on National Scenic and Historic Trails under Alternative 2 would be the same as those described for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures are not needed for Alternative 2 to reduce impacts on National Scenic and Historic Trails.

Residual Impacts
Residual impacts on National Scenic and Historic Trails are not anticipated from Alternative 2.

Macari Fiber Optic Alternative

Direct Impacts
As described for the Proposed Action, direct impacts are not anticipated under the Macari Fiber Optic Alternative.

Indirect Impacts
Due to its distance from the Pony Express National Historic Trail, indirect impacts on National Scenic and Historic Trails are not anticipated from the Macari Fiber Optic Alternative.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would not be necessary for the Macari Fiber Optic Alternative.

Residual Impacts
Residual impacts on National Scenic and Historic Trails are not anticipated from the Macari Fiber Optic Alternative.

No Action Alternative
The No Action Alternative would have no impacts on National Scenic and Historic Trails.

Ormat Project Area

Proposed Action

Direct Impacts
The Ormat Proposed Action would not directly cross any National Scenic and Historic Trails, including the Pony Express National Historic Trail. As such, the Proposed Action would not have any direct effects on National Scenic and Historic Trails.

Indirect Impacts
Due to its distance from the Pony Express National Historic Trail, the Ormat Proposed Action is not anticipated to have indirect effects on National Scenic and Historic Trails.

Mitigation and Monitoring Measures
Mitigation and monitoring measures are not needed for the Ormat Proposed Action to reduce impacts on National Scenic and Historic Trails.

Residual Impacts
Residual impacts on National Scenic and Historic Trails are not anticipated from the Ormat Proposed Action.

Alternative 1

Direct Impacts
Alternative 1 would not directly cross any National Scenic and Historic Trails, including the Pony Express National Historic Trail. As such, the Proposed Action would not have any direct effects on National Scenic and Historic Trails.

Indirect Impacts
Due to its distance from the Pony Express National Historic Trail, Alternative 1 is not anticipated to have indirect effects on National Scenic and Historic Trails.

Mitigation and Monitoring Measures
Mitigation and monitoring measures are not needed for Alternative 1 to reduce impacts on National Scenic and Historic Trails.

Residual Impacts
Residual impacts on National Scenic and Historic Trails are not anticipated from Alternative 1.

No Action Alternative

Under the No Action Alternative, no impacts on National Scenic and Historic Trails would occur.

Vulcan Project Area

Proposed Action

Direct Impacts
The Vulcan Proposed Action would not directly cross any National Scenic and Historic Trails, including the Pony Express National Historic Trail. As such, the Proposed Action would not have any direct effects on National Scenic and Historic Trails.

Indirect Impacts
Proposed power plant at Power Plant Site 5, as well as associated structures, would be visible from a portion of the Pony Express National Historic Trail. This could have visual impacts on the historic landscape, as described in **Section 4.17**, Visual Resources. However, in accordance with the 2006 Memorandum of Understanding, which calls for viewshed protection for National Scenic and Historic Trails, the land managers have responsibility for resources and viewshed protection and would consider impacts and mitigation for the Proposed Action.

Mitigation and Monitoring Measures
Mitigation and monitoring measures described in **Section 4.17**, Visual Resources, would be implemented to reduce indirect visual impacts on the Pony Express National Historic Trail.

Residual Impacts
Residual visual impacts would occur for the Vulcan Project, since Power Plant Site 5 would remain visible from a portion of the Pony Express National Historic Trail.

Alternative 1

Direct Impacts
Alternative 1 includes the transmission line extension, which would cross the Pony Express National Historic Trail. Construction of the transmission line would increase noise and human presence in this otherwise remote and noiseless area, causing temporary potential impacts on visitor satisfaction for trail users near the construction site. Visitors, as well as special events, such as the Pony Express National Historic Trail re-ride, would not be able to use a portion of the trail during construction activities, which would impact visitor satisfaction and conflict with the 2006 MOU, which includes provision of appropriate access. However, Alternative 1 would not permanently preclude use of the Pony Express National Historic Trail.

Construction would disturb surface soils, which would potentially destroy evidence of surface features associated with the trail over time, causing impacts on cultural resources, as described in **Section 4.14**, Cultural Resources.

Indirect Impacts
Operation of the transmission line, Power Plant Site 5, and associated facilities would have permanent visual impacts, described in **Section 4.17**, Visual Resources. The transmission line would cross the trail and would be visible along a portion of the trail to the north and south for several miles. This would be in conflict with the 2006 Memorandum of Understanding, which calls for viewshed protection for National Scenic and Historic Trails.

Mitigation and Monitoring Measures
To mitigate for the potential impacts on visitor satisfaction, the proposed project would not be constructed during the timeframe when the Pony Express National Historic Trail re-ride occurs. This usually occurs over a two week period in June, although project proponents would coordinate with the organizers of the event to determine the exact dates and to completely avoid impacting this event.

Mitigation and monitoring measures described in **Section 4.17**, Visual Resources, would be implemented to reduce indirect visual impacts on the Pony Express National Historic Trail.

Residual Impacts
Residual visual impacts would occur for Alternative 1, since the transmission line and Power Plant Site 5 would remain visible from a portion of the Pony Express National Historic Trail.

No Action Alternative
Under the No Action Alternative, no impacts on National Scenic and Historic Trails would occur.

4.21 NOISE

Summary

Assessment Methodology
For this analysis, application of the EPA noise control ordinance guidelines were used as a guide for assessing impacts at the nearest home, ranch, business, or identified receptor, and all identified sensitive receptors.

For the purposes of the noise impact analysis, the following qualitative terms describe the potential impact levels associated with the Alternatives:

Major – Noise impacts in residential areas would exceed the thresholds set for residential areas in the commonly implemented version of the EPA Model Community Noise Control Ordinance of:

- 75 dBA Ldn instantaneously
- 65 dBA for 15 minute average

- 55 dBA Ldn for one hour or 24 hour average

Moderate – Noise impact would represent a noticeable increase over background levels that could approach but not reach the major noise impact threshold.

Minor – Noise impacts could be higher than current background noise levels, but would not approach the major noise impact thresholds on any timeframe.

Negligible – Noise impacts would be at or lower than background noise levels and therefore indistinguishable from typical background noise.

Construction

For all project-related construction activity, the nearest sensitive receptor is identified, and impacts on that and other potential receptors have been assessed.

The duration of construction activity at any particular site is generally expected to be brief, measured in weeks to months, except in staging areas and at the power plant sites. Along the linear construction lines, a qualitative assessment of impact to sensitive receptors and duration of that impact was completed.

The unit of sound level measurement (i.e., volume) is the dB, expressed as dBA. The A-weighted decibel measure is used to evaluate ambient noise levels and common noise sources. Sound measurements in dBA give greater emphasis to sound at the mid- and high- frequency levels, which are more discernible to humans. The decibel is a logarithmic measurement; thus, the sound energy increases by a factor of 10 for every 10 dBA increase. A 3 dBA change in noise levels is considered barely perceptible, while a 5 dBA change is typically perceptible to most people. Noise level attenuates by 6 dBA for every double of distance from the source.

Neither Nevada nor Churchill County has regulations quantitatively limiting noise generation or impacts from the proposed projects during the construction or operational phases. The EPA has prepared a Model Community Noise Control Ordinance to provide guidance for local communities or jurisdictions to design noise control regulations (EPA undated). One of the more commonly used applications of the EPA noise control guidelines is the recommendation that noise levels should be limited to 55 dBA Ldn for a daily and hourly average, allowing for higher impacts for shorter averaging periods, with a maximum noise impact of 75 dBA Ldn at any time in residential areas.

Geothermal Operations

Noise impacts were evaluated for the operational phase of the project using the indicators, but also included a comparison against the BLM-adopted noise restriction for projects on federal leases. The USGS Geothermal Resources Operational Order No. 4 states that geothermal-related activities on federal

leases would not exceed a noise level of 65 dBA at the lease boundary or at 0.8 kilometers (0.5 miles) from the source, whichever is greatest (USGS 1974). Noise from power plants was evaluated using noise data from existing geothermal power plants that employ similar technologies.

Indicators

The primary indicator of noise levels for this and similar analyses is the A-weighted average noise level measured in decibels (LAeq). The one-hour average noise level (dBA LAeq (1 hour)) is often used to characterize ongoing operations or longer-term impact analyses. The maximum dBA level (dBA Lmax) is used to document the highest intensity, temporary noise level. Another commonly used measure of noise impacts is Ldn. The Ldn value matches the LAeq value for noise generated from 7 a.m. to 10 p.m., but accounts for increased public sensitivity to noise at night by the A-weighted equivalent sound level for a 24-hour period with an additional 10 dB imposed on the equivalent sound levels for night time hours of 10 p.m. to 7 a.m.

Region of Influence

The ROI for the noise analysis is one mile from all project activities.

SPPC Project Area

Proposed Action

Direct Impacts

The construction and maintenance of the transmission lines and substations would involve noise-making activities from blasting and equipment used for drilling, earth moving, and hauling. This would occur along the transmission routes, along ROWs, in staging areas, at switching stations, and at the Greenwave Substation.

The exact layout and boundaries of the Greenwave Substation is still under consideration pending acquisition of properties by SPPC in the area to the southeast of the intersection of Scheckler Road and Allen Road. Seven residences, one school, and one church are located within 500 feet of the proposed Greenwave Substation. Some of the sensitive receptors may be bought out by SPPC to clear the land and build the substation; any such properties would be razed and would no longer be by the site of sensitive receptors. The Greenwave Substation would be constructed over approximately 6 to 9 months, depending on weather and worker availability.

The peak construction period for the transmission line is expected to last about 15 months. Because of the linear nature of the transmission line portion of the project, workers, noise-making activities, and equipment are not expected to be in one place for a long period of time. Also, noise from blasting would be limited in frequency and would be temporary (less than half a second).

To minimize impacts on ambient noise levels when near noise-sensitive receptors, SPPC's standard work procedures include limiting activities producing noise to Monday through Saturday from 7 a.m. to 5 p.m. Otherwise, work may occur for 12-hours per day on every day of the week. The specified hours of construction and maintenance would not apply to driving on access roads or work that does not substantially exceed exterior ambient noise levels. Construction equipment would be equipped with manufacturer-recommended (or other appropriate) mufflers. As a result, construction of the Greenwave Substation would involve minor temporary noise impacts on nearby receptors for the duration of the 6 to 9 month construction period. There would also be minor temporary impacts on ambient noise levels during construction of transmission line routes adjacent to and through populated areas.

Operation of the SPPC project components would result in noise from the transmission lines and towers, noise from activities for routine inspection and maintenance of the new facilities, and noise from the switching station and substation facilities. Noise from routine maintenance is considered to be low, intermittent, and would not represent an impact to any sensitive receptors.

Noise generated by the Greenwave Substation may affect residences, a school, and a church that are located nearby. The transformers within substations emit low frequency noise (120 hertz) that is heard as a humming sound, which results from vibrations caused by expansion and contraction of the transformer core. Whether such noise can be heard outside a substation depends on a number of factors, including transformer type and the level of noise attenuation present (either engineered intentionally or provided by other structures). Transformers may be as close as 150 feet to the fence line of the substation.

Residents of properties near the substation could be impacted by operational noise of the transformers. The layout of the substation and the noise impacts on nearby residences would be addressed during the Churchill County permitting process for the facility. SPPC would file a permit application for siting the Greenwave Substation, which would involve an open, public forum. Residents with properties adjoining the substation would be notified and invited to provide comment to the Planning Commission.

Transmission line noise includes corona, insulator, and eolian noise.

"Corona" noise is the most common noise generated by transmission lines. Corona is the electrical ionization of air near the surface of the conductor and suspension hardware from the high electric field strength. This type of noise varies with both weather and voltage of the transmission line, and most often occurs in conditions of heavy rain and high humidity (typically greater than 80 percent). An electric field surrounds power lines and causes implosion of ionized water droplets in the air, which produces the sound.

During relatively dry conditions, corona noise typically results in continuous noise levels of 40 to 50 dBA in close proximity to the transmission line, such as at the edge of the right-of-way. During wet or high humidity conditions, corona noise levels typically increase to levels of 50 to 60 dBA and possibly higher. Corona noise levels vary from location to location due to differences in conductor surface defects, damage, dust, and other factors. Due to the dry climate and lack of humidity in the high desert climate of the SPPC Project Area, elevated noise from corona is only expected during and following precipitation events. Due to the limited precipitation experienced in the Project Area, the lack of sensitive receptors direction adjacent to the transmission line ROW and the overall elevated background noise levels due to NAS Fallon overflights, impacts from corona noise are expected to be negligible.

The newer polymer insulators that are used today minimize this type of noise. Due to the use of polymer insulators, the lack of sensitive receptors directly adjacent to the transmission line ROW and the overall elevated background noise levels due to NAS Fallon overflights, impacts from insulator noise are expected to be negligible.

Eolian noise is the sound of wind blowing through conductors and frames. This type of noise is generally infrequent and varies with wind velocity and direction. Wind must blow steadily and perpendicular to the lines to set up an eolian vibration, which can produce resonance if the frequency of the vibration matches the natural frequency of the transmission line. High winds are common in the Project Area so eolian noise could potentially occur under appropriate conditions. High winds result in elevated noise conditions and naturally raise the ambient noise level.

Corona and eolian noise may be generated along the length of the transmission line route and could be audible at sensitive receptors directly adjacent to the ROW. Corona noise are typically not audible beyond the transmission line ROW and would therefore not be expected to affect any sensitive receptors; however, the Proposed Action does have 20 sensitive receptors located within 500 feet of the Greenwave Substation and transmission line ROW.

Eolian noise would be produced only during periods of high winds, which themselves produce higher levels of ambient noise. Twenty sensitive receptors are located within 500 feet of the Greenwave Substation and transmission line and may be affected by eolian noise during periods of high winds. Eolian noise is expected to be infrequent and quieter than the NAS Fallon overflights.

Indirect Impacts

No indirect noise impacts have been identified in relation to the Proposed Action.

Mitigation and Monitoring Measures
Since the exact location of the Greenwave Substation within the land parcel is not yet known, only general mitigation measures are proposed at the time of this writing. SPPC would do the following to reduce noise impacts:

- SPPC would meet the EPA noise threshold level of 55 dBA at the property line.

Additional measures to reduce noise may be considered by SPPC through the Churchill County permit application process, and may include:

- Planning the substation layout such that the noise-generating components are set back from sensitive receptors;
- Installation of a wall constructed of materials such as cinder blocks, which may reduce sound levels.

Residual Impacts
After mitigation, construction activities for the Greenwave Substation and the transmission line would still be audible at nearby sensitive receptors within the hours of 7 a.m. to 5 p.m. for the duration of those construction activities. Depending on final design and noise mitigation implemented through the Churchill County planning process, operation of the substation may or may not be audible from nearby sensitive receptors.

Alternative 1

Direct Impacts
Impacts from the Greenwave Substation would be as described under the Proposed Action. Potential impacts of transmission line operational noise are as described under the Proposed Action but could affect the additional 19 residences that were identified within 500 feet of the proposed transmission line.

Indirect Impacts
No indirect noise impacts have been identified in relation to Alternative 1.

Mitigation and Monitoring Measures
Mitigation measures are as described under the Proposed Action.

Residual Impacts
Residual impacts for construction activities at the Greenwave Substation and the transmission line would be as described under the Proposed Action, with additional residual impacts potentially occurring at 19 additional residences identified in close proximity to the transmission line ROW.

Alternative 2

Direct Impacts
Impacts from the Greenwave Substation would be as described under the Proposed Action. Potential impacts of transmission line operational noise are as described under the Proposed Action but could affect one additional residence that was identified within 500 feet of the proposed transmission line.

Indirect Impacts
No indirect noise impacts have been identified in relation to Alternative 2.

Mitigation and Monitoring Measures
Mitigation measures are as described under the Proposed Action.

Residual Impacts
Residual impacts for construction activities at the Greenwave Substation and the transmission line would be as described under the Proposed Action, with additional residual impacts potentially occurring at one additional residence that may occur in close proximity to the transmission line ROW.

Macari Fiber Optic Alternative

Direct Impacts
The Macari Fiber Optic Alternative would involve the installation of the fiber optic cable along a route that would come within 0.37 miles (2,000 feet) east of the nearest sensitive receptor, a residence along Macari Road. At this distance, there would be no noise impacts on this or any other sensitive receptor.

Indirect Impacts
No indirect noise impacts have been identified in relation to the Macari Fiber Optic Alternative.

Mitigation and Monitoring Measures
No mitigation measures were identified for the Macari Fiber Optic Alternative.

Residual Impacts
No residual impacts were identified for the Macari Fiber Optic Alternative.

No Action Alternative
No noise impacts were identified for the No Action Alternative.

Ormat Project Area

Proposed Action

Direct Impacts

Expected sources of noise associated with the Proposed Action include construction activities (earth-moving equipment for road, well pad, and sump pit construction), drilling operations, well testing, and power plant operation.

The only sensitive receptor potentially impacted by the Ormat proposed project would be the home located on Macari Road, 0.35 mile (1,850 feet) west of the Ormat 80 acre parcel, 0.49 mile (2,590 feet) from the proposed power plant, and 0.40 mile (2,100 feet) from the nearest proposed well pad. This section estimates the noise levels at the residence from all noise-generating activities associated with the proposed project.

Noise modeling was conducted based on existing noise data from geothermal operations at other locations. **Table 4-18**, Project Noise Contributions at Residence from Project Phases, shows the distance of the residence from each of the well pads and the estimated noise at the residence from each phase of the Proposed Action. Both the LAeq and the estimated noise range are provided in dBA.

Table 4-18
Projected Noise Contributions at Residence from Project Phases

Project Component	Distance from Residence (feet)	Estimated Noise at 50 feet (dBA)	Estimated Noise at Residence (dBA)
Well pad construction for C-i	2,100	70 - 95	37.5 – 62.5 LAeq = 50
C-i drilling	2,100	75 - 85	42.5 – 52.5 LAeq = 47.5
Well testing	2,100	90	55.7
Power Plant Construction	2,590	70 - 95	35.7 – 60.7 LAeq = 48.2
Power Plant Operation	2,590	75 - 85	40.7 – 50.7 LAeq = 45.7

Note: LAeq is calculated as the average sound level across the range.
Source: Leitner undated; Engineering Page 2009.

Impacts from Road, Well Pad and Power Plant Construction

Heavy earth-moving equipment is used to prepare roads, drill pads, and sumps. Sound pressure levels for these activities have been measured in the range of 70

to 95 dBA at a distance of 50 feet (Leitner undated). Average noise levels at the residence would be expected to be around 50 dBA for the construction activities at the nearest well pad (C-i), and 48.2 dBA for construction activities at the power plant. Construction of the well pads would take place consecutively and would take approximately one to two days per pad. Construction of the power plant would take approximately 15 months.

Impacts from Drilling Activities

The dominant noise sources associated with exploratory drilling are the large diesel engines that power the rotary rig and mud pumps and the large diesel-driven air compressors. These noise sources are consistent throughout drilling. Additional intermittent noise sources result from the hoisting of drill pipe or casing and the auto-driller. Hoisting during drilling is usually masked (sound-wise) by the air compressors, but the auto drillers are not. The auto-driller generates a loud squeal one, two, or more times throughout each well hole drilling. Drilling occurs 24 hours per day and is planned to continue for 45 to 60 days per well.

Typical sound levels during drilling when mud is used as the circulating medium range from 75 to 85 dBA at 50 feet (Leitner undated). Based on this data, average noise levels at the residence would be approximately 47.5 dBA during drilling of the nearest well, C-i. Drilling of the other wells would result in sounds levels at the residence of 41.5 dBA or less.

Impacts from Well Testing

The process of flowing geothermal wells to test production capability also generates noise. Noise is made primarily by the diesel generator that powers the down-hole electric pump, with lesser noise emitted from the fluids flowing through the well head and pipeline to the reinjection well. Additional noise may be realized from any additional diesel generator that is required to power a second pump at the injection well. Flow testing occurs 24 hours per day and would be conducted for 30 to 90 days per well.

Data from geothermal exploration in Imperial Valley, California, suggest that sound pressure levels during flow testing can be as high as 90 dBA at 50 feet (Leitner undated). Based on this data, noise levels at the residence would be expected to be as high as 55.7 dBA for the nearest well pad. Other well pads are at least twice the distance as the nearest well pad and so would be expected to result in noise levels at the residence of 50 dBA or lower, since noise levels drop by 6 dBA for every doubling in distance. Because the primary source of noise during flow testing is from the diesel generators, noise levels can be reduced through the use of hospital mufflers.

Impacts from Power Plant Operation

Noise from power plant operation was calculated using existing noise data for other geothermal power plants. Cooling towers, which are the main noise source in binary power plants, have been recorded as generating noise in the

range of 75 to 85 dBA at a distance of 50 feet. The middle of this range, 80 dBA, was used to calculate an estimated noise level of 45.7 dBA at the residence, although noise levels could be as high as 50.7 dBA.

Noise impacts on local wildlife are discussed in **Section 4.9**.

Indirect Impacts
No indirect noise impacts have been identified for the Proposed Action.

Mitigation and Monitoring Measures
The BLM would require the project proponent to ensure that mufflers are present on all diesel engines and any other components that can be muffled such that noise emissions are reduced by at least 15 dBA from the original, non-muffled noise level for the equipment.

The BLM would include that well pad construction activities for well C-i be limited to the 7 a.m. to 10 p.m. timeframe.

Residual Impacts
After mitigation, there would remain some audible noise during well pad construction, drilling, and flow testing of for well C-i; however, noise levels at the residence from project activities would be lower than noise levels from NAS Fallon jet overflights.

Alternative 1

Direct Impacts
Noise impacts would be the same as under the Proposed Action.

Indirect Impacts
No indirect noise impacts have been identified for Alternative 1.

Mitigation and Monitoring Measures
Mitigation and monitoring measures would be as described under the Proposed Action.

Residual Impacts
Residual noise impacts would be as described under the Proposed Action.

No Action Alternative
No noise impacts were identified for the No Action Alternative.

Vulcan Project Area

Proposed Action

Direct Impacts
There are no noise sensitive receptors near the Vulcan Project Area. No direct noise impacts on humans are anticipated. Noise impacts on local wildlife are discussed in **Section 4.9**.

Indirect Impacts
No indirect noise impacts have been identified for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures have been identified for the Proposed Action.

Residual Impacts
No residual noise impacts have been identified for the Proposed Action.

Alternative 1

Direct Impacts
Direct noise impacts for Alternative 1 are as discussed under the Proposed Action.

Indirect Impacts
No indirect noise impacts have been identified for Alternative 1.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are identified for Alternative 1.

Residual Impacts
No residual noise impacts have been identified for Alternative 1.

No Action Alternative
No noise impacts would result from the No Action Alternative.

4.22 PUBLIC HEALTH AND SAFETY

Summary

Assessment Methodology
Distances to schools, residences, businesses, and known contaminated sites were evaluated from various project components. Risk scenarios were developed for the points of interface between hazardous substances and the human environment, including direct handling, storage in the proximity of workers, and transportation along public routes.

Indicators

The following indicators were considered when analyzing potential impacts on public health and safety:

- Potential exposure to the public through the routine transport, use, or disposal of hazardous materials;
- Potential exposure to the public through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- Emission of hazardous emissions or handling of hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school;
- Collocation of a project component with a site included on a list of hazardous materials sites compiled by the federal or state government and, as a result, would create a hazard to the public; and
- Proximity, capacity, and response time of nearby fire, medical, and police services.

Region of Influence

The ROI for direct and indirect effects for public health and safety includes the biological survey area for each project. This includes the defined project footprint of each project facility, as well as a minimum 300-foot buffer, in some cases expanded to 500 feet if a facility was not well defined.

SPPC Project Area

Proposed Action

Direct Impacts

EMF Effects. Based on lateral profiles calculated for EMFs of transmission lines for similar projects (BLM 2004; Bonneville Power Administration 2006), it is anticipated that that the EMFs for the Proposed Action would be less than the most stringent state standards for transmission line EMFs at the edge of the ROW (there are no federal standards limiting occupational or residential exposure to 60-Hz EMF). For electric fields, this standard is 1.0 kV/m, and for magnetic fields it is 150 milligauss.

The magnetic field from substation and switching station equipment is typically low at locations beyond the substation or switching station property due to the placement of the equipment centrally within the station. Magnetic fields from substation equipment act as point sources and attenuate quickly with distance from the equipment. The dominant sources of magnetic fields near a substation or switching station are typically the electrical power lines that enter and exit

the substation and switching station, and, as described previously, the transmission lines would have minor impacts involving magnetic fields.

Worker and Site Safety. Use of hazardous materials during project construction, operation, and maintenance would pose potential health and safety hazards to construction and maintenance workers and nearby residents. These impacts would be associated with blasting (if required and approved), use of hazardous substances during construction and maintenance activities, and the potential for spills. However, SPPC would minimize these public health and safety hazards through compliance with existing laws regulating the use, storage, transportation, and disposal of hazardous materials; implementation of comprehensive BMPs, including those listed in **Appendix E**; and the preparation and implementation of the POD, which would address fire, emergency preparedness, and response, blasting, transportation management, flagging, and fencing, and general spill prevention control.

Construction, operation, and maintenance can affect general public safety along the transmission line routes, in staging areas, and at the proposed substation and switching station sites. This would involve, for example, safe passage past construction sites along roadways, fencing around the substation and switching stations to prevent unauthorized access, and proper installation and operation of equipment to prevent electrical shock or fire. These potential impacts would be minor because SPPC would comply with Nevada Department of Transportation roadway work zone safety requirements and ROW permits. SPPC would also comply with the National Electrical Safety Code at project sites.

Guy wires would present a potential collision hazard to OHV riders, bikers or horse riders. However, site safety requirements involve increasing visibility of the guy wires used to anchor the transmission line poles. If guy wires cross over any designated access roads, they would be marked or flagged, or signs would be posted.

Indirect Impacts

Indirect impacts on public health and safety are not expected from the Proposed Action.

Mitigation and Monitoring Measures

No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts

With implementation of the Environmental Protection Measures in **Appendix E**, as well as plans included in the POD, no residual impacts on public health and safety are expected from the Proposed Action.

Alternative 1

Direct Impacts
Direct impacts on public health and safety from Alternative 1 are expected to be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts on public health and safety are not expected from Alternative 1.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
With implementation of the Environmental Protection Measures in **Appendix E**, as well as plans included in the POD, no residual impacts on public health and safety are expected from Alternative 1.

Alternative 2

Direct Impacts
Direct impacts on public health and safety from Alternative 2 are expected to be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts on public health and safety are not expected from Alternative 2.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
With implementation of the Environmental Protection Measures in **Appendix E**, as well as plans included in the POD, no residual impacts on public health and safety are expected from Alternative 2.

Macari Fiber Optic Alternative

Direct Impacts
Direct impacts on public health and safety from the Macari Fiber Optic Alternative are expected to be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts on public health and safety are not expected from the Macari Fiber Optic Alternative.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
With implementation of the Environmental Protection Measures in **Appendix E**, as well as plans included in the POD, no residual impacts on public health and safety are expected from the Macari Fiber Optic Alternative.

No Action Alternative
Under the No Action Alternative, there would be no direct or indirect impacts on public health and safety.

Ormat Project Area

Proposed Action

Direct Impacts
Direct impacts on public health and safety for the Ormat Project would be similar to those described for the SPPC Project. However, impacts caused by EMF would be less of a concern for the Ormat Project, as the transmission line is only 200 feet long.

Indirect Impacts
Indirect impacts on public health and safety are not expected from Ormat's Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts on public health and safety are not expected from Ormat's Proposed Action.

Alternative 1

Direct Impacts
Direct impacts on public health and safety for Alternative 1 would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts on public health and safety are not expected from Alternative 1.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts on public health and safety are not expected from Alternative 1.

No Action Alternative
Under the No Action Alternative, there would be no direct or indirect impacts on public health and safety.

Vulcan Project Area

Proposed Action

Direct Impacts
Direct impacts on public health and safety for the Vulcan Project would be similar to those described for the SPPC Project. However, impacts caused by EMF would be less of a concern for the Vulcan Project, as the 230-kV interconnection line, switching station and power plants are not located near residences or developed areas

Indirect Impacts
Indirect impacts on public health and safety are not expected from Vulcan's Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts on public health and safety are not expected from Vulcan's Proposed Action.

Alternative 1

Direct Impacts
Direct impacts on public health and safety for Alternative 1 would be similar to those described for the Proposed Action.

Indirect Impacts
Indirect impacts on public health and safety are not expected from Alternative 1.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts on public health and safety are not expected from Alternative 1.

No Action Alternative
Under the No Action Alternative, there would be no direct or indirect impacts on public health and safety.

4.23 FIRE MANAGEMENT

Summary

Assessment Methodology
Fire management status of Salt Wells Energy Projects Area lands was acquired from the BLM and fire ignition risk scenarios were developed and evaluated.

Indicators
The following indicators were considered when analyzing potential impacts relative to fire management:

- Proximity, capacity, and response time of nearby fire, medical, and police services; and
- Fire risk status of lands potentially ignited by project-related actions.

Region of Influence
The ROI for direct and indirect effects for fire management includes the biological survey area for each project. This includes the defined project footprint of each project facility, as well as a minimum 300-foot buffer, in some cases expanded to 500 feet if a facility was not well defined.

SPPC Project Area

Proposed Action

Direct Impacts
Construction, operation, and maintenance of the transmission lines, switching stations, and substation for the Proposed Action could increase the potential for a fire in the SPPC Project Area. Construction and maintenance could start a fire

caused by equipment sparks, workers smoking, or ground disturbances that allow nonnative fire-prone vegetation to establish.

An energized transmission line could pose a fire hazard if a conducting object were to come into proximity to the transmission line, resulting in a flashover to ground, or if an energized phase conductor were to fall to the earth and remain in contact with combustible material long enough to ignite it. It is possible that an energized phase conductor could fall to the ground and cause a fire by creating an electrical arc that could ignite combustible material; however, this is a very unlikely event.

Indirect Impacts
The construction of access roads would temporarily increase accessibility of public lands to recreationalists, which would indirectly raise the risk of ignition of wildfires from smoking, camping, and other activities on public lands.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E.**

Residual Impacts
The implementation of the mitigation measures described previously would reduce potential fire-related impacts; however, the increased access to public lands provided through the access roads constructed as part of the project would result in temporary increases in risk of fire due to increased use by the public until the temporary access, spur and centerline roads have been reclaimed.

Alternative 1

Direct Impacts
Fire impacts under Alternative 1 would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts under Alternative 1 would be the same as described for the Proposed Action.

Alternative 2

Direct Impacts
Fire impacts under Alternative 2 would be the same as described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts under Alternative 2 would be the same as described for the Proposed Action.

Macari Fiber Optic Alternative

Direct Impacts
Fire impacts under the Macari Fiber Optic Alternative would be the same as described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts under the Macari Fiber Optic Alternative would be the same as described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, there would be no change in the potential for fire within the SPPC Project Area.

Ormat Project Area

Proposed Action

Direct Impacts
Construction, operation, and maintenance of the geothermal power plant, substation, switching station, transmission line, well pads, and pipelines could

increase the potential for fire in the Ormat Project Area. Possible sources of fire associated with construction and maintenance include equipment sparks, workers smoking, or ground disturbances that allow the establishment of nonnative fire-prone vegetation. In addition, pentane, a flammable working fluid used in the binary power plant, could increase the potential for fire.

Indirect Impacts
The construction of access roads would increase accessibility of public lands to recreationalists, which would indirectly raise the risk of ignition of wildfires from smoking, camping, and other activities on public lands.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
The implementation of the Environmental Protection Measures would reduce potential fire-related impacts; however, the permanent increased access to public lands provided through the access roads constructed as part of the project would result in permanent increases in risk of fire due to increased use by the public.

Alternative 1

Direct Impacts
Fire impacts under Alternative 1 would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts under Alternative 1 would be the same as described for the Proposed Action.

No Action Alternative
Under the No Action Alternative, there would be no change in the potential for fire within the Ormat Project Area.

Vulcan Project Area

Proposed Action

Direct Impacts
Construction, operation, and maintenance of 4 possible geothermal power plants, substations, a transmission line, well pads, and pipelines could increase the potential for fire in the Vulcan Project Area. Possible sources of fire associated with construction and maintenance include equipment sparks, workers smoking, or ground disturbances that allow the establishment of nonnative fire-prone vegetation. In addition, pentane, a flammable working fluid used in the binary power plant, could increase the potential for fire.

Indirect Impacts
The construction of access roads would increase accessibility of public lands to recreationalists, which would indirectly raise the risk of ignition of wildfires from smoking, camping, and other activities on public lands.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
The implementation of the Environmental Protection Measures would reduce potential fire-related impacts; however, the permanent increased access to public lands provided through the access roads constructed as part of the project would result in permanent increases in risk of fire due to increased use by the public.

Alternative 1

Direct Impacts
Fire impacts under Alternative 1 would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**.

Residual Impacts
Residual impacts under Alternative 1 would be the same as described for the Proposed Action.

No Action Alternative

Under the No Action Alternative, there would be no change in the potential for fire at the Vulcan Project Area.

4.24 WASTES, HAZARDOUS OR SOLID

Summary

Assessment Methodology

Data was collected from project proponents describing the types and volumes of hazardous and non-hazardous materials expected to be used, stored, and generated per unit time during both construction and operational phases. As available, disposal plans for these materials were also evaluated. Federal and state databases were checked to determine the presence of any contaminated sites within the Salt Wells Energy Projects Area.

Indicators

The following indicators were considered when analyzing potential impacts on resources from hazardous materials and solid waste:

- Acreage, nature, and proximity of existing contaminated sites included on a list of hazardous materials sites compiled by the federal or state government;
- Types of hazardous materials and wastes used during construction;
- Tons or pounds per year of hazardous wastes and by-products generated by project operations;
- Amount and type of hazardous materials transported and stored at the project facilities;
- Location and type of solid or hazardous waste disposal sites/systems; and
- Existing risk assessments of effects of hazardous compounds.

Region of Influence

The ROI for direct and indirect effects for hazardous materials includes the SPPC, Ormat, and Vulcan Survey Areas.

SPPC Project Area

Proposed Action

Direct Impacts

No hazardous materials were known to be stored within the SPPC Survey Area. Thus the Proposed Action would not expose workers to any preexisting

hazardous materials and wastes not associated with the Proposed Action during construction, operation, and maintenance.

Project construction and operation phases would involve hazardous material use. These materials would include, but would not be limited to, drilling additives and mud, diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, paint, and cleaners. The transport, use, or disposal of such hazardous materials could affect workers, the public, and the environment through accidental spills or emissions.

Indirect Impacts
Indirect impacts involving hazardous materials would entail transport and disposal of such materials to off-site locations, which could expose people and lands outside of the SPPC Project Area to hazardous materials.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**. These Environmental Protection Measures along with a Spill Contingency Plan would be incorporated into the POD.

Residual Impacts
No residual impacts have been identified for the Proposed Action.

Alternative 1

Direct Impacts
Impacts from hazardous materials under Alternative 1 would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be the same as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**. These Environmental Protection Measures along with a Spill Contingency Plan would be incorporated into the POD.

Residual Impacts
No residual impacts have been identified for Alternative 1.

Alternative 2

Direct Impacts
Impacts from hazardous materials under Alternative 2 would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts would be the same as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**. These Environmental Protection Measures along with a Spill Contingency Plan would be incorporated into the POD.

Residual Impacts
No residual impacts have been identified for Alternative 2.

Macari Fiber Optic Alternative

Direct Impacts
Impacts from hazardous materials under the Macari Fiber Optic Alternative would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts under the Macari Fiber Optic Alternative would be the same as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**. These Environmental Protection Measures along with a Spill Contingency Plan would be incorporated into the POD.

Residual Impacts
No residual impacts have been identified for the Macari Fiber Optic Alternative.

No Action Alternative

Under the No Action Alternative, there would be no impacts from hazardous materials.

Ormat Project Area

Proposed Action

Direct Impacts
The proposed power plant, substation, pipelines, wells, transmission lines, and access roads would be primarily on undeveloped land where no hazardous materials occur, so the project would not expose workers to any preexisting hazardous materials and wastes during construction, operation, and maintenance.

Project construction and operation phases would involve hazardous material use. These materials would include, but would not be limited to, drilling additives and mud, diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, geothermal water, laboratory materials, and ammonia water (working fluid). The primary types of exposure to pentane are from inhalation, skin contact, and eye contact. The transport, use, or disposal of such hazardous materials could affect workers, the public, and the environment through accidental spills or emissions.

General geothermal lease stipulations for geothermal developers and site workers would be adhered to in order to address the potential impacts involving hazardous materials.

The geothermal power plant would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes. A detailed reclamation plan, as part of the POU, would be developed in consultation with the US Navy, BLM, Reclamation, and other stakeholders before the power plant is built and operated.

Indirect Impacts
Indirect impacts involving hazardous materials would entail transport and disposal of such materials to off-site locations, which could expose people and lands outside of the Project Area to hazardous materials.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**. These Environmental Protection Measures along with a Spill Contingency Plan would be incorporated into the POU.

Residual Impacts
No residual impacts have been identified for the Proposed Action.

Alternative 1

Direct Impacts
Impacts from hazardous materials under Alternative 1 would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**. These Environmental Protection Measures along with a Spill Contingency Plan would be incorporated into the POU.

Residual Impacts
No residual impacts have been identified for Alternative 1.

No Action Alternative
Under the No Action Alternative, there would be no impacts from hazardous materials.

Vulcan Project Area

Proposed Action

Direct Impacts
The proposed power plants, substations, switching stations, wells, pipelines, transmission lines, and access roads would be primarily on undeveloped land where no hazardous materials occur, so the project would not expose workers to any preexisting hazardous materials and wastes during construction, operation, and maintenance.

Project construction and operation phases would involve hazardous material use. These materials would include, but would not be limited to, drilling additives and mud, diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, geothermal water, laboratory materials, and ammonia water (working fluid). The primary types of exposure to pentane are from inhalation, skin contact, and eye contact. The transport, use, or disposal of such hazardous materials could affect workers, the public, and the environment through accidental spills or emissions.

General geothermal lease stipulations for geothermal developers and site workers would be adhered to in order to address the potential impacts involving hazardous materials.

The geothermal power plant would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes. A detailed reclamation plan, as part of the POU/POD, would be developed in consultation with BLM and other stakeholders before the power plant is built and operated.

Indirect Impacts
Indirect impacts involving hazardous materials would entail transport and disposal of such materials to off-site locations which could expose people and lands outside of the Project Area to hazardous materials.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**. These Environmental Protection Measures along with a Spill Contingency Plan would be incorporated into the POU.

Residual Impacts
No residual impacts have been identified for the Proposed Action.

Alternative 1

Direct Impacts
Impacts from hazardous materials under Alternative 1 would be the same as those described for the Proposed Action.

Indirect Impacts
Indirect impacts under Alternative 1 would be as described for the Proposed Action.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond the Environmental Protection Measures detailed in **Appendix E**. These Environmental Protection Measures along with a Spill Contingency Plan would be incorporated into the POD/POU.

Residual Impacts
No residual impacts have been identified for Alternative 1.

No Action Alternative
Under the No Action Alternative, there would be no impact from hazardous materials.

4.25 SOCIAL AND ECONOMIC VALUES

Summary

Assessment Methodology

Impacts were analyzed in terms of the proposed increase in megawatts of geothermal energy and the associated changes expected in employment, income, tax revenue, public infrastructure needs, and other socioeconomic factors. Quantitative estimates were provided, when available, based on the best available data. Where quantitative data were not available, professional judgment was used to describe impacts using qualitative terms.

When secondary impacts are discussed, an economic multiplier effect of 2.5 is applied, based on standard multiplier effects observed in the geothermal industry (US DOE 2006b). This means that one dollar of investment in a geothermal venture produces $2.50 in economic activity, or for every job created at a geothermal power plant an additional 2.5 jobs are created. Only some of the secondary impacts would occur in the local community.

Indicators

Potential impacts on socioeconomics and environmental justice were evaluated based on the following indicators:

- Effect on other land uses that currently create revenue;
- Effect on local industry that supports other land uses such as recreation and hunting;
- Effect on the nonmarket values of open space;
- Effect on expenditures or income within the Salt Wells Energy Projects Area and Churchill County;
- Induced growth or concentrations of populations;
- Displacement of a proportion of available residences in a community;
- Creation of a demand for additional housing that could not be sustained within the area;
- A decrease in local or Projects Area employment; or
- Displacement or disruption of businesses.

Region of Influence

The ROI for impacts on Social and Economic Values is defined as Churchill County.

SPPC Project Area

Direct and indirect impacts on socioeconomics include the potential for job creation and property values changes.

Proposed Action

Direct and Indirect Impacts

Population and Economic Activity. The Proposed Action may cause minor increases in population and economic activity within Churchill County during power line, sub-station, and switching station construction. The Proposed Action would require a relatively small addition to the Churchill County construction workforce. The Proposed Action would cause both direct and indirect job creation.

Power line, switching station, and substation construction is expected to directly increase construction employment by approximately 25 to 50 employees for the 12 to 15 month construction period. Project construction may require additional support personnel contracted by SPPC, including construction inspectors, surveyors, project managers, and environmental inspectors. This increase in workers represents an approximate increase of 3 percent of the 1,642 workers in the Churchill County construction workforce in 2008.

Some of the construction jobs or additional service jobs may be filled by workers already residing within Churchill County, while some workers may come from outside of Churchill County to fill new jobs or as contracted employees from outside the region. Even if all the workers relocated to the Salt Wells Energy Projects Area from somewhere else, Churchill County has the infrastructure (e.g., temporary housing, schools, and public services) to absorb them without any socioeconomic impact. No substantial impacts on traffic in the area are anticipated as a result of workers travelling to and from project sites. Like most construction employment, the Proposed Action would be temporary and is not expected to result in a permanent increase in the population, employment, or spending within the region.

Based on the three percent temporary increase in construction employment, the Proposed Action is projected to result in a slight growth of the regional population and economic activity.

Property Values. Current land uses on private land in the area primarily include agriculture with a minimal amount of industrial and rural residential properties. The Proposed Action, particularly the proposed 230-kV transmission line, has the potential to reduce property value for these uses.

The development of the proposed Alternative would necessitate the acquisition of easements over private property for the development of the transmission

line. SPPC would provide financial compensation to private property owners when acquiring a property easement. Compensation for easements across private lands would be determined for each parcel as appropriate and would likely involve an appraisal process to identify the direct cost of purchasing an easement from a property owner and, where necessary, a calculation and compensation for consequential losses incurred on the remaining property as a result of power line construction. For the SPPC Proposed Action, a total of 35 parcels totaling 329 acres may require compensation along the proposed transmission line route. **Table 4-19**, Number of Parcels and Total Acreage (not managed by BLM) Potentially Requiring Easement Acquisition by Zoning Category, compares the properties that would be affected by easement acquisition for the Proposed Action and each of the Alternatives.

Table 4-19
Number of Parcels and Total Acreage (not managed by BLM) Potentially Requiring Easement Acquisition by Zoning Category[1]

		Agricultural(A5) 1 house per 5 acre parcel	Agricultural(A10)-1 house per 10 acre parcel	Industrial	Rural Residential (RR20) 1 house per 20 acres	Total Requiring Easement Acquisition
SPPC Proposed Action	Acres	49	149	0	131	X/329
	Parcels	18	31	1	2	X/52
Alternative 1	Acres	53	155	0	131	X/339
	Parcels	22	63	0	2	X/87
Alternative 2	Acres	49	148	0	131	X/328
	Parcels	18	32	1	2	X/53
Macari Fiber Optic Alternative	Acres	0	0	0	NA	X/X
	Parcels	0	0	0	1	X/1

[1]Acres and Parcels determined for permanent 125-foot ROW corridor for Proposed Action and Alternatives 1and 2. For the Macari Fiber Optic Alternative, easement of 6 feet required as described in Chapter 2.
Source: Churchill County 2010.

In addition, a review of current property value impact studies and the issue of high voltage power lines indicate that property values can be affected by the

proximity to a power line and that the effects can depend on site-specific conditions. Property values can be impacted by views toward a power line and from the uncertainty of power line-related health hazards. Conversely, potential benefits can result from an adjacent power corridor creating a large open area near a property, potential recreational uses within or adjacent to the corridor, and increased separation between houses that are on either side of a corridor. Other factors, such as terrain, vegetation, size of power line towers or pylons, views from a particular property, and views toward power lines, conductors, or towers also greatly influence private property values (De Rosiers 2002). In general, other factors such as general location, size of property, and supply and demand factors, are far more important criteria in determining the value of real estate. The majority of the proposed transmission line route would be in rural agricultural or industrial areas. For such areas, the Proposed Action is expected to result in a slight decrease in property values. The POD would include measures to minimize any direct impacts on area residents during project construction. All areas temporarily disturbed during construction activities would be reclaimed following project development.

Additional impacts on property values may occur as a result of the construction of the proposed Bass Flat and Pony Express Switching Stations, the Greenwave Substation, and the proposed 60-kV electric line folds. The Bass Flat and Pony Express Switching Stations would be built adjacent to existing structures on BLM land. The Greenwave Substation would be located on private land. All private property for these project components would be purchased by SPPC, and no additional easement acquisitions would be required. As described for the transmission line, the majority of the proposed locations are in rural areas or adjacent to existing energy structures and impacts on adjacent property value are expected to be minimal. The possible exception is the Greenwave Substation, which is located within 500 feet of several residences, one school, and one church. Mitigation measures proposed for visual impacts would ensure that the switching stations and other facilities blend into the environment as much as possible.

Other direct and indirect impacts. Additional direct impacts include contributions to the local government tax base from the construction of the project. Indirect tax contributions, as a result of increased economic activity in the local area are also possible.

Construction and operation of the Proposed Action could affect nearby recreational resources, which also could affect the economies of the areas in which the recreational resources are located if fewer visitors use the resources (and spend fewer dollars in the local economy). Revenues associated with recreation could decline if these activities were reduced or eliminated, or increase if they were made more accessible. Recreation in the area is dispersed and includes hunting, wildlife viewing, and OHV use. The Pony Express National Historic Trail may be impacted by portions of the project, in particular the

viewshed from the trail. Portions of the SPPC Project Area would be unavailable for recreation during construction of the transmission line and switching stations, and the switching station sites would be permanently unsuitable for recreation. Addition of access roads for the project may increase access to recreational activities in the area particularly for OHV use, which may have temporary impacts on local recreational use until such roads are reclaimed. While some areas used for recreation would be impacted, recreation in the region is dispersed and there are plenty of other open and public lands available for such uses. No impact on money spent on recreation is expected.

Ranchers rely on portions of the geothermal leasing areas for grazing. The level of local economic impact of proposed activities on grazing would depend on the extent to which reducing the grazing areas would reduce the size or health of a permit holder's herds or require that a permit holder lease or purchase additional lands. It is not anticipated that the level of impacts would affect the economic livelihood of ranchers and herders. Details are provided in **Section 4.18**, Livestock Grazing.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are proposed beyond compensations being paid for easements.

Residual Impacts
No residual impacts are anticipated for this project.

Alternative 1
Impacts under Alternative 1 are generally the same as those described under the Proposed Action. The Alternative transmission line configuration would result in an additional 52 parcels potentially requiring easement acquisition, therefore impacts on property values may be increased under this Alternative prior to the payment of compensation to landowners. Mitigation would be the same as described under the Proposed Action and no residual impacts would remain.

Alternative 2
Impacts under Alternative 2 are similar to those described under the Proposed Action. The Alternative transmission line configuration would result in one additional parcel potentially requiring easement acquisition; therefore impacts on property values may be slightly increased under this Alternative prior to compensation payments. Mitigation would be the same as described under the Proposed Action and no residual impacts would remain.

Macari Fiber Optic Alternative
Under this Alternative, the transmission line route would be the same as for the Proposed Action or chosen Alternative. The Alternative then includes a fiber optic cable going east-west along Macari Lane that would be routed in an underground trench. The additional fiber-optic cable and trenching proposed for

this Alternative may necessitate additional construction employees. In addition, there is one additional parcel that my require easement acquisition.

No Action Alternative

Under the No Action Alternative, the proposed transmission line and associated facilities as proposed in this EIS would not be built. No changes to the existing employment levels would occur; no new income would be generated beyond existing trends; and no additional demands would be placed on community services in the ROI beyond existing trends as a result of the Proposed Action.

Ormat Project Area

The ROI for the Ormat Project Area is Churchill County.

Proposed Action

Direct Impacts and Indirect Impacts

Population and Economic Activity. The Proposed Action may cause minor increases in population and economic activity within Churchill County during construction of the Carson Lake Binary Power Plant and Substation, Macari Switching Station, and a 230-kV transmission line between Carson Lake Substation and the Macari Switching Station as well as well pads and access roads. The Proposed Action would require a relatively small addition to the Churchill County construction workforce. Because the effect on the workforce would be minimal, the overall project-induced direct and indirect effects on the Churchill County economy are also expected to be minimal and beneficial.

Power plant construction is expected to directly increase construction employment by approximately 25 to 50 employees but would average about 25 on site for the duration of the 8- to 12-month construction period. In addition, pipeline construction would require approximately 35 workers over a period of approximately 9 months. Pipelines would be constructed after the wells are drilled and before the power plant begins operation.

This maximum number of workers at a given time, 85, represents an approximate temporary increase of 5.1 percent of the 1,642 workers in the 2008 Churchill County construction workforce. The actual number of workers is likely to be less at any given time. The number of permanent employees that may be required has not been determined, but would be significantly smaller than the construction workforce.

Some of the construction jobs or additional service jobs may be filled by workers already residing within Churchill County, while some workers may come from outside of Churchill County to fill new jobs or as contracted employees from outside the region. Even if the maximum workers relocated to the Ormat Project Area from somewhere else, Churchill County has the infrastructure (e.g., housing, schools, and public services) to absorb them

without any socioeconomic impact. No substantial impacts on traffic in the area are anticipated as a result of workers. Like most construction employment, the Proposed Action would be temporary and is not expected to result in a permanent increase in the population, employment, or spending within the region.

Based on the 5.1 percent temporary increase in construction employment, the Proposed Action is projected to result in a relatively slight growth of the overall population and economic activity in the region. The minor increases and the currently adapted economy of the area to such projects indicate that all social and economic effects are expected to be minimal and beneficial; accordingly, no mitigation is required.

Property Values. All private land in the Ormat Project Area has been purchased by the proponent. The proposed power plant and substation and switching station would all occur on private land owned by Ormat. Proposed pipelines and wells would be located on public land. Therefore there would be not impacts on land value associated with the Proposed Action. Elevated noise levels at the property line could result in a decrease in the value of adjacent property if that property were ever to be used for a noise-sensitive land use, such as housing.

Other direct and indirect impacts. Additional direct impacts include contributions to the local government tax base from the construction of the project and operation of the Carson Lake Binary Power Plant. Indirect tax contributions as a result of increased economic activity in the local area are also possible.

Construction and operation of the Proposed Action could affect nearby recreational resources, which also could affect the economies of the areas in which the recreational resources are located if fewer visitors use the resources and spend fewer dollars in the local economy. Revenues associated with recreation could decline if these activities were reduced or eliminated. Portions of the Ormat Project Area would be unavailable for recreation during construction and the power plant and associated structures on public lands would be permanently unsuitable for recreation. Addition of access roads for the project may temporarily increase access to recreational activities in the area, particularly for OHV vehicle use, which may have minor impacts on local recreational use. Recreational opportunities similar to those in the Project Area are abundant across the ROI.

Ranchers rely on portions of the Project Area for grazing. The level of local economic impact of proposed activities on grazing would depend on the extent to which reducing the grazing areas would reduce the size or health of a permit holder's herds or require that a permit holder lease or purchase additional lands. It is not anticipated that the level of impacts would affect the economic

livelihood of ranchers and herders. Details are provided in **Section 4.18**, Livestock Grazing.

Mitigation and Monitoring Measures
Due to the lack of permanent impacts on socioeconomic resources from the Proposed Action, no mitigation or monitoring measures are recommended.

Residual Impacts
No residual negative impacts would result from the Proposed Action.

Alternative 1
Impacts, mitigation and monitoring measures, and residual impacts under Alternative 1 are the same as those described under the Proposed Action.

No Action Alternative
Under the No Action Alternative, the proposed power plant and associated facilities would not be built. No changes to the existing employment levels would occur; no new income would be generated beyond existing trends; and no additional demands would be placed on community services in the ROI beyond existing trends as a result of the No Action Alternative.

Vulcan Project Area

Proposed Action

Direct Impacts and Indirect Impacts

Population and Economic Activity. The Proposed Action involves the construction of as many as four power plants and associated substations, a 230-kV transmission line and switching station, and as many as 26 well pads and associated wells, roads, and pipelines. The Proposed Action may cause minor increases in population and economic activity within Churchill County during construction and operation of the power plants, sub-station construction, and during well drilling and pipeline construction. The Proposed Action would require an addition to the Churchill County construction workforce and a small number of permanent employees.

Binary Power Plants: Vulcan proposed to construct as many as three nominal 30-MW (net) binary geothermal power plants at Power Plant Sites 1, 2, and 4 and either 30-MW (net) binary or 60-MW (net) flash power plants at Power Plant Sites 3 and 5 for a maximum output of 120 MW (net). Workforce estimates for the binary power plants include as many as 122 workers during the construction of each 30-MW (net) power plant and associated well field and interconnection facilities. Up to two binary power plants may be constructed at a given time. If two 30-MW (net) power plants are constructed, as many as 244 power plant construction workers would be needed.

In addition, Vulcan may use two or three drilling crews at a time to complete drilling of the proposed production and injection wells needed for the 120 MW of total proposed development. Each drilling crew would have approximately six workers, and drilling is expected to continue to the completion of power plant construction. Well pads typically require a crew of six workers for their construction.

Total construction employment for maximum binary power plant and well field construction scenarios would therefore employ approximately 262 temporary employees. Once two 30-MW power plants are installed, the plants and well field operations would have a combined estimated 33 employees. The staffing plan assumes six power plant operators for the first 30-MW binary power plant and four for the second 30-MW binary power plant. Additional power plants would require a similar number of operators.

Flash Power Plant: Vulcan estimates that it would need approximately 130 workers during the construction of a 60-MW (net) flash power plant and associated well field and interconnection facilities. The 60-MW flash power plant construction is expected to require 12 to 15 months. Construction of the 60-MW (net) flash well field pipelines requires the same estimated work force as identified under the binary power plant development.

In addition, Vulcan may use two or three drilling crews to complete drilling of the 24 production and injection wells needed for the first 60-MW phase of development. As described for the binary power plant, each drilling crew would have approximately six workers, and drilling is expected to continue to the completion of power plant construction. If additional well pads are needed, a crew of six workers would be needed to construct each proposed well pad.

Once the 60-MW flash power plant was installed, the plant and well field operations would have an estimated total of 26 employees. The permanent staffing plan assumes five operators for the power plant. Complete 24-hour coverage, 7 days per week requires 168 hours, divided into 40-hour work weeks per person, resulting in 4.2 work weeks per week. Thus, five power plant shift operators could handle power plant operations, factoring in sick time and vacation. Additional power plants would require a similar number of operators.

In summary, the maximum number of workers needed for construction of power plants and associated structures at a given time is 270. A breakdown of the estimated workers required for different build-out scenarios is shown in **Table 4-20**, Temporary Construction Staffing - Direct Employment. The maximum proposed build-out represents an approximate temporary increase of 16 percent of the 1,642 workers in the 2008 Churchill County construction workforce. It is unlikely that all work would occur simultaneously; therefore the actual number of workers required at any given time is likely to be much

Table 4-20
Temporary Construction Staffing - Direct Employment

Proposed Build Out	Maximum number of construction workers required at one time[1]
One 30-MW Binary Power Plant and Associated Well Field and Interconnection Facilities	122
Associated Production and Injection Wells	18
TOTAL	**140**
One 60-MW Flash Power Plant and Associated Well Field Interconnection Facilities	130
Associated Production and Injection Wells	18
TOTAL	**148**
Two 30-MW Binary Power Plants	244
Associated Production and Injection Wells	18
TOTAL	**262**
One 30-MW Binary Power Plant and One 60-MW Flash Power Plant	252
Associated Production and Injection Wells	18
TOTAL	**270**

[1]Assumes simultaneous construction of a maximum number of 2 power plants at a given time.

smaller. Some of the construction jobs may be filled by workers already residing within Churchill County, while some workers may come from outside of Churchill County to fill new jobs or as contracted employees from outside the region, particularly for temporary construction positions. While the construction employment represents a substantial increase in employment in this sector in the County, this increase would be temporary. Churchill County has supported development of large geothermal plants previously; including the 66-MW Dixie Valley project. Housing vacancy rates as of 2009 for housing are at over 19 percent in Churchill County. In addition, unemployment rates in the county (9.1 percent annual rate in 2009) and the State of Nevada (11.8 percent annual rate in 2009) indicate that the work force would be available to support this project (Bureau of Labor Statistics 2010). Even if the maximum workers relocated to the Vulcan Project Area from somewhere else, Churchill County

has the infrastructure (e.g., housing, public services) to absorb them without any substantial permanent socioeconomic impact.

Long term staffing of the competed power plants could result in an increase of approximately 69 permanent employees. A breakdown of the estimated permanent employees under different build-out scenarios is shown in **Table 4-21**, Permanent Staffing - Direct Employment. Using a multiplier of 2.5, there is the potential for an additional 173 jobs in the local economy, particularly in the service sector. While the addition of jobs would bring some increase in money to the local area, the permanent jobs created are not expected to result in a substantial permanent increase in the population, employment, or spending within the region; a maximum direct and indirect increase would represent a one percent change over the total current workforce in the County. It is likely that the indirect employment would not all be included in the local area.

Table 4-21
Permanent Staffing - Direct Employment

Proposed Build Out	Permanent Employees
One 30-MW Binary Power Plant	6
Associated Well Field	23
TOTAL	**29**
Two 30-MW Binary Power Plants	10
Associated Well Field	23
TOTAL	**33**
One 60-MW Flash Power Plant	5
Associated Well Field	21
TOTAL	**26**
Two 30-MW Binary Power Plants and Two 60-MW Flash Power Plants	20
Associated Well Fields	49
TOTAL	**69**

Property Values. All private land in the Vulcan Project Area has been purchased by the proponent. There is very limited development in the surrounding area and no residences. Therefore, there would be no impacts on land value from the Proposed Action.

Other direct and indirect impacts. Additional direct impacts include contributions to the local government tax base from the construction of the

project and operation of the power plants. Indirect tax contributions, as a result of increased economic activity in the local area are also possible.

Construction and operation would not impact public utilities. Water for construction would be obtained from wells on site, or bought from irrigation districts or private parties. Vulcan would not require any surface water for the geothermal power plants during normal operations.

Construction and operation of the Proposed Action could affect nearby recreational resources, which could affect local economies if fewer visitors use the resources (and spend fewer dollars in the local economy). Revenues associated with recreation could decline if these activities were reduced or eliminated or increase if they were made more accessible. The viewshed from the Pony Express National Historic Trail may be impacted by portions of the project. Portions of the Vulcan Project Area would be unavailable for recreation during construction of the power plants, and associated structures on public lands and some sites would be permanently unsuitable for recreation. Addition of access roads for the project may temporarily increase access to recreational activities in the area, particularly for OHV vehicle use, which may have minor impacts on local recreational use. While some areas used for recreation would be impacted, recreation in the region is dispersed and there are plenty of other open and public lands available for such uses. No impact on money spent on recreation is expected.

Ranchers rely on portions of the Project Area for grazing. The level of local economic impact of proposed activities on grazing would depend on the extent to which reducing the grazing areas would reduce the size or health of a permit holder's herds or require that a permit holder lease or purchase additional lands. It is not anticipated that the level of impacts would affect the economic livelihood of ranchers and herders. Details are provided in **Section 4.18**, Livestock Grazing.

Mitigation and Monitoring Measures
No mitigation or monitoring measures are recommended.

Residual Impacts
No residual negative impacts would result from the Proposed Action.

Alternative 1
Impacts under Alternative 1 would be the same as those described under the Proposed Action.

No Action Alternative
Under the No Action Alternative, the proposed power plants and associated facilities would not be built. No changes to the existing employment levels would occur, no new income would be generated beyond existing trends, and

no additional demands would be placed on community services in the ROI beyond existing trends as a result of the Proposed Action.

4.26 ENVIRONMENTAL JUSTICE

Summary

Assessment Methodology

On February 11, 1994, President William Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. This Executive Order was designed to focus the attention of federal agencies on the human health and environmental conditions in minority communities and low-income communities. In an accompanying Presidential memorandum, the President emphasized that existing laws, including NEPA, provide opportunities for federal agencies to address environmental hazards in minority and low-income communities. In April of 1995, the EPA released the document titled Environmental Justice Strategy: Executive Order 12898. The document established EPA-wide goals and defined the approaches by which the EPA would ensure that disproportionately high and adverse human health or environmental effects on minority communities and low-income communities are identified and addressed. The socioeconomic characteristics of the ROI were analyzed for the presences of minority and/or low-income populations according to the EPA's Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses (EPA 1998).

Indicators

EPA's Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses (EPA 1998) suggests a screening process to identify environmental justice concerns. This two-step process defines the impact indicators for this issue; if either criteria is unmet, there is little likelihood of environmental justice effects occurring. The two-step process is as follows:

(1) Does the potentially affected community include minority and/or low-income populations?

(2) Are the environmental impacts likely to fall disproportionately on minority and/or low income members of the community and/or tribal resource?

If the two-step process discussed under Study Methods indicates that there exists a potential for environment justice effects on occur, the following analyses are conducted to consider the following:

- whether there exists a potential for disproportionate risk of high and adverse human health or environmental effects; whether

communities have been sufficiently involved in the decision-making process; and

- whether communities currently suffer, or have historically suffered, from environmental and health risks and hazards

Region of Influence

The ROI for analysis of Environmental Justice impacts is the Salt Wells Energy Projects Area.

SPPC Project Area

Proposed Action and Alternatives

In the context of analyzing the Proposed Action 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.

Low income populations are defined as persons living below the poverty level based on total income of $10,991 for an individual and $22,025 for a family household of four for 2008 data (US Census Bureau 2009). There are no known minority populations fitting the definition for environmental justice concerns within the SPPC Project Area. 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. Any potential physical effects of constructing and operating the proposed facilities would be unlikely to affect these populations.

In addition, there is not a meaningfully greater low-income population in the Project Area than for the County as a whole. Poverty rates for the census tracts composing the majority of the Project Area were found to have a lower percentage of persons living below the poverty level than the County or state level (US Census Bureau 2010); therefore, there are no direct or indirect impacts anticipated as a result of the Proposed Action or Alternatives.

Ormat Project Area

Proposed Action and Alternatives

As described for the SPPC project, there are no known minority or low income populations fitting the definition for environmental justice concerns within the Project Area; therefore, there are no direct or indirect impacts anticipated as a result of the Proposed Action or Alternatives.

Vulcan Project Area

Proposed Action and Alternatives

As described for the SPPC project, there are no known minority or low income populations fitting the definition for environmental justice concerns within the Project Area; therefore, there are no direct or indirect impacts anticipated as a result of the Proposed Action or Alternatives.

4.27 THE RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

This section compares the potential temporary effects of the alternatives analyzed in this EIS on the environment with the potential effects on its long-term productivity. The BLM must consider the degree to which the Proposed Actions or Alternatives would sacrifice a resource value that might benefit the environment in the long-term, for some temporary value to the proponent or the public.

Implementation of the Proposed Actions or Alternatives would require use of the environment for construction, operation and maintenance of the power plants, substations, switching stations, access roads, pipelines, well pads, and the transmission line corridors. Most land disturbance would be temporary and would be concurrent with site preparation and construction of the facilities. These effects include soil disturbance, increased erosion potential, water use, vehicle and equipment emissions, fugitive dust, and habitat disturbance. Measures would be employed to minimize disturbances and reclaim or improve vegetation cover, soil, and wildlife habitat on these lands within five years. To the extent that disturbances can be reclaimed, other productive use of these lands would not be precluded in the long term. Regional economies could be expected to experience temporary benefits from related expenditures and employment opportunities during construction.

Overall productivity would remain similar to existing conditions where land uses are not substantially changed. Where undeveloped land is used for facilities or is designated as a utility corridor, most other productive uses would be precluded. Some agricultural and grazing uses could continue and other utilities could use the corridor, potentially reducing the use of other land for this purpose. There is potential for mitigated permanent loss of cultural resources. There would be some loss of existing vegetation, soil, and quality of habitat available for wildlife, but most of the study area has vegetation cover and habitat that is common to the region. The placement of transmission lines could cause visual impacts. These resources would be committed along the length of the corridor and at the substations for the life of these facilities or their successors. If no longer needed, these lands would be restored to a suitable condition consistent with zoning or adjacent land use. Full recovery of these lands and restoration of any lost habitat or associated wildlife is not assured.

The Proposed Actions and Alternatives would help meet electrical power distribution infrastructure needs in the region, maintain and enhance productivity, and provide permanent economic benefits. Overall, the Proposed Actions' use of the environment has very little adverse impact on the maintenance and enhancement of long-term productivity. Implementation of the No Action Alternative would require fewer resource commitments but would be associated with future infrastructure deficiencies and the reduced ability to provide electrical power for residential, commercial and industrial uses regionally.

4.28 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects this use could have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural resource). The Proposed Actions and Alternatives would not result in a large commitment of nonrenewable resources.

Land would be disturbed during construction and during the life of the facilities and their successors. There would be some loss of existing vegetation, habitats, and wildlife resources. Land not needed for operation and maintenance of the facilities would be reclaimed immediately after construction. At the end of the useful life of the facilities these lands could be reclaimed as well. While every effort would be made to recover native vegetation and habitat, full restoration of preexisting conditions is not assured.

Project construction would require the irretrievable commitment of fossil fuels (diesel and gasoline), oils, and lubricants used by construction equipment and by workers commuting to the site. Construction materials and some equipment that may not be productively recycled would be consumed by the project. Ongoing operation and maintenance of the facilities would use marginal amounts of fuels, lubricants and other nonrenewable consumables.

The Proposed Actions and Alternatives would provide more electrical capacity and reliability to the region. To the extent that the improvements would accommodate projected population growth and demand, the project would contribute indirectly to future potential resource loss associated with the development of housing, businesses, industry and infrastructure. These would include the potential loss of native vegetation and habitat, conversion of agricultural lands, changes in air quality, noise levels, and cultural resources.

Cultural resources are by their nature irreplaceable, so altering or eliminating any such resource, be it National Register eligible or not, represents an irreversible and an irretrievable commitment. Mitigations, however appropriate,

often preclude preservation or other future desirable management options. There would also be a potential for irretrievable loss of the regional resource base for future scientific use and interpretation and for irretrievable loss of resources of value to contemporary Native American groups.

CHAPTER 5
CUMULATIVE IMPACTS

5.1 INTRODUCTION

The analysis presented in this chapter, as required by CEQ regulations (40 CFR 1500-1508), addresses the potential cumulative impacts associated with all project Alternatives. The CEQ regulations state that the cumulative impact analysis should include the anticipated impacts to the environment resulting from "the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time" (40 CFR 1508.7).

What is the Process of Assessing Cumulative Impacts?

The cumulative impact analysis in the following sections builds upon the analyses of the direct and indirect impacts discussed in **Chapter 4**, Environmental Consequences. The cumulative impact analysis considers: (1) the combined effect of all three Proposed Actions (SPPC, Ormat, and Vulcan, or Whole of the Action); and (2) other past, present, and reasonably foreseeable future actions' impacts on natural resources, ecosystems, and human communities in the Salt Wells Energy Projects Area (Other Cumulative Projects).

What is the Methodology?

The cumulative effects analysis focuses on the natural resources, ecosystems, and human communities that could be affected by the impacts from all project Alternatives, in combination with other past, present, and reasonably foreseeable future actions, regardless of who undertakes them.

The CEQ discusses the assessment of cumulative effects in detail in its report, "Considering Cumulative Effects under the National Environmental Policy Act" (Council on Environmental Quality 1997). Based on the CEQ's report, the following methodology was developed for assessing cumulative impacts:

1. The geographic scope (i.e., ROI) is defined for the analysis. The ROIs encompass the areas of affected resources and the distances at which impacts associated with anticipated future actions to be taken consistent with the project Alternatives may occur. To determine which other actions should be included in a cumulative impacts analysis, the regions

of influence must first be defined. These regions should not be limited to only the geographic areas of resources addressed by the project Alternatives, but they should also take into account the distances that cumulative impacts may travel and the regional characteristics of the affected resources. The cumulative ROIs for each resource are identified below.

2. The time frame for the analysis is defined. The temporal aspect of the cumulative impacts analysis generally extends from the past history of impacts on each resource through the anticipated life of the project (and beyond, for resources having more permanent impacts). The time frame of the cumulative impact analysis incorporates the sum of the effects of anticipated future actions consistent with the implementation of the project Alternatives in combination with other past, present, and future actions, because impacts may accumulate or develop over time. The future actions described in this analysis are those that are "reasonably foreseeable;" that is, they are ongoing (and will continue into the future), are funded for future implementation, or are included in firm near-term plans. The reasonably foreseeable time frame for future actions evaluated in this cumulative analysis is 20 years from the allocation of lands available for geothermal leasing and completion of land use plan amendments. While it is difficult to project reasonably foreseeable future actions (or trends) beyond a 20-year time frame, it is acknowledged that the effects identified in the cumulative impacts analysis would likely continue beyond the 20-year horizon.

3. Past, present, and reasonably foreseeable future actions are identified. These include projects, activities, or trends that could impact human and environmental resources within the defined regions of influence during the defined time frame. Past and present actions are generally accounted for in the analysis of direct and indirect impacts for each resource and are carried forward to the cumulative impacts analysis. **Tables 5-1** through **5-3, Figures 5-1** through **5-3** and **Appendix F**, Land Use Authorizations in the Salt Wells Energy Projects Area, identify known past, present, and reasonably foreseeable future actions within the ROIs. BLM land management activities also occur and would continue in the ROIs.

4. The baseline conditions of resources are characterized. Baseline characteristics are described in the affected environment sections for each resource in **Chapter 3**, Affected Environment.

5. Direct and indirect impacts on resources from anticipated future actions that may be taken consistent with the respective Alternatives are characterized. Direct impacts are caused by anticipated future actions to

Table 5-1
Past, Present and Reasonably Foreseeable Future Actions

Project	**Project Location**	Project Description	Project Completion Date
ENEL Geothermal Power Plant	Salt Wells, NV (adjacent to the proposed Pony Express Switching Station and less than 2 miles from the Vulcan Project Area)	The 18-MW (net) power plant is located within an approximate 23-acre footprint. The plant operates with a substation, associated wells (5 production and 4 injection) and pipelines and a 6 mile transmission line.	Constructed, in operation.
Carson Lake and Pasture Land Transfer	Churchill County, NV	In 1990, Congress passed Public Law 101-618 in which Section 206(e) authorizes the Secretary of the Interior to transfer title of the 22,700 acres comprising the Carson Lake and Pasture area to the State of Nevada to be managed by NDOW as a Wildlife Management Area. An EA was completed and the transfer is pending completion. Public Law-111-8 extends the CLP transfer completion date to June 30, 2012. The SPPC transmission line would cross the northeast boundary under all alternatives. Other portions of the routes are adjacent to but not within the CLP transfer boundary. Seven wells under Ormat's proposal are located within this transfer area.	Not specified at this time.
Newlands Project RMP	Washoe, Storey, Lyon and Churchill Counties, NV	An RMP to manage approximately 442,000 acres of Reclamation-administered land associated with the Newlands Project in Nevada.	ROD expected in Summer 2011.
Fallon Energy Park	Fallon, NV, on Reclamation Lands	A proposed Energy Park on Reclamation lands near Fallon Nevada	Not specified at this time.
Grimes Point Petroglyph Trail	Seven miles east of Fallon, within the no surface occupancy portion of the Ormat Project Area	The Trail features rocks with carvings as much as eight thousand years old, created by native peoples who were drawn to the shores of ancient Lake Lahontan. The site is a self-guided interpretive trail open to the public on BLM land.	Visited year round.

Table 5-1
Past, Present and Reasonably Foreseeable Future Actions

Project	**Project Location**	Project Description	Project Completion Date
OHV Races	Salt Wells, NV	It is likely that roads used for the Salt Wells Energy Projects could be listed as designated routes of travel when the travel management plan for Churchill County is completed. Currently, these routes can be considered existing routes of travel and provide opportunities for access to public lands for motorized recreation. As shown on Figure 3-23, roads within the proposed Salt Wells Energy Projects Area were authorized by the BLM as designated OHV race routes prior to 1993 for annual race events. Two of the major events are the Vegas to Reno and the VORRA Fallon 250 Desert Night Race.	Not specified at this time.
Pony Express National Historic Trail Re-Ride Event	Along the Pony Express National Historic Trail (traverses Salt Wells), NV	The Pony Express National Historic Trail runs from Highway 95 to the east near Buckland Station, crosses over Simpson Pass, and continues on to the east past Sand Mountain. The Pony Express National Historic Trail crosses near the Vulcan and SPPC Project Areas as shown on Figure 3-23. There are existing historical monuments on the west side of the Cocoons and at Simpson Pass, with an additional monument scheduled to be installed on the east side of the Cocoons near the ENEL Geothermal Power Plant. The National Pony Express Association conducts annual Re-Rides of the Pony Express National Historic Trail from St. Joseph, Missouri, to Sacramento, California. This re-ride is a 10-day, 24-hour a day, non-stop event by over 500 riders and horses. The 1,966 mile route travels over the Pony Express National Historic Trail from Missouri through Kansas, Nebraska, Colorado, Wyoming, Utah, and Nevada, to California. It is the longest event held annually on a historical trail in the nation.	Annually.

Table 5-1
Past, Present and Reasonably Foreseeable Future Actions

Project	**Project Location**	Project Description	Project Completion Date
Ormat Geothermal Exploration in Carson Lake/Salt Wells (Previously Permitted)	Salt Wells/Fallon, NV	The twelve (12) well pads previously approved from the exploration phase would be used to the greatest extent feasible. Therefore, the entire cumulative build out under Ormat's proposal would comprise a total of twenty five (25) well pads with multiple wells possible at each well pad. See Table 5-2 and Figure 5-2 for a complete list of permitted wells.	In progress–Two wells have been constructed.
Vulcan Geothermal Exploration in Salt Wells (Previously Permitted)	Churchill County, NV	Vulcan holds eight geothermal resource leases at Salt Wells, Nevada, issued by the BLM's CCDO, effective July 1, 2005. Vulcan has conducted initial exploration activities on these leases. On February 6, 2007, the BLM issued a Finding of No Significant Impact for ten exploration wells on these leases. On April 24, 2009, the BLM approved a Finding of No Significant Impact to construct ten additional well pads and access roads and to drill and test ten exploration wells at new locations established as the result of the initial exploratory activity. One other exploration well is proposed on private land and will include a Reclamation canal crossing. See Table 5-3 and Figure 5-3 for a complete list of permitted wells. Vulcan has drilled two observation wells and nine exploration wells.	In progress–Eleven wells have been constructed.
NAS Fallon Geothermal Program	Fallon, NV	NAS Fallon has retained permits to explore for geothermal development on their lands (part of which falls under the Ormat Geothermal Exploration); however, the geothermal program at the moment is on hold with no estimated start date in the near future.	In progress.

Table 5-2
Ormat Carson Lake/Salt Wells Previously Permitted Well Pads

Well Pad Number	Kettlemen Number	Lease Number	Township/ Range	Section	Permanent Well Pad Area Acres
A	13-30	NVN 079105	18N30E	30	2.06
B	42-30	NVN 079105	18N30E	30	2.06
C	55-30	NVN 079105	18N30E	30	2.06
D	88-30	NVN 079105	18N30E	31	2.06
E	51-31	NVN 079104	18N30E	31	2.06
F	44-31	NVN 079104	18N30E	31	2.06
G	72-36	NVN 079104	18N29E	36	2.06
H	85-30	NVN 079105	18N30E	30	2.06
I	84-31	NVN 079104	18N30E	31	2.06
J	18-19	NVN 079105	18N30E	19	2.06
K	32-31	NVN 079104	18N30E	31	2.06
Q	11-32	NVN 079105	18N30E	32	3.10

Table 5-3
Vulcan Power Permitted Salt Wells Well Pad Sites

Well Pad Number	Kettlemen Number	Lease Number	Township/ Range	Section	Permanent Well Pad Area Acres
1	35-11	N-79666	17N30E	11	3.5
2	47-11	N-79666	17N30E	11	3.5
3	56-14	N-79665	17N30E	14	3.5
4	62-15	N-79310	17N30E	15	3.5
5	86-15	N-79310	17N30E	15	3.5
6	71-15	N-79310	17N30E	15	3.5
7	58-9	N-79666	17N30E	9	3.5
8	76-9	N-79666	17N30E	9	3.5
9	84-16	N-79665	17N30E	16	3.5
10	17-16	N-79665	17N30E	16	3.5
11	51-20	N-79663	17N30E	20	3.5
12	24-21	N-79663	17N30E	21	3.5
13	55-17	N-79665	17N30E	17	3.5
14	54-20	N-79663	17N30E	20	3.5
15	51-29	N-79663	17N30E	29	3.5
16	14-1	N-79668	17N30E	1	3.5
17	11-12	N-79666	17N30E	12	3.5
18	34-33	N-79664	17N30E	33	3.5
19	67-29	N-79663	17N30E	29	3.5
20	65-32	N-79664	17N30E	32	3.5

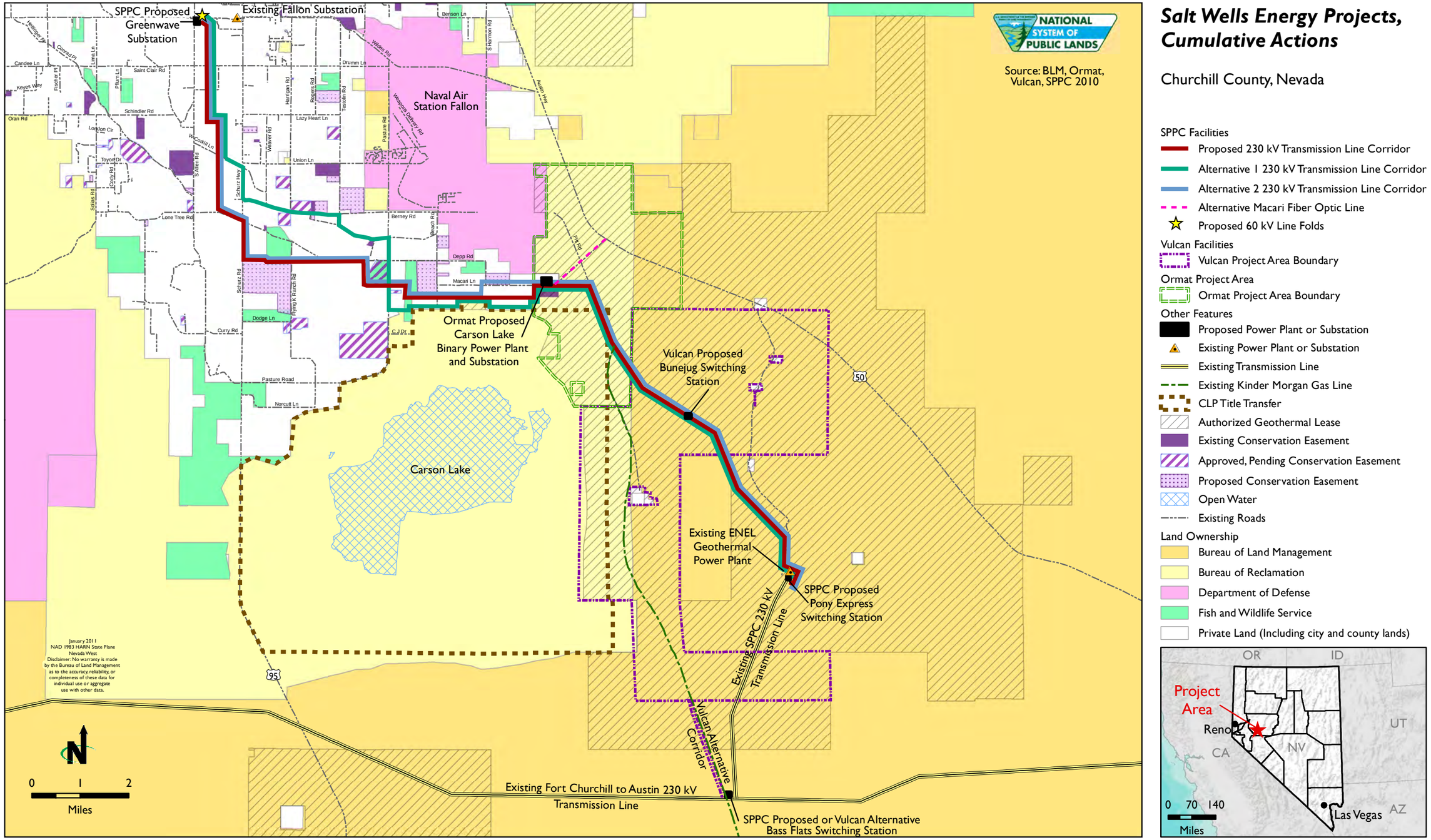
Salt Wells Energy Projects, Cumulative Actions
Churchill County, Nevada
Source: BLM, Ormat, Vulcan, SPPC 2010
NATIONAL SYSTEM OF PUBLIC LANDS
SPPC Proposed Greenwave Substation
Existing Fallon Substation
Naval Air Station Fallon
Ormat Proposed Carson Lake Binary Power Plant and Substation
Vulcan Proposed Bunejug Switching Station
Carson Lake
Existing ENEL Geothermal Power Plant
SPPC Proposed Pony Express Switching Station
Existing SPPC 230 kV Transmission Line
Vulcan Alternative Corridor
Existing Fort Churchill to Austin 230 kV Transmission Line
SPPC Proposed or Vulcan Alternative Bass Flats Switching Station
SPPC Facilities
Proposed 230 kV Transmission Line Corridor
Alternative 1 230 kV Transmission Line Corridor
Alternative 2 230 kV Transmission Line Corridor
Alternative Macari Fiber Optic Line
Proposed 60 kV Line Folds
Vulcan Facilities
Vulcan Project Area Boundary
Ormat Project Area
Ormat Project Area Boundary
Other Features
Proposed Power Plant or Substation
Existing Power Plant or Substation
Existing Transmission Line
Existing Kinder Morgan Gas Line
CLP Title Transfer
Authorized Geothermal Lease
Existing Conservation Easement
Approved, Pending Conservation Easement
Proposed Conservation Easement
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)
Project Area
OR
ID
UT
NV
CA
AZ
Reno
Las Vegas
0 70 140
Miles
0 1 2
Miles
January 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.

Figure 5-1

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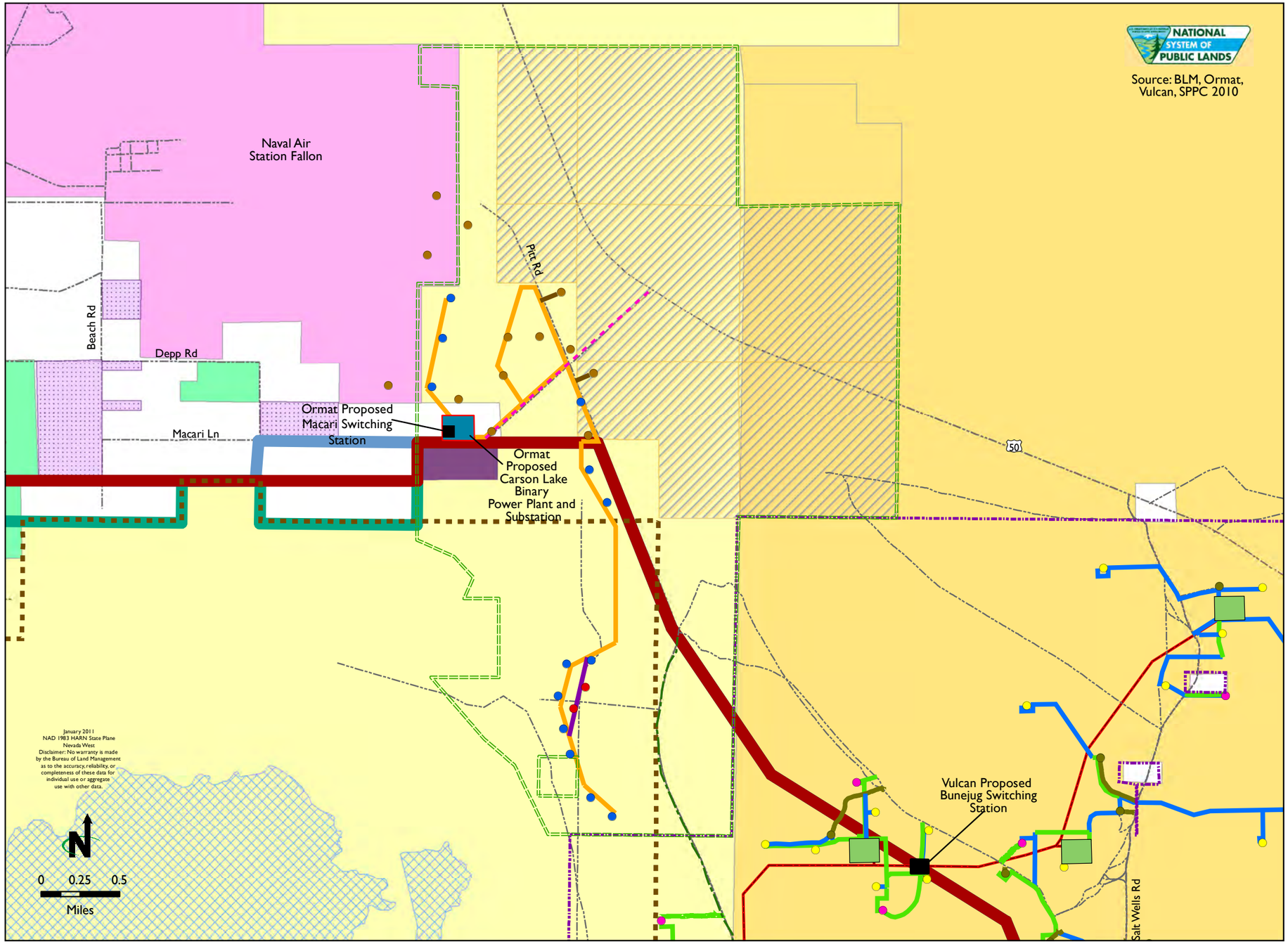

Salt Wells Energy Projects, Ormat Cumulative Actions

Churchill County, Nevada

Ormat Facilities
- Ormat Project Area Boundary
- Existing/Approved Well Pad
- Proposed Alternative Well Pad
- Alternative Well Pad
- Existing/Approved Pipeline
- Proposed Pipeline
- Alternative Pipeline
- Proposed Power Plant and Substation

Vulcan Facilities
- Vulcan Project Area Boundary
- Proposed Well Pad
- Approved Well Pad
- Existing Well Pad
- Proposed Steamfield Pipeline or Associated Road
- Approved Steamfield Pipeline or Associated Road
- Existing Steamfield Access Road
- Proposed 230 kV Interconnection Line
- Proposed Power Plant and Substation

SPPC Facilities
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor
- Alternative 2 230 kV Transmission Line Corridor
- Alternative Macari Fiber Optic Line

Other Features
- Proposed Switching Station
- Existing Kinder Morgan Gas Line
- CLP Title Transfer
- Existing Conservation Easement
- Proposed Conservation Easement
- No Surface Occupancy
- Open Water
- Existing Road

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

Figure 5-2

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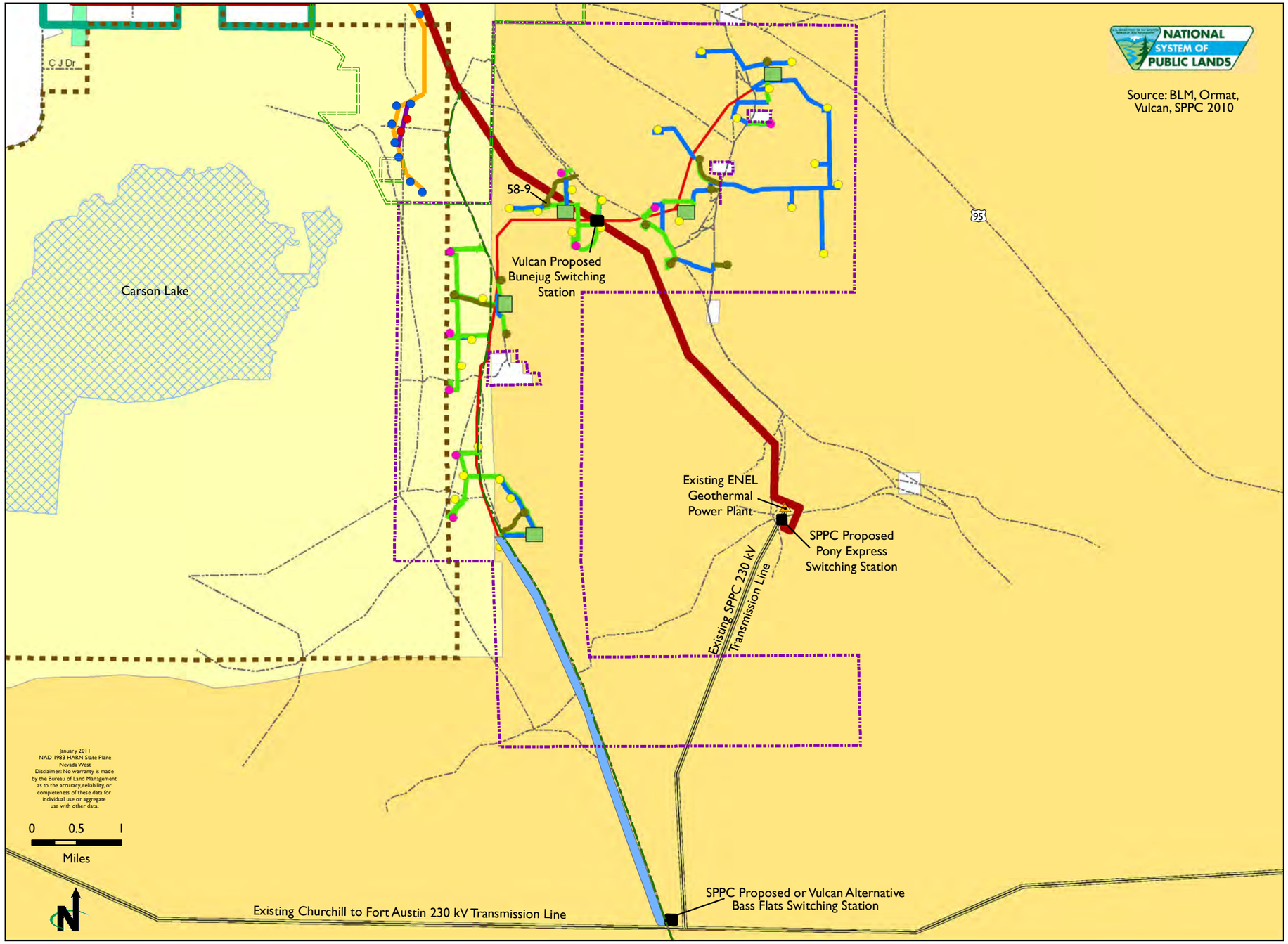

Source: BLM, Ormat, Vulcan, SPPC 2010

Salt Wells Energy Projects, Vulcan Cumulative Actions

Churchill County, Nevada

Vulcan Facilities
- Vulcan Project Area Boundary
- Proposed Well Pad
- Approved Well Pad
- Existing Well Pad
- Proposed Steamfield Pipeline or Associated Road
- Approved Steamfield Pipeline or Associated Road
- Existing Steamfield Access Roads
- Proposed 230 kV Interconnection Line
- Proposed Power Plant and Substation
- Alternative 230 kV Interconnection Line Corridor

Ormat Facilities
- Ormat Project Area Boundary
- Proposed Well Pad
- Alternative Well Pad
- Proposed Pipeline
- Alternative Pipeline

SPPC Facilities
- Proposed 230 kV Transmission Line Corridor
- Alternative 1 230 kV Transmission Line Corridor

Other Features
- Proposed Switching Station
- Existing Substation
- Existing Transmission Line
- Existing Kinder Morgan Gas Line
- CLP Title Transfer
- Existing Conservation Easement
- Proposed Conservation Easement
- Open Water
- Existing Road

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

Figure 5-3

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be taken consistent with implementing an Alternative, and they occur at the same time and place as those actions. Indirect impacts are caused by anticipated future actions to be taken consistent with the Alternative but occur later in time or farther in distance from those actions and are still reasonably foreseeable. These impacts are detailed in the environmental consequences sections of **Chapter 4**, Environmental Consequences, for each resource.

7. The potential impacting factors of each past, present, or reasonably foreseeable future action or activity are determined. Impacting factors are the mechanisms by which an action affects a given resource. Anticipated future actions to be taken consistent with all project Alternatives could also generate factors that could impact resources; these individual contributions form the basis of the cumulative impacts analysis.

8. The cumulative impact assessment focuses on: (1) the combined effects of implementing the three Proposed Actions (SPPC, Ormat, and Vulcan); and (2) the past, current, and reasonably foreseeable future actions, regardless of who undertakes them. In other words, the assessment considers other uses on all lands in the Projects Area regardless of land ownership.

9. Cumulative impacts on resources are evaluated by considering the impacting factors for each resource and the incremental contribution of anticipated future actions to be taken consistent with implementing the project Alternatives to the cumulative impact. The analysis for each resource is presented in **Sections 5.2** through **5.27.**

In cases where the contributions of individual actions to an impacting factor were uncertain or not well known, a qualitative evaluation of cumulative impacts was necessary. A qualitative evaluation covers the locations of actions, the times they would occur, the degrees to which the impacted resource is at risk, and the potential for permanent and/or synergistic effects.

5.2 LAND USE AUTHORIZATIONS, AIRSPACE, AND ACCESS

Region of Influence

The ROI for cumulative impacts land use, airspace, and access is the same as identified under the impacts for the Proposed Actions, which is the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan actions)

Cumulative impacts on land use, airspace, and access from the whole of the actions would be similar to those identified under the Proposed Actions in **Section 4.2**, Land Use Authorizations, Airspace, and Access. The SPPC ROW easements would have a permanent impact on approximately 177 to 212 acres

of private land. In addition, the projects have the potential to impact airspace and APZ areas designated by the Navy and historic portions of the Lincoln Highway or Highway 50. Mitigation would minimize these potential impacts; however, the combination of the projects would likely result in impacts on land use, airspace, and access.

Cumulative Impacts

It is assumed that under the cumulative impacts scenario, grazing would continue to operate, and impacts would be the same as under the Proposed Actions. Based on the cumulative project list identified in Table 5-1, six projects would affect land use, airspace, and access in addition to the Proposed Actions: the ENEL Geothermal Power Plant; the Carson Lake and Pasture title transfer; Newlands Project RMP; Fallon Energy Park; OHV races; and the NAS Fallon Geothermal Program. In addition, 33 land use authorizations (**Appendix F**) have been approved on BLM managed land in the ROIs and include Highway ROW, materials sites, transmission lines, fiber optic lines, geothermal leases, mineral material sales, and geothermal exploration. The cumulative projects could result in conflicts with existing or adjacent land uses, increase or modify access within the ROI, or conflict with airspace safety zones as designated by the Navy. However, the projects have or would require approval from the land management agency with jurisdiction of the project lands, and would be developed to be consistent with existing federal, state, and local land use plans and policies. Therefore, potential cumulative impacts on land uses, airspace, or access would be minimized.

5.3 AIR QUALITY

Region of Influence

The ROI for assessing regional air quality impacts is the western Salt Wells Basin and Lahontan Valley east of Highway 95.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Together, the Proposed Actions and Alternatives would impact air quality through construction of the proposed transmission line and associated facilities, well drilling, and operation of the geothermal power plants. The projects would have temporary and permanent effects on air quality as described in **Section 4.3**, Air Quality. Construction impacts would be localized in the case of fugitive dust. Fugitive dust is a recognized nuisance condition that would be effectively controlled through the implementation of standard BMPs and best practical methods. The combined emissions associated with construction equipment exhaust would have a regional impact; however, given the temporary nature of construction and the attainment status of air quality in the region, construction would not be expected to result in a violation of state or federal air quality standards.

Well drilling of the Ormat and Vulcan geothermal wells would result cumulative air quality effects. However, well drilling would be temporary, ending once the well fields have been fully developed. The greatest source of emissions would occur with the drilling of production wells, which require large diesel-engine drill rigs. While a large number of wells are proposed, the limited number of drill rigs available to drill these wells would result in a limited number of such drill rigs operating at one time. Therefore, emissions associated with well drilling would not result in a violation of air quality standards.

Operation of the Ormat and Vulcan geothermal power plants would have limited effects on air quality in the case of binary power plants, as these power plants are closed systems that release few regulated pollutants. Effects associated with vapor plumes and drift would be effectively controlled by proposed mitigation measures.

Well drilling and the Vulcan flash power plant have the potential to release hydrogen sulfide, a state-regulated pollutant with the potential to affect human health in high concentrations. The amount of pollutant that would be released depends upon the amount present in the geothermal resource. Levels of this pollutant would be mitigated with abatement systems, if necessary, to ensure that levels remain low enough to protect human health.

Cumulative Impacts

Combined with other past, present, and reasonably foreseeable future actions, the Proposed Actions would have incremental impacts on air quality in the region both temporarily and permanently. Direct impacts would result from any surface-disturbing actions that occur as part of future projects in the region. These impacts would be mitigated through established methods to control fugitive dust. Indirect impacts associated with management actions would occur; the extent of these impacts would depend on how many additional surface-disturbing activities would be allowed above current conditions.

Past, present, and reasonably foreseeable geothermal projects in the region have the potential to introduce regulated criteria pollutants associated with well drilling equipment, employee traffic, and maintenance equipment, as well as hydrogen sulfide found within geothermal fluid. With implementation of the measures described in **Section 4.3**, Air Quality, cumulative impacts caused by the Proposed Actions would be minimized, and no additional mitigation measures are recommended.

The proposed geothermal projects in combination with other geothermal projects in the region would also have an impact on greenhouse gas emissions by introducing a renewable source of electrical power in the region.

5.4 MINERALS/GEOLOGY

Region of Influence

The ROI is the SPPC Survey Area and the Ormat and Vulcan Project Areas.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Past and ongoing development throughout the Salt Wells Energy Projects Area has resulted in minor alterations to the natural landscape. However, large scale future projects could contribute to the cumulative effects of geology and minerals creating a triggering or acceleration of erosion or slope failures, or an introduction of more people exposed to the effects of ground-shaking, earthquake-induced ground failure, and fault rupture (Patel 2009). Triggering or acceleration of erosion or slope failures would be limited to the areas within and adjacent to the boundaries of the individual projects. In order to be cumulatively considerable, such conditions would have to occur at the same time and in the same location as the Proposed Actions. It is unlikely that the Proposed Project impacts would have the potential to combine with similar effects from other projects and, as such, would not be cumulatively considerable.

Seismic impacts (ground-shaking, earthquake-induced ground failure, and fault rupture) from the numerous local and regional faults comprise an impact of the geologic environment on individual projects and would not introduce cumulatively considerable impacts. However, moderate to strong ground-shaking may occur at the Project sites during the life of the Projects and could result in collapse of Proposed Project structures. Collapse of Project structures could result in power outages, damage to nearby roads or structures, and injury or death to nearby people. Past and future projects located in close proximity to project structures would be exposed to the same conditions and therefore the same impacts. Collapse of project structures and adjacent structures would combine to result in an impact where such structures are in close proximity to other structures or people.

Cumulative Impacts

This section includes an evaluation of cumulative impacts concerning geology and minerals.

Geotechnical impacts tend to be site specific rather than cumulative in nature, and each development site would be subject to, at minimum, site development and construction standards relative to seismic and other geologic conditions that are prevalent within the region.

The Proposed Actions and Alternatives, in combination with reasonably foreseeable development in the Salt Wells Energy Projects Area, would not contribute to cumulative geologic and mineral impacts, as the impacts would be site-specific. Impacts associated with geology and minerals are based on existing site-specific conditions that are situated within the subsurface materials that

underlay project sites. Further, implementation of mitigation measures described in **Section 4.4** would ensure that the Salt Wells Energy Projects would not contribute to cumulative geologic and minerals impacts in the region.

If the Project activities are designed to comply with current design specifications, which minimize the potential for structure collapse or other mechanical faults, it is expected that seismic events would cause minimal potential damage. Therefore it is unlikely that seismic impacts on the proposed project would have the potential to combine with similar effects from other projects and would therefore not be cumulatively considerable. Cumulative geologic impacts would not occur.

Overall, contributions of the Proposed Actions and/or Alternatives to cumulative impacts concerning geology and minerals are found to be less than significant.

5.5 SOILS

Region of Influence

The ROI for cumulative impacts on soil resources includes areas where soil would be directly disturbed and adjacent areas that may be influenced by wind or water-borne sediment, which includes the SPPC, Ormat, and Vulcan Survey Areas.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The combined impacts on soils from the Proposed Actions can be separated into impacts in eastern areas that do not have agricultural use, and western areas that do have agricultural use. In the Salt Wells Energy Projects Area east of and including the Ormat Survey Area, playas, dune land, bare rock, and areas of thin soil predominate. Construction activities in that area would disturb soil with high susceptibility to wind erosion, and would also disturb cryptobiotic soils. Development in areas with high susceptibility to wind erosion would require particular attention to mitigation measures that reduce soil disturbance and shorten the time that disturbed areas remain unvegetated. Mitigation measures would include leaving soil intact in some areas, and cutting vegetation at the ground surface. A reclamation plan would be developed for each project to guide rapid re-establishment of vegetation. Even with mitigation measures, minor amounts of wind erosion and nearby deposition of wind-deposited soil would occur where sufficient wind energy is applied. The areas east of Carson Lake and Pasture do not have a high percentage of vegetative cover, and access roads to project features could exacerbate destruction of the sparse vegetative cover by recreational use of OHVs, thereby increasing wind erosion. Reclamation plans would address restricting access of OHVs to construction areas and to areas in the process of reclamation.

In the Salt Wells Energy Projects Area west of the Ormat Survey Area, agricultural land use is predominant. Permanent impacts on agricultural soil

resources from the whole of the actions would consist of direct conversion of soil to constructed non-soil features in the footprint of transmission towers. Additional soil would be affected on a temporary basis during construction by actions such as grading to form flat working surfaces at transmission structure and stringing sites.

Cumulative Impacts

The majority of impacts on soils in the vicinity of the Salt Wells Energy Projects Area are from activities that restrict the use of water for irrigation (Harriman 2010). Where water is no longer used for irrigation, previous farmland becomes unvegetated and disturbed soil can be mobilized by wind. If sufficient water is applied, however, agriculture has a low impact on soil quality in the Projects Area and common management practices are effective at protecting soil from erosion. If water is no longer used for irrigation, sodium and salt effects on surface soils increase, and the capacity of soil to support vegetation is severely reduced. This effect is particularly evident in areas near Carson Lake and Pasture, where soils are generally more fine-grained and have a greater ability to wick salts to the surface.

Restriction of water for irrigation and resulting soil conservation near the city of Fallon is caused by diversion of water or water rights to residential development for the City of Reno, the City of Sparks, the Truckee Meadows Water Authority, and Washoe County (Dahl 2010). In addition, the Pyramid Lake Paiute Tribe diverts water away from agricultural irrigation to support in-stream flows for fish habitat, and the USFWS diverts water to wetland wildlife refuges near the Carson Lake and Pasture. If agricultural fields have sufficient irrigation water, wind erosion is generally low in the Salt Wells Energy Projects Area. This is because alfalfa is the major crop, and stubble is left in the fields to protect the soil from wind erosion. When water rights are removed from farmland, the farmland typically becomes abandoned. Organic matter is quickly lost from the non-irrigated lands, and the soils often become hydrophobic, posing difficulties for future reclamation of the land into either wildlife habitat or back into agriculture.

The Salt Wells Energy Projects would not divert significant amounts of potential irrigation water away from agricultural application, and would not negatively affect existing irrigation water quality. Because of this, the Salt Wells Energy Projects would not exacerbate the existing soil impacts associated with restricted irrigation.

In the areas east of Carson Lake and Pasture, grazing and OHV use currently cause destruction of vegetation and expose soil directly to wind erosion. Impacts from the whole actions when combined with OHV use and grazing would result in impacts to soil resources. However, the Proposed Action and Alternatives would implement Environmental Protection Measures and reclamation and each project would be required to submit plans to NDEP and

Churchill County outlining soil protection measures; therefore, potential cumulative impacts on soil resources would be minimized.

5.6 FARM LANDS (PRIME OR UNIQUE)

Region of Influence

The ROI for cumulative impacts on soil resources includes areas where soil would be directly disturbed and adjacent areas that may be influenced by wind or water-borne sediment, which includes the SPPC, Ormat, and Vulcan Survey Areas.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

No Unique Farmlands have been designated in the Salt Wells Energy Projects Area. The combined impacts on Prime Farmlands from the whole of the actions occur almost exclusively in the SPPC Project Area. No Prime Farmland is present in the Vulcan Project Area, and insufficient irrigation water is available to farm the lands categorized as Prime Farmland If Irrigated in the Ormat Project Area. As a result, the impacts to Prime Farmlands from the Whole of the Actions would be the same as those discussed for the SPPC Proposed Action or Alternatives (see **Section 4.6.2**).

Cumulative Impacts

The largest disturbance or threat to potential Prime Farmlands near the city of Fallon is the removal of water rights. The amount of irrigated farmland near Fallon has decreased to approximately 45,000 acres from a previous high of 60,000 acres. This is due to procurement of water rights for residential development for the City of Reno, the City of Sparks, the Truckee Meadows Water Authority, and Washoe County (Dahl 2010). In addition, the Pyramid Lake Paiute Tribe diverts water away from agricultural irrigation to support in-stream flows for fish habitat, and the USFWS diverts water to wetland wildlife refuges near the Carson Lake Pasture. These impacts not only reduce the amount of water available in an area where water is scarce, but they also reduce participation in and funding for the maintenance of irrigation canals. NAS Fallon has instituted a program to purchase and conserve adjacent lands in agricultural use, and Churchill County has an easement purchasing program to promote farmland conservation in the agricultural area south of Fallon. Residential development pressure has occurred but has been partially offset by the previously described conservation programs.

Due to the deficiency in precipitation (approximately 4 inches per year) compared to evapotranspiration (up to 50 inches per year), irrigation is necessary for productive farming in the vicinity of Fallon. However, the Proposed Action and Alternatives would not divert large amounts of potential irrigation water away from agricultural application, and would not affect existing irrigation water quality. The Salt Wells Energy Projects would allow water to be applied to the applicable Prime Farmlands if irrigated. Therefore, the whole of

the actions would not decrease the potential for Prime farmlands in the ROI when combined with other past, present, and reasonably foreseeable actions.

5.7 WATER QUALITY AND QUANTITY

Region of Influence

The ROI for the assessment of cumulative impacts on water resources is the same as for the direct and indirect impact assessment and consists of an area bounded by the following features:

- Western edge of the Carson Lake wetlands on the west (boundary between R28E and R29E);
- Eastern edge of Salt Wells Basin on the east;
- Fallon, Nevada on the north; and
- Southern edge of the Vulcan lease boundary.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Impacts from the whole of the Proposed Actions are summarized in **Table 5-4**, Potential Direct and Indirect Impacts on Water Quality and Quantity, below. These potential impacts are listed for the SPPC, Ormat, and Vulcan Proposed Actions, including Alternatives.

Cumulative Impacts

Cumulative impacts from the whole of the Proposed Actions (SPPC, Ormat, and Vulcan) would occur to water quality and quantity. The cumulative impacts on water resources are described qualitatively because no specific groundwater modeling has been completed to quantify the potential impacts.

The ENEL Geothermal Power Plant is located in the Salt Wells Energy Projects Survey Area, less than 2 miles east of the Vulcan Project Area; this facility has five production wells and four injection wells, along with pipelines and a 6-mile transmission line. If geothermal groundwater that would support the Vulcan and Ormat projects is pumped from the same aquifer used by the ENEL Geothermal Power Plant, then the following cumulative effects could occur: (a) change in quality and quantity of flows from thermal springs and seeps due to pumping; (b) reduction in groundwater in storage due to pumping; (c) change in deep groundwater flow paths and pressures; and (d) change in shallow groundwater quality from on-site septic systems. If relatively shallow groundwater is pumped from the ENEL Geothermal Power Plant for cooling water, then cumulative drawdown of groundwater could occur in the cool-water aquifers. These impacts would occur during the period of groundwater pumping and for some time thereafter, until the affected groundwater system recovers to near equilibrium conditions.

Table 5-4
Potential Direct and Indirect Impacts on Water Quality and Quantity

SPPC Action & Alternative	Ormat Action & Alternative	Vulcan Action & Alternative
Potential Direct Impacts - Cumulative		
Accidental release of chemical pollutants during construction, operation, and maintenance of facilities.	Same as SPPC	Same as SPPC
Change in quality and quantity of surface water from erosion and sedimentation caused by ground disturbance and removal of vegetation.	Same as SPPC	Same as SPPC
	Infiltration of drilling fluids and geothermal water from base of unlined reserve pit located at each drill pad (drilling mud would help seal pit bottom.)	Same as Ormat, except reserve pits would be lined with local clay material.
	Change in quality and quantity of flows from thermal springs and seeps due to pumping.	Same as Ormat
	Reduction in some groundwater storage due to pumping from >1500 ft. depth.	Greater reduction in ground-water storage due to higher water consumption for flash power plant(s).
	Change in deep groundwater (>1500 ft. depth) flow paths and pressures due to well pumping and reinjection.	Same as Ormat
	Affect water rights of other groundwater users in ROI.	Same as Ormat
	Makeup water needs (2500 to 3500 gpm April to October) would be obtained from existing rights on Newlands project canal; no impact by using existing water rights.	Makeup water needs (up to 11,000 gpm) for cooling would be from up to 20 ground-water wells; additional withdrawal impacts from cool water aquifer (approx. 750 ft. depth).
	Impacts to shallow groundwater quality from on-site septic system.	Same as Ormat

Table 5-4
Potential Direct and Indirect Impacts on Water Quality and Quantity

SPPC Action & Alternative	Ormat Action & Alternative	Vulcan Action & Alternative
Potential Indirect Impacts - Cumulative		
Minor changes in evapo-transpiration from and recharge to shallow ground-water due to removal of vegetation.	Same as SPPC	Same as SPPC
	Overall change in water balance (e.g. recharge-discharge; evapotranspiration; groundwater flow systems).	Same as Ormat

Additional similar cumulative impacts may occur on groundwater resources from the pumping of previously approved geothermal pumping and injection wells in the Ormat and Vulcan Project Areas. At the Ormat site, 12 pads were previously approved, with multiple wells at each pad. At the Vulcan site, 20 exploration wells have been approved. These previously permitted wells in both Project Areas, however, are for exploration purposes with pumping occurring only on a temporary basis.

A proposed energy park near Fallon, and a proposed geothermal program at NAS Fallon, could result in some cumulative impacts to geothermal groundwater resources if extraction wells are installed and put into production at one or both of these sites.

If any additional construction activities are completed at one or more of the sites mentioned previously, cumulative impacts on surface water could occur from increased erosion and sedimentation caused by ground disturbance and removal of vegetation. Mitigation using BMPs, however, would control these temporary impacts.

5.8 FLOODPLAINS, WETLANDS, AND RIPARIAN ZONES

Region of Influence

The ROI for cumulative impacts on floodplains, wetlands, and riparian zones includes the project lease areas, as well as Carson Lake and Pasture and the Salt Wells Basin.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

All projects would directly or indirectly affect some wetlands, including wet meadows, playas, and perennial wetlands. These are Waters of the State and require a permit to comply with Section 401 of the CWA. Vegetation removal and ground disturbing activities could increase the likelihood for erosion and

sedimentation in nearby wetlands. All project proponents would create Stream, Wetland, Well, Spring, and Canal Protection Plans, Erosion Control Plans, and Spill Prevention Control Plans to reduce impacts.

Portions of the SPPC and Ormat Projects would be built within the 100-year floodplain. Neither of these projects would affect the locations of floods, and the project proponents would take precautions when working in flood areas to minimize impacts.

Cumulative Impacts

Combined with other past, present, and reasonably foreseeable future actions, the Proposed Actions would contribute incrementally to wetland, riparian, and floodplain disturbance and removal in the region both temporarily and permanently. Past, present, and future geothermal development and exploration would continue to disturb and destroy wetlands and riparian zones in the region due to project facilities, transmission line, and access roads. Increasing recreation pressure, including OHVs, would continue to disturb wetlands and riparian zones and spread weeds. If the Proposed Actions were constructed simultaneously with other projects, cumulative construction and operation impacts on wetlands, riparian zones, and floodplains could increase. If projects in the region were not successfully restored, wetland communities would be lost or permanently converted to communities dominated by invasive, nonnative species. Alternately, land use planning efforts could help prioritize areas for protection, particularly wetland, riparian, and floodplain areas. With implementation of applicant proposed measures and suggested mitigation measures in **Section 4.8**, Floodplains, Wetlands, and Riparian Zones, cumulative impacts caused by the Proposed Actions would be minimized, and no additional mitigation measures are recommended.

5.9 VEGETATION

Region of Influence

The ROI for vegetation resources encompasses the Salt Wells Energy Projects Area plus a one-mile buffer.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Together, the three Proposed Actions would have impacts on vegetation resources by removing native plant communities. The projects would have both temporary and permanent effects on vegetation. Temporary impacts on vegetation would be exacerbated by concurrent construction of the Proposed Actions. **Table 5-5**, Impacts on Vegetation Communities Associated with the Whole of the Actions, shows the total acres of impacted vegetation caused by the three Proposed Actions.

Table 5-5
Impacts on Vegetation Communities Associated with the Whole of the Actions

Vegetation Community[1]	Temporary Impacts (acres)	Permanent Impacts (acres)
Greasewood flat	805	476
Mixed salt desert scrub	989	540
Playa	259	154
Emergent marsh and wet meadow	75	32
Agriculture and developed	389	165

[1] Note that riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.
Source: SWReGAP 2010

Indirect impacts would be similar to those described in **Section 4.9**, Vegetation. Together, the projects could result in weed spread and soil disturbance over a large area, especially if constructed concurrently. In addition to the projects being located near existing development and agricultural lands, similar native vegetation communities in the region are abundant. Applicant proposed measures and suggested mitigation measures in **Section 4.9**, Vegetation, would reduce impacts and no additional mitigation measures are recommended.

Cumulative Impacts

Combined with other past, present, and reasonably foreseeable future actions, the Proposed Actions would contribute to vegetation disturbance and removal in the region both temporarily and permanently. Past, present, and future geothermal development and exploration would continue to disturb and remove vegetation in the region due to project facilities, transmission lines, and access roads. Increasing recreation pressure, including OHVs, would continue to disturb native vegetation and spread weeds. If the Proposed Actions were constructed simultaneously with other projects, cumulative construction and operation impacts on native vegetation could increase. If projects in the region were not successfully revegetated, native vegetation communities would be lost, or native vegetation communities would be permanently converted to communities dominated by invasive, nonnative species. Alternately, land use planning efforts could help prioritize areas for protection, particularly native plant communities. With implementation of applicant proposed measures and suggested mitigation measures in **Section 4.9**, Vegetation, cumulative impacts caused by the Proposed Actions would be minimized, and no additional mitigation measures are recommended.

5.10 INVASIVE, NONNATIVE SPECIES

Region of Influence

The ROI for invasive, nonnative species includes the Salt Wells Energy Projects Area and a one-mile buffer.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Together, the three Proposed Actions could cause the introduction or spread of invasive, nonnative species over a large area. The projects would have temporary and permanent effects on vegetation as described previously in **Section 5.9**, Vegetation.

Ground-disturbing activities, increased access, and increased urbanization caused by the Proposed Actions could contribute to increasing invasive, nonnative species. Invasive, nonnative species populations could expand, and new populations could take hold in areas that become disturbed by construction activities. These impacts may not be mitigated unless all parties cooperate in accepted weed control measures and efforts to revegetate with native species. With implementation of applicant-proposed measures and mitigation measures recommended in **Sections 4.9**, Vegetation, and **4.10**, Invasive, Nonnative Species, the Proposed Actions would have a minimal impact on introduction or spread of invasive, nonnative species.

Cumulative Impacts

Ground-disturbing activities, increased access, and increased urbanization caused by the Proposed Actions and other past, present, and reasonably foreseeable actions could contribute to increasing invasive, nonnative species in the region. The Proposed Actions would contribute incrementally to the spread of invasive, nonnative species. Invasive, nonnative species populations could expand, and new populations could take hold in areas that become disturbed by construction activities associated with geothermal exploration and development as well as increasing recreation and OHV use. These impacts may not be mitigated unless all parties cooperate in accepted weed control measures and efforts to revegetate affected areas with native species. With implementation of applicant-proposed mitigation measures, in addition to those recommended in **Sections 4.9**, Vegetation, and **4.10**, Invasive, Nonnative Species, cumulative impacts caused by the Proposed Actions would have a minimal impact on introduction or spread of invasive, nonnative species in the region.

5.11 WILDLIFE

Region of Influence

The ROI for wildlife resources includes Salt Wells Energy Projects Area plus a one-mile buffer. For game species, the NDOW hunt units are considered.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Impacts on wildlife habitats are presented in **Section 5.9**, Vegetation. Cumulative impacts on wildlife resources would be similar to those described in **Section 4.11**, Wildlife, but could be exacerbated if project schedules were to coincide. Construction of all three projects simultaneously could result in greater impacts from emissions, noise, construction equipment, vehicle traffic, and overall habitat degradation and loss. Impacts from habitat fragmentation as described in **Section 4.11**, Wildlife, would be more substantial for the three projects combined, as they would impact a larger area of habitat. In general, the larger area of developed land that would result from constructing the three projects would be less attractive to wildlife for use as foraging, wintering, migrating, or nesting habitat. Not all species would be harmed by conversion of land to more intensive uses, and many would adapt to the developed landscape and associated noise and human use, given the existing level of development and noise currently in the region. The projects are located near existing development and similar wildlife habitat types in the region are abundant. The applicant-proposed measures described in **Section 4.11**, Wildlife, would help to reduce impacts on wildlife caused by the Proposed Actions.

Cumulative Impacts

Cumulative impacts resulting from the Proposed Actions and other past, present, and reasonably foreseeable actions would be similar to those described previously for the whole of the actions. The Proposed Actions would contribute incrementally to impacts on wildlife. Existing, proposed, and approved geothermal exploration and development in the region would contribute similar impacts as the proposed project and could result in direct and indirect impacts on wildlife and habitat. Increased recreational uses in the region, including OHVs, could further disturb wildlife due to mortality, injury, and habitat degradation through noise, human presence, and weed spread. The combined effects of the conversion of wildlife habitats to developed uses associated with actions in the region could exacerbate impacts associated with the Proposed Actions through habitat fragmentation and loss. Implementation of applicant proposed measures in **Section 4.11**, Wildlife, would reduce cumulative impacts caused by the Proposed Actions. No additional mitigation measures are recommended.

5.12 MIGRATORY BIRDS

Region of Influence

The ROI for cumulative impacts on migratory birds considers effects within the Nevada flyway, including Carson Lake and Pasture and Stillwater National Wildlife Refuge.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts on migratory birds would be similar to those described in **Section 5.11**, Wildlife. The combined length of transmission lines from the

three projects, particularly the SPPC and Vulcan Projects, would have a permanent effect on birds in the region. Birds utilizing Carson Lake and Pasture also use other nearby water bodies, such as the Stillwater National Wildlife Refuge, Harmon Reservoir, and S Line Reservoir. They travel between these wetlands with some regularity, and the transmission lines bisect this travel route, increasing the risk of collisions. Despite this permanent effect, birds would eventually adapt to the new power lines, and mortality levels are not anticipated to result in permanent loss of population viability for any species. The projects are located near existing development, and similar wildlife habitat types in the region are abundant. The applicant-proposed mitigation measures, in addition to those described in **Section 4.12**, Migratory Birds, would reduce impacts on birds caused by the Proposed Actions.

Cumulative Impacts

Cumulative impacts on migratory birds from the Proposed Actions combined with other past, present, and reasonably foreseeable future actions would be similar to those described previously for the whole of the actions. The Proposed Actions would contribute incrementally to impacts on migratory birds. Other geothermal exploration and development would further fragment habitats by erecting transmission lines. Increasing recreation, including OHV use, would degrade habitat through increased noise, human presence, and weed spread. Implementation of applicant-proposed mitigation measures, in addition to those described in **Section 4.12**, Migratory Birds, would reduce cumulative impacts caused by the Proposed Actions. No additional mitigation measures are recommended.

5.13 BLM-DESIGNATED SENSITIVE SPECIES (ANIMALS AND PLANTS)

Region of Influence

The ROI for BLM-designated sensitive animal and plant species includes the Salt Wells Energy Projects Area plus a one-mile buffer.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts on BLM-designated sensitive animal and plant species would be similar to those described previously in **Sections 5.11**, Wildlife, and **5.12**, Migratory Birds. In total, the projects could affect two BLM-designated sensitive plant species, one BLM-designated sensitive invertebrate species, ten BLM-designated sensitive bird species, and eight BLM-designated sensitive bat species. Given their special status, all of these species are likely to be sensitive to habitat loss and fragmentation. Several of these species, including bats, golden eagle, and prairie falcon, are especially sensitive to human presence and disturbance. The projects are located near existing development, and similar wildlife habitat types in the region are abundant for use by BLM-designated sensitive species. Implementation of the applicant-proposed measures and mitigation measures described in **Section 4.13**, BLM-Designated Sensitive Species (Animals and

Plants), would help to reduce impacts on sensitive species caused by the Proposed Actions.

Cumulative Impacts

Cumulative impacts on BLM-designated sensitive animal and plant species from the Proposed Actions combined with other past, present, and reasonably foreseeable future actions would be similar to those described previously for the whole of the actions. The Proposed Actions would contribute incrementally to impacts on BLM-designated sensitive species. Other geothermal exploration and development would further fragment habitats by erecting transmission lines. Increasing recreation, including OHV use, would degrade habitat through increased noise, human presence, and weed spread. With the implementation of applicant proposed mitigation measures, in addition to those described in **Section 4.13**, BLM-Designated Sensitive Species (Animals and Plants), cumulative impacts caused by the Proposed Actions would be reduced and no additional mitigation measures are recommended.

5.14 CULTURAL RESOURCES

Region of Influence

The ROI for cumulative impacts on cultural resources includes the Salt Wells Energy Projects Area plus a one-mile buffer. The architectural cultural resources ROI is a one-half-mile buffer about the proposed transmission line corridors.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Potential cumulative impacts on cultural resources, specifically historic properties, would include both direct and indirect effects. Direct impacts resulting from ground disturbance, vegetation removal, increased access, and artifact collection, as well as indirect impacts such as visual integrity compromise through construction of transmission lines, power plants, wells, and other highly visible facilities, are expected from the construction of the whole Action. Implementation of the mitigation and avoidance measures outlined in the Salt Wells Energy Projects PA (2010) including development of site specific treatment plans and their implementation would help reduce or mitigate adverse effects to historic properties found within the project APEs.

Cumulative Impacts

Cumulative impacts on cultural resources, specifically historic properties, from the Proposed Actions combined with other past, present, and reasonably foreseeable future actions would be similar to those described for the whole of the actions. The Proposed Actions would contribute incrementally to impacts to regional historic properties. Additional geothermal exploration and development would further add to the modern well pad, plant, pipeline, and transmission line developments that already occur in the region. Increasing recreation, including OHV use, might increase human presence and artifact collecting. With the implementation of applicant proposed measures such as

avoidance of historic properties, and use of mitigation measures outlined in **Appendix D**, Programmatic Agreement for the Salt Wells Energy Projects, for cultural resources, cumulative impacts caused by the Proposed Actions would be reduced, and potential adverse effects mitigated.

5.15 NATIVE AMERICAN RELIGIOUS CONCERNS

Region of Influence

As identified in **Section 4.15**, Native American Religious Concerns, the ROI for cumulative impacts on Native American Religious Concerns is the Salt Wells Energy Projects Area and surrounding lands designated as traditionally important to the local Native American culture.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts on Native American Religious Concerns from the whole of the actions would be similar to those identified under the SPPC Proposed Action in **Chapter 4**, Environmental Consequences.

Cumulative Impacts

Within the ROI, cumulative impacts have occurred within lands that have provided, and continue to provide, sustenance as well as spiritual and religious renewal for the indigenous people. Mining-related activities, cattle grazing, and other actions in the cumulative ROI cumulatively have affected, or would affect, these resources and Fallon Paiute-Shoshone tribal tradition and lifeways.

5.16 PALEONTOLOGICAL RESOURCES

Region of Influence

The ROI for paleontological resources includes existing, approved, proposed, and reasonably foreseeable development within and around the City of Fallon, Nevada, and unincorporated areas of Churchill County in the vicinity of the Salt Wells Energy Projects.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

This section addresses potential cumulative impacts of the whole of actions, including SPPC, Ormat, and Vulcan, concerning paleontological resources. Paleontological resources include vertebrate, invertebrate, or plant fossils.

Paleontological investigations previously conducted within the Salt Wells Energy Projects Area identified paleontological localities, including significant paleontological localities within the boundaries of the Projects, resulting in a net loss of paleontological resources. There is also low the possibility for the inadvertent discovery of paleontological resources during ground disturbing project activities. Consequently, there is a low possibility that these projects could result in a net loss of paleontological resources.

If significant paleontological resources are present within the Projects Area, implementation of the mitigation measures outlined in **Section 4.16,** Paleontological Resources are expected to reduce the cumulative impacts on paleontological resources.

Cumulative Impacts

Adoption of the Proposed Actions or Alternatives (SPPC, Ormat, and Vulcan), along with any foreseeable development in the region, is unlikely to result in cumulative impacts due to the loss of as yet unrecorded paleontological localities. Such impacts would be reduced by mitigation implemented on a project-by-project basis. This contribution is considered, cumulatively, to be less than significant.

5.17 VISUAL RESOURCES

Region of Influence

The ROI for assessing regional visual resources impacts includes the viewsheds from KOPs along the SPPC corridor, viewsheds that include the Ormat Project Area and viewsheds that include the Vulcan Project Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The three Proposed Actions together would impact visual resources through construction of the proposed transmission line and facilities, well drilling, and operation of the geothermal power plants. There would be various temporary and permanent effects on viewsheds in the Salt Wells Energy Projects Area. Construction activities would be visible from area roadways, including Highway 95, Highway 50, and roads along transmission line corridors. Additional access roads, staging areas, and structural supports would be visible structures but would be removed when construction is complete. The combined effects of the construction of all three projects would have increased visual impacts and increased visibility. The temporary nature of the visual impacts from construction would not constitute a violation of BLM Class III VRM standards.

The Ormat and Vulcan geothermal power plants would be the most visible portions of the combined projects and would have cumulative visual effects. With proposed mitigation measures, the impacts from the power plants would be reduced, but would still exist. The geothermal power plants would be the most visible and would likely result in a noticeable change of visual character in the area.

The transmission line, substation, geothermal wells, and pipelines would be less immediately visible as they are smaller structures and they would blend in with existing infrastructure.

Cumulative Impacts

Past, present, and reasonably foreseeable geothermal projects in the region have the potential to introduce additional structures or equipment, transmission

lines, roads, employee traffic, and maintenance facilities. Of the 20 previously approved Vulcan exploration wells, 11 have been constructed and are included in the baseline condition for visual resources. Additional wells constructed within the viewsheds of Highway 50 or Highway 95, which carry the most traffic in the area, combined with the Salt Wells Energy Projects, could have visual impacts in the area. The previously approved Ormat and Vulcan wells and well pads in the Salt Wells Energy Projects Area, when combined with the Salt Wells Energy Projects, could have visual impacts from the Highway 50 viewshed. The northeastern portion of the Ormat Project Area, which is the only portion of the Project Area highly visible from Highway 50, consists mostly of proposed and existing well pad locations. Only two previously approved well pads have not been construction and construction of these two locations would not likely cause additional impacts when combined with the Salt Wells Energy Projects.

Implementing proposed mitigation measures would reduce some impacts from the geothermal power plants. All other parts of the projects would have various cumulative effects.

5.18 LIVESTOCK GRAZING

Region of Influence

As identified in **Section 4.18**, Livestock Grazing, the ROI for cumulative impacts on livestock grazing includes BLM grazing allotments and Reclamation pastures that overlap with the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts on livestock grazing from the whole of the actions would be similar to those identified in **Chapter 4**, Environmental Consequences. Temporary disturbance would be phased as construction of the three projects would not take place simultaneously. **Table 5-6**, Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Whole of the Actions, depicts approximate acreage of disturbance collectively from the three Proposed Actions. Under this scenario, less than 1 percent of the forage within the Bass Flat Allotment and the Carson Lake and Pasture would be permanently lost. Approximately 1.45 percent of the forage base would be lost within the Rock Springs Allotment, and over 3 percent of the forage base would be lost in the Grimes Point Pasture (which is the same as identified under the Proposed Action). Collectively these permanent disturbances encompass a greater amount of acreage than under the individual projects; however the loss of permanent forage would not necessitate reduction in AUMs or removal of any cattle.

The potential reduction in water quantity caused by consumptive water use associated with the Ormat and Vulcan projects could displace cattle from the

Table 5-6
Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Whole of the Actions (SPPC, Ormat, and Vulcan)

Allotment/ Pasture	Land Ownership	Temporary Disturbance (acres)**	Permanent Disturbance (acres)**
Rock Springs	BLM	1,117	615
Bass Flat	BLM	98	64
Carson Lake and Pasture	Reclamation	333	186
Grimes Point	Reclamation	105	61

*The Proposed Actions were used for representative disturbance calculations for all three projects.
**Includes 230-kV transmission line, pipelines, well pads, substations, interconnect transmission lines, switching stations, and power plant disturbances on public land (if applicable).

Rock Springs allotment and cause cattle to concentrate in other areas, as described in **Chapter 4**. Collectively, this impact would be greater than impacts from either of the projects individually.

Cumulative Impacts

It is assumed that under the Carson Lake and Pasture title transfer, grazing would continue to operate, and impacts would be the same as under the Proposed Actions. Based on the rest of the cumulative project list identified under Table 5-1, only three projects would affect livestock grazing in addition to the Proposed Actions: the ENEL Geothermal Power Plant, Ormat's previously permitted exploration program, and Vulcan's previously permitted exploration program. **Table 5-7**, Approximate Cumulative Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands, depicts the acreage of base forage that would be permanently lost under each of the Proposed Actions and the whole of the actions in combination with identified cumulative projects. The combined loss of forage acreages and potential for water quantity reduction are slightly greater than identified under the Proposed Actions or the whole of the actions. Under the worst cumulative case scenario (the whole of the actions plus any identified cumulative projects), Grimes Point Pasture would lose 4 percent of available grazing forage. Considering that only 16 cattle graze on the Grimes Point Pasture during the grazing season, enough forage would be available to sustain the herd.

5.19 RECREATION

Region of Influence

The ROI for assessing cumulative recreation impacts is the Salt Wells Energy Projects Area.

Table 5-7
Approximate Cumulative Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands

Allotment/ Pasture	Permanent Disturbance-Proposed Action	Permanent Disturbance-Identified Cumulative Projects (acres)**	Total Permanent Disturbance
SPPC Proposed Action plus Identified Cumulative Projects*			
Rock Springs	97	89	186
Bass Flat	6	4	10
Grimes Point	0	14	14
Carson Lake and Pasture	34	0	34
Ormat Proposed Action plus Identified Cumulative Projects*			
Grimes Point	61	14	74
Carson Lake and Pasture	92	0	92
Vulcan Proposed Action plus Identified Cumulative Projects*			
Rock Springs	518	89	607
Bass Flat	59	4	67
Grimes Point	0	14	14
Carson Lake and Pasture	61	0	61
Whole of the Actions plus Identified Cumulative Projects*			
Rock Springs	615	89	704
Bass Flat	65	4	69
Carson Lake and Pasture	152	0	152
Grimes Point	61	14	74

* The Proposed Actions were used for representative disturbance calculations for all three projects. Identified Cumulative Projects=Vulcan Power previous Exploration Program, Ormat Previous Exploration Program and the ENEL Geothermal Power Plant.
**Includes 230-kV transmission line, pipelines, well pads, substations, interconnect transmission lines, switching stations, and power plant disturbances on public land (if applicable).

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The three Proposed Actions together would impact recreation through construction of the proposed transmission line and facilities, well drilling, and operation of the geothermal power plants. There would be various temporary and permanent effects on recreation in the ROI. Construction activities would create noise and visual changes that could impact visitor satisfaction with existing recreation areas or uses temporarily. The SPPC transmission line and power plants would have longer-term impacts related to noise and visual changes. The projects would also result in increased roads in the ROI and the potential for increased OHV use of the area. These impacts would be reduced through the reclamation of temporary access, centerline, and spur roads. Access for recreation in the ROI would be mitigated to minimize impacts to wildlife viewing and hunting in the Carson Lake and Pasture area. Therefore, the projects would not result in permanent cumulative impacts.

Cumulative Impacts

It is assumed that under the Carson Lake and Pasture title transfer, recreational use would continue and impacts would be the same as under the Proposed Actions. Based on the rest of the cumulative project list identified under Table 5-1, only three projects would affect recreation in addition to the Proposed Actions; the ENEL Geothermal Power Plant, Ormat's previously permitted exploration program, and Vulcan's previously permitted exploration program. The VORRA race route was moved to address safety concerns associated with the ENEL Geothermal Power Plant and facilities. In addition other future geothermal projects in the region have the potential to introduce additional structures or equipment, transmission lines, roads, employee traffic, and maintenance facilities. Cumulative impacts caused by the Proposed Actions would range from moderate to minor. Of the 20 previously approved Ormat exploration wells, 11 have been constructed and are included in the baseline condition for recreation resources. Additional wells constructed within the ROI, combined with the Salt Wells Energy Projects, could result in recreation impacts in the area if OHV use increased or if recreational access was modified. The previously approved Ormat, Vulcan, and ENEL activities in the Salt Wells Energy Projects Area, when combined with the Salt Wells Energy Projects, could result in cumulative impacts on recreation.

5.20 NATIONAL SCENIC AND HISTORIC TRAILS

Region of Influence

The ROI for National Scenic and Historic Trails includes a ten-mile buffer around the SPPC Survey Area and Ormat and Vulcan Project Areas.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The SPPC and Ormat Projects would not contribute to impacts on National Scenic and Historic Trails. As such, the Vulcan Project would be the only source of impacts. Impacts from the whole of the actions would only result from the Vulcan Project, as described in **Section 4.20**, National Scenic and Historic Trails.

Cumulative Impacts

The existing ENEL Geothermal Power Plant and associated facilities east of the Bunejug Mountains are a source of degradation to the viewshed, which currently may impact visitor satisfaction along this portion of the Pony Express National Historic Trail. Mitigation measures were applied for the ENEL Geothermal Power Plant project to reduce visual impacts. The proposed Vulcan Project would compound this degradation, although the Vulcan power plant that would be visible is farther from the Pony Express National Historic Trail than the ENEL Geothermal Power Plant. Other projects, particularly geothermal and other energy generation projects, could permanently degrade the viewshed if they were visible from the Pony Express National Historic Trail. In addition, cumulative projects could have temporary impacts if construction activities

were to occur on the Pony Express National Historic Trail. Mitigation measures would be required for all projects to reduce impacts and to preserve the historic qualities for which the Pony Express National Historic Trail was designated.

5.21 NOISE

Region of Influence

The ROI for cumulative impacts on noise includes a one-mile buffer around the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The three projects would not combine to cumulatively increase noise for any sensitive receptors within 1 mile of the ROI during either construction or operation; however, two of the projects, the SPPC Project and the Ormat Project, could result in cumulative impacts on the residence located approximately 0.35 mile to the west of the proposed Ormat power plant location. This cumulative impact would occur only under the following conditions:

- Under SPPC Alternative 2, which would locate the transmission line within 500 feet of the residence; and
- If construction activities of the transmission line under Alternative 2 were to occur at the same time as construction of the power plant, construction of Carson Lake Substation, construction of the well pad, access roads, or pipeline associated with well C-i, or at the same time as the drilling or flow testing of well C-i.

Cumulative Impacts

No cumulative impacts are anticipated from the whole of the actions when combined with the identified cumulative project list; however, the whole of the actions may result in cumulative noise impacts on sensitive receptors near the SPPC and Ormat Project Areas when combined with existing noise from NAS Fallon overflights. Such cumulative impacts would be temporary for the construction phase of the project and permanent for the operational phase of the project.

5.22 PUBLIC HEALTH AND SAFETY

Region of Influence

The ROI for cumulative impacts on public health and safety is the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Together, the three Proposed Actions could increase the amount and extent of public safety hazards in the ROI, especially if the projects were concurrent,

having potential impacts on workers and the general public. All projects would implement BMPs and would comply with public health and safety regulations, as described in **Section 4.22**, Public Health and Safety.

Implementing the whole of the actions would cumulatively increase the number of EMF sources in the ROI, although impacts would be localized to the source. The level of EMF at the edge of the ROW for all projects would be low, as described in **Section 4.22**, Public Health and Safety.

Cumulative Impacts

While there are many sources of EMF currently in the ROI, impacts tend to be localized to the source. The number of sources would likely increase as development continues in the region, particularly geothermal and other energy development. Projects would be expected to implement mitigation measures if EMF levels were high at the edge of the ROW, thus minimizing cumulative impacts.

The combination of hazardous materials and other health and safety risks associated with the development and operation of geothermal and other energy facilities in conjunction with similar health and safety concerns for other reasonably foreseeable projects in the region is expected to be within acceptable levels. All projects would have to comply with state and federal requirements pertaining to worker safety and the use, storage, transport, and disposal of debris and hazardous materials and wastes, thereby minimizing cumulative impacts. The potential for hazardous waste spills (fuel, drilling muds, etc.) would be minimized through the application of BMPs included in lease terms and would not be at a large enough scale to cumulatively affect human health and safety within the ROI.

5.23 FIRE MANAGEMENT

Region of Influence

The ROI for fire management includes the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

All three projects and Alternatives could cumulatively increase the potential for fire within the ROI. Direct impacts would be greater if construction of the projects were concurrent, as this would expose a greater area to fire hazards at the same time, thus increasing the risk of a large, catastrophic fire should multiple fires occur. However, all three project proponents would implement BMPs to reduce the likelihood for fire and improve fire management during construction and operation of the projects. No indirect cumulative effects on fire management are anticipated.

Cumulative Impacts

Cumulative impacts caused by other geothermal and energy development in the area could increase the potential for fire within the ROI. Direct impacts would

be greater if construction of several projects were concurrent, as described previously. It is assumed that all project proponents would implement similar BMPs to prevent the likelihood of fire during construction and operation of the projects. In addition, cumulative impacts involving wildfires would be reduced given that local cities and Churchill County continue to provide increased firefighting services as development increases.

5.24 WASTES, HAZARDOUS OR SOLID

Region of Influence

The ROI for hazardous and solid wastes includes the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The Proposed Actions would increase the amount of hazardous and solid wastes in the ROI, particularly if projects were concurrent. This could increase public health and safety concerns and stress the capacity of the waste disposal stream. BMPs implemented for the projects would reduce potential impacts to the environment. All solid and hazardous wastes generated during construction and operation of the projects would be transported to licensed facilities off-site for treatment and disposal. These wastes cannot be quantified at this time with any degree of certainty; however, in the context of existing and foreseeable solid and hazardous waste generation locally, the projects would constitute a minimal increase in waste generation and management, well within existing capacities and infrastructure. Therefore, construction and operation activities associated with the whole of the action would not cause or contribute substantially to cumulative impacts with respect to hazardous materials handling within the ROI.

Cumulative Impacts

Projects that could contribute to cumulative impacts in the area are mainly other geothermal or energy development projects. Existing, permitted, and proposed energy development projects would generate hazardous waste during construction, with less waste generated during operation and maintenance. These projects would likely be spread out geographically and temporally, thereby reducing demands on the hazardous waste disposal stream.

Other identified cumulative projects would be required to comply independently with hazardous materials regulations, depending on the nature and quantities of hazardous materials stored and used. As stated for the whole of the action, all solid and hazardous wastes generated during construction and operation of the projects would be transported to licensed facilities off-site for treatment and disposal and would not likely impact the waste disposal stream. Therefore, project construction and operation activities would not cause or contribute substantially to cumulative impacts with respect to hazardous materials handling within the ROI.

5.25 SOCIAL AND ECONOMIC VALUES

Region of Influence

The ROI for cumulative impacts on Social and Economic Values is Churchill County.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts of the Proposed Actions include the direct addition of up to 405 construction jobs. This addition would represent a 24.7 percent change from the 1,642 workers in the 2008 Churchill County construction workforce. Construction employment, while substantial, is not likely to result in permanent changes to the local population base or put a significant strain on local services. It is likely that construction employment needs would be staggered and that many employees would be available from the local area, thus a large influx in population is not anticipated. In addition, the high rate of housing vacancies in the County (19.5 percent in Churchill County in 2009) would make it likely that any influx of temporary employees could be absorbed without a strain on the local housing market. Finally, the high rate of unemployment in the region due to the recent economic downturn (9.1 percent in Churchill County in 2009) increases the availability of workers in the region. The temporary employment would bring an economic benefit to the local area by adding local job opportunities and bringing additional income into the County.

Permanent employment would represent an additional 69 employees. Assuming maximum direct employment, using an economic multiplier of 2.5 as defined in **Section 4.25**, Social and Economic Values, there is the potential for 173 jobs being added to the local economy as quantified for the Vulcan power plant project. This change represents a 1.4 percent increase from baseline County total employment. Additional employment needs for the SPPC transmission line or Ormat power plant and well pads have not been determined. Should these projects require permanent employees, they are likely to be less than the needs of Vulcan due to the smaller proposed project size. Therefore, total County employment is not likely to change by more than 2 to 3 percent. Even if full employment needs were recognized and all employees were recruited from outside the County, this increase is not likely to impact the local housing market or public services.

Cumulative impacts on property values include a total of up to 158 agricultural, industrial, and rural residential parcels potentially requiring compensation for property easements for the SPPC Proposed Action. Area properties in the vicinity of proposed transmission lines, new substations, and power plants may also experience changes in property values; however the amount cannot be quantified here due to the importance of other factors in determining property values. Impacts are expected to be minimal as the rural or industrial setting of the area would result in lesser impacts than in a more densely populated residential setting.

Additional cumulative impacts include contributions to the local government tax base from the construction of the Salt Wells Energy Projects and possible indirect tax contributions as a result of increased economic activity in the local area.

Cumulative impacts on recreation could also affect the local economy should the Proposed Actions impact the current dispersed recreational uses, including hunting, wildlife viewing, and OHV use. Revenues associated with recreation could decline if these activities were reduced or eliminated, or increase if they were made more accessible. The Pony Express National Historic Trail may be impacted by portions of both the SPPC and Vulcan Projects. Portions of these Project Areas would be unavailable for recreation during construction of the transmission lines, switching stations, and substations; the switching stations, substations, and power plant sites would be permanently unsuitable for recreation. Additional access roads required for the projects may increase access for recreational activities in the area until such roads are reclaimed. While some areas used for recreation would be impacted, recreation in the region is dispersed and there are plenty of other open and public lands available for such uses. No cumulative impact on money spent on recreation is expected.

It is not anticipated that cumulative impacts would affect the economic livelihood of ranchers and herders. Details are provided in **Section 5.18**, Livestock Grazing.

Cumulative Impacts

Past, present, and reasonably foreseeable geothermal projects in the region have the potential to introduce additional socioeconomic impacts to the ROI, including additional job creation and related economic and social impacts, as well as changes to property values.

The previously permitted Ormat and Vulcan Geothermal Explorations are in progress and may require some additional construction and operational employment. Cumulative impacts on construction employment numbers and related demands on area housing and public services would only occur should construction happen simultaneously with the Salt Wells Energy Projects. Work is in progress on both previously permitted projects. Commutative build out under Ormat's permitted project would comprise a total of twenty four (24) well pads with multiple wells possible at each well pad, of which two well pads have been constructed. Permitted work on Vulcan Salt Wells Exploration Project includes 20 permitted wells, of which 11 have been constructed. Permanent impacts on the local population base and economy resulting from these permitted projects are unlikely, since there would be little permanent employment.

Additionally, a proposed energy park on Reclamation-administered lands near Fallon and the NAS Fallon Geothermal Program may add employment opportunities, but no specific plans for development in the near future are

known at this time. The ENEL Geothermal Power Plant is complete and in operation. Any impacts of this plant and other operational power plants have been included in the current conditions discussion.

Impacts on private property value by present or foreseeable projects have been and would be assessed on a case-by-case basis by each proponent. It is possible that if the Proposed Actions or any of the project Alternatives are constructed, more development, such as other energy, infrastructural, industrial, commercial, or residential projects, would be built in the same area. This may or may not result in a permanent change to the rural nature of the area with potential impacts on current land uses such as recreation and ranching.

5.26 ENVIRONMENTAL JUSTICE

Region of Influence

The ROI for cumulative impacts on Environmental Justice is the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

There are no known minority or low income populations fitting the definition for environmental justice concerns within the Salt Wells Energy Projects Area. Therefore, there are no cumulative impacts on an environmental justice population as a result of the Proposed Actions.

Cumulative Impacts

There are no known minority or low income populations fitting the definition for environmental justice concerns within the Salt Wells Energy Projects Area. Therefore, there are no cumulative impacts on an environmental justice population as a result of the Proposed Actions.

CHAPTER 6
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CHAPTER 7
CONSULTATION, COORDINATION, AND PREPARATION

This section presents a summary of public participation, a list of persons consulted in preparation of the EIS and a list of preparers.

PUBLIC PARTICIPATION

Public participation specific to the Proposed Salt Wells Energy Projects (Proposed Actions) is summarized in this chapter. The summary indicates how the public has been involved, identifies persons and organizations contacted for feedback, and specifies time frames for accomplishing goals in accordance with 40 CFR 1506.6.

Public involvement in the EIS process includes the necessary steps to identify and address public concerns and needs. The public involvement process assists the agencies in broadening the information base for decision making; informing the public about the Proposed Actions and the potential long-term impacts that could result from the project; and ensuring that public needs are understood by the agencies.

Public participation in the EIS process is required by NEPA at four specific points: the scoping period, review of the Draft EIS, review of the Final EIS, and receipt of the Record of Decision. Public comments were encouraged throughout the EIS process.

Cooperating Agencies

The BLM invited nine agencies to participate in the EIS process as cooperating agencies and requested them to make a decision and to notify the BLM by August 30, 2009. The agencies that accepted are Reclamation, Churchill County, City of Fallon, Naval Air Station (NAS) Fallon, Nevada Division of Minerals, and NDOW. Representatives of these agencies are listed below:

Cooperating Agencies

Name	Organization
Eleanor Lockwood Planning Director	Churchill County Planning Fallon, NV
Steven D. King Assistant City Attorney	City of Fallon Fallon, NV
Ed DeCarlo Water and Lands Specialist	Bureau of Reclamation Carson City, NV
Becky Kurtz NEPA Coordinator	Naval Air Station Fallon Fallon, NV
John Dirickson Community Planning Liaison Officer	Naval Air Station Fallon Fallon, NV
Mark Freese Western Region	State of Nevada, Department of Wildlife Reno, NV
Lowell Price Oil, Gas, and Geothermal Program Manager	Nevada Division of Minerals Carson City, NV

SCOPING

The public is provided with a 30-day scoping period to disclose potential issues and concerns associated with the Proposed Actions. Information obtained by the agencies during public scoping is combined with issues identified by the agencies and this forms the scope of the EIS.

The public scoping period began on September 11, 2009, with the publication of the Notice of Intent (NOI) in the Federal Register and continued through November 10, 2009 (Scoping Period). A public scoping meeting, hosted by Churchill County, was held on October 21, 2009, at the County Administration Complex in Fallon, Nevada. The meeting provided an opportunity for members of the public, local government, tribes, utilities, and other interest groups to learn about the EIS, to provide input into the development of the EIS, and to voice their concerns related to potential environmental impacts so that they may be addressed in the EIS.

Additional Notifications

The following state and federal agencies were consulted during preparation of the EIS:

- Fallon-Paiute Shoshone Tribe
- Nevada State Historic Preservation Office
- United States Fish and Wildlife Service

The following current authorization holders were also sent notification letters about the project (see **Appendix F**, Land Use Authorizations in the Salt Wells Energy Projects Area):

- AMP Resources, LLC
- Hodges Transportation, Inc.
- AT&T Nevada
- HOV Energy
- Paiute Pipeline Co.
- Carson Lake Basin Project, LLC
- A & K Earthmovers

LIST OF PREPARERS

BLM
Interdisciplinary Team

Name	Role/ Resource Program
Chris McAlear	Carson City District Office Manager
Terri Knutson	Stillwater Field Office Manager
Colleen Sievers	EIS Project Manager/ Public Health and Safety
Jim DeLaureal	Air Quality / Farm Lands, Prime and Unique / Floodplains, Wetlands, and Riparian Zones / Invasive, Nonnative Species / Soils
Jill Devaurs	Livestock and Grazing / Vegetation
Carla James	Minerals and Geology
David Parker	EIS Assistant Project Manager
Erik Pignata	Land Use Authorizations, Air Space, and Access
Dave Schroeder	Wastes, Hazardous or Solid Materials
Gabe Venegas	Water Quality and Quantity
Dan Westermeyer	Special Designations and Lands with Wilderness Characteristics / Recreation / Visual Resources
John Wilson	Migratory Birds / Special Status Species / Noise / Wildlife
Jason Wright	Cultural Resources / Native American Religious Concerns / National Scenic and Historic Trails / Paleontological Resources
Desna Young	Environmental Justice / Social and Economic Values

EMPSi –
Environmental Management and Planning Solutions, Inc. (*Contractor*)

Name	Resource Program	Degree(s)	Years of Experience
David Batts	Project Manager / Environmental Justice / Social and Economic Values	MS, Natural Resource Planning	20
Holly Prohaska	Deputy Project Manager / Livestock Grazing	MS, Environmental Management	12
Terry Grotbo	Principal Geologist/ Minerals and Geology	BS, Earth Sciences	33
Angie Adams	Formatting	BA, Biology	15
Wendy Broadhead	Biological Resources Review	BS, Plant Science	20
Vickie Clay	Cultural Resources / Native American Religious Concerns	MS, Quaternary Studies	25
Amy Cordle	Air Quality / Land Use Authorizations, Air Space, and Access	BS, Civil Engineering	13
Andrew Gentile	Wastes, Hazardous or Solid Materials / Noise / Public Health and Safety / Fire Management	MS, Environmental Management	10
Julia Howe	Visual Resources	MLA, Landscape Architecture	2
Sonia Hutmacher	Paleontological Resources / Minerals and Geology	MA, Anthropology	11
John King	QA/QC	MPH, Toxicology	30
Laura Long	Technical Editing	MA, Media and Communications	2
Marcia Rickey	GIS Specialist	MS, Biology	5
Doug Rogness	Water Quality and Quantity	MS, Hydrology	30
Cam Stringer	Water Quality and Quantity	MS, Geology/ Hydrogeology	20
Jennifer Thies	Floodplains, Wetlands, and Riparian Zones / Special Designations and Lands with Wilderness Characteristics / Land Use Authorizations, Airspace, and Access / Recreation / National Scenic and Historic Trails	MS, Resource Management	13
Wilhelm Welzenbach	Farm Lands, Prime and Unique / Soils	MS, Soil Science	6
Kate Wynant	Visual Resources, Formatting	BA, Environmental Studies	4
Craig Young	Cultural Resources	Ph.D, Anthropology	22
Meredith Zaccherio	Invasive, Nonnative Species / Migratory Birds / Special Status Species / Vegetation / Wildlife	MA, Biology	5

CHAPTER 8
GLOSSARY

Access Roads—Access roads are used during development to construct the production wells and install equipment. During utilization, access roads are used for accessing wells for maintenance.

Ambient air—Any unconfined portion of the atmosphere; the outside air.

Aluminum conductor steel reinforced—This type of conductor has aluminum strands wrapped around a stranded steel core. The steel reinforces the conductor because it is much stronger.

Ambient air quality standard—A federal and state measure of the level of air contamination that is not to be exceeded in order to protect human health.

A-weighted decibel (dbA)—The scale normally used to approximate human hearing response to sound.

BLM Sensitive Species—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 because the species is or has faced a downward trend in population or depends on native habitat that is considered threatened.

Capacity—The power ability of electrical equipment, measured in watts.

Cumulative project—Any project that has an impact on the environment that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions.

Distribution Line—Medium-voltage 25-kV lines that convey energy from the substation to the consumer.

Emergent Marsh—Within the Salt Wells Energy Projects Area, this community type is primarily comprised of obligate wetland species such as hardstem bullrush (Scirpus acutus) and Baltic rush (Juncus balticus), which were found at springs or areas with obvious shallow groundwater and surface water saturated soils.

Generation—The production of electricity from other forms of energy, such as combustion, falling water, or thermal transfer.

Generation capacity—Maximum electric production limit for which a generator is rated. The maximum limit fluctuates with changes in temperature or other environmental circumstances, depending on the type of machine.

Geothermal energy— Geothermal energy is energy derived from the natural heat of the earth. Geothermal resources are typically underground reservoirs of hot water or steam created by heat from the earth, but geothermal resources also include subsurface areas of dry hot rock.

Greasewood flat—A vegetation community dominated by Greasewood, other shrubs, and perennial grasses.

Kilovolt—A measure of electric voltage, one thousand volts. Household current is supplied at 120 volts.

Makeup Water- Water fed to a system to replace that which is lost - for example, water fed to a boiler to replace that lost as steam or condensate; water fed to a cooling tower to replace that lost by evaporation, drift, or other causes.

Megawatt—A measure of alternating current electric power that performs work. One thousand kilowatts, or one million watts. A standard light bulb is 60 watts.

Mixed Salt Desert Scrub—A vegetation community characterized by a mixture of shrubs and forbs.

Nitrogen oxides—A gaseous mixture of nitric oxide (NO) and nitrogen oxide (NO_2) and symbolically represented as NO_3.

Nitric oxide—A molecule of one nitrogen and one oxygen atom. Results usually from combustion of organic substances containing nitrogen and from recombination of nitrogen decomposed in air during high temperature combustion; poisonous and highly reactive gases produced when fuel is burned at high temperatures, causing nitrogen in the air to combine with oxygen.

Nitrogen dioxide—A molecule of one nitrogen and two oxygen atoms. Results usually from further oxidation of nitric oxide in the atmosphere. Ozone accelerates to conversion.

Off-gassing—Offgassing or outgassing refers to the release of chemicals from various substances under normal conditions of temperature and pressure.

Ormat Project Area—The Ormat Project includes the construction and operation of a 40 40-MW (gross) binary combined air- and wet-cooled

geothermal power plant, up to 13 well pads (which could accommodate multiple wells), pipelines, a substation, switching station, 230-kV connection lines to the proposed SPPC transmission line, and access roads on approximately 6,948 acres of land.

Ozone—A colorless gas formed by a complex series of chemical and photochemical reaction of reactive organic gases, principally hydrocarbons, with oxides of nitrogen, which is harmful to the public health, the biota, and some materials; a molecule of three oxygen atoms. A principle component of oxidant in photochemically polluted atmospheres.

Particulate matter (particles)—Very fine solid matter or droplets, typically averaging one micron or smaller in diameter. Also called aerosol.

Parts per billion—A measure of the amount of one substance in a second substance, which is the carrier.

Parts per million—A measure of the amount of one substance found in a carrier.

Playas—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.

PM_{10}—Particulate matter less than 10 microns in size, which is small enough to be inhaled deeply into the lungs and to cause disease.

Power—The rate at which work is done. (Electrical power can be calculated through voltage and current and expressed in watts.)

Right-of-way—An easement, lease, permit, or license across an area or strip of land to allow access or to allow a utility to pass through public or private lands.

Salt Wells Energy Projects Area—The area encompassed by the SPPC, Ormat, and Vulcan proposals covering approximately 24,152 acres in the Salt Wells, Nevada, about 15 miles east of Fallon.

Sensitive receptor—Land uses or people adjacent to or within close proximity of a project site that could be affected by construction, operation, and maintenance activities.

Sierra Pacific Power Company (SPPC) Project Area—The SPPC Project Area covers approximately 1,582 acres and includes construction of a new substation, 22 miles of single-circuit 230-kV transmission line, two 230-kV switching stations, a fiber optic cable along the length of the transmission line, and four 60-kV electric folds connecting the proposed new substation to the

existing Fallon substation. The ROW for the transmission line would be 125 feet for H-frame structures and 60 feet for single-pole structures.

GAP Analysis Project—The mapping and modeling of land cover and vertebrate habitat using geospatial data.

Substation—A control building that regulates or reduces the electric voltage from the transmission line to levels that can be conveyed to the customer.

Sulfur oxides—The group of compounds formed during combustion or thereafter in the atmosphere of sulfur compounds in the fuel, each having various levels of oxidation, ranging from two oxygen atoms for each sulfur to four oxygen atoms.

Survey Area—The study area used for cultural and biological surveys

Total suspended particulates—Solid or liquid particles small enough to remain suspended in air. PM10 is the portion of total suspended particulates that can be inhaled.

Transmission line— High-voltage lines (60-kV or greater) that convey bulk power from remote power sources to the electrical service area.

Utility corridor—A linear corridor usually designated for facilities, such as powerlines, pipelines, fiber-optic cables, and roads.

Vulcan Project Area—The Vulcan leases on BLM land, the 500-foot corridor for the alternative interconnection line from power plant site 5 to the Bass Flat Switching Station and the Bass Flat Switching Station site.

Wetland—Lands traditionally between obviously upland and aquatic environments. Wetlands are generally highly productive environments with abundant fish, wildlife, esthetic, and natural resource values. For this reason, coupled with the alarming rate of their destruction, they are considered valuable resources, and several regulations and laws have been implemented to protect them.

APPENDIX A
TYPICAL GEOTHERMAL RESOURCE DEVELOPMENT AND TRANSMISSION TOOLS

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APPENDIX A
TYPICAL GEOTHERMAL RESOURCE DEVELOPMENT AND TRANSMISSION TOOLS

GEOTHERMAL INTRODUCTION

The term *geothermal* comes from the Greek *geo* meaning "earth" and *thermal* meaning "heat." As such, geothermal energy is energy derived from the natural heat of the earth. Geothermal resources are typically underground reservoirs of hot water or steam created by heat from the earth, but geothermal resources also include subsurface areas of dry hot rock. In cases where the reservoir is dry hot rock, the energy is captured through the injection of cool water from the surface, which is then heated by the hot rock and extracted as fluid or steam. Geothermal steam and hot water can naturally reach the earth's surface in the form of hot springs, geysers, mud pots, or steam vents. Geothermal reservoirs of hot water are also found at various depths beneath the Earth's surface. Geothermal resources can also be accessed by wells (**Figure A-1**).

Figure A-1: Geothermal Flow Chart

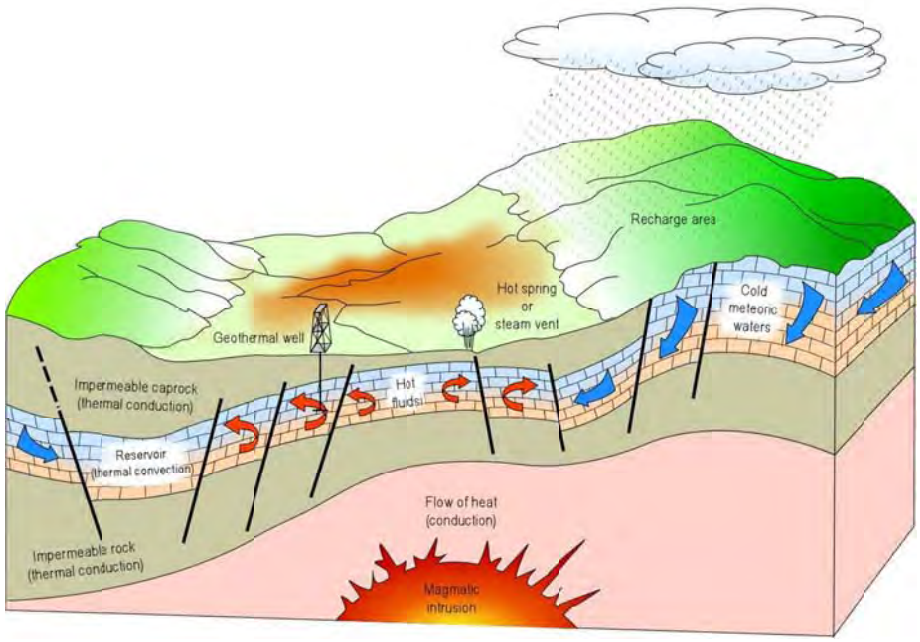


Table A-1 identifies the typical facilities required to generate electricity from geothermal resources.

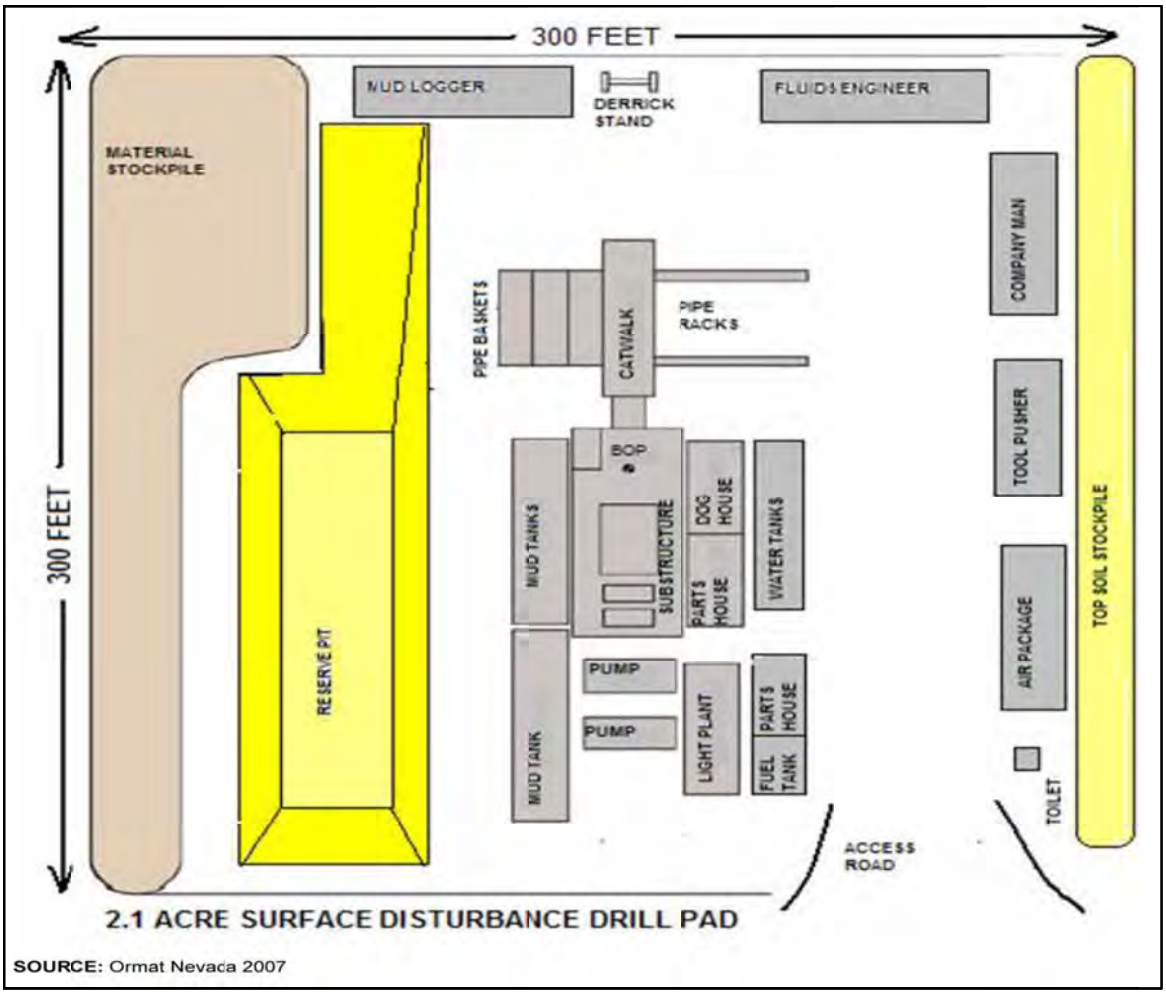
Table A-1
Typical Geothermal Development Facility Functions

Structure	Function
Well Pad Access Roads	Access roads are used during development to construct the production wells and install equipment. During utilization, access roads are used for accessing wells for maintenance.
Well Pads	Well pads include all the equipment necessary to operate a well. During development, any additional drilling would occur from the well pads. Well pads also include reserve pits for testing of new wells.
Production Wells	Production wells flow geothermal fluid to the surface that is then piped to the power plant to generate electricity.
Injection Wells	Injection wells are used to inject geothermal fluid from the power plant back into the geothermal reservoir. Injection ensures the longevity and renewability of the geothermal resource.
Observation Wells	The observation well is used to monitor the geothermal resource. Water samples and downhole pressure data are gathered from the observation well.
Geothermal Fluid Collection Pipeline	Injection pipeline moves geothermal fluid from the power plant to the injection well, where it is returned to the geothermal reservoir.
Injection Pipeline	Injection pipeline moves geothermal fluid from the power plant to the injection well, where it is returned to the geothermal reservoir.
Power Plant	The power plant produces electricity using either binary, flash steam or some combined geothermal power plant technology.
Substation	The substation converts power generated from the plant to the power system.
Transmission Line	The transmission line transmits the electricity generated to users.

Well Pads

Well pads are constructed to perform temperature gradient and geothermal exploratory drilling. The layout of a typical well pad is shown in **Figure A-2**.

Figure A-2: Typical Geothermal Well Pad Layout.



Well pad facilities and equipment needed for the development phase include a drill rig and ancillary equipment, such as generators, support trailers, and well testing equipment. Each production well pad will be equipped with a small metal equipment building (approximately 15 feet by 15 feet) that will be located on the well pad so as to not interfere with drilling or workover operations.

The building will house:

- Auxiliary systems
- Motor switch gear
- Controls

- Sensors
- Transmitters

Drilling

Exploratory drilling determines if the geothermal resource is viable to be used in energy generation. Each exploration well is drilled with a large rotary drill rig. During drilling, the top of the drill rig mast could be as much as 178 feet above the ground surface, and the rig floor could be 20 to 30 feet above the ground surface. **Figure A-3** shows example drill rigs.

Figure A-3: Example Drill Rigs

Typical Exploration Well (178 feet tall)

Typical Slim Well Rig (50 feet tall)

SOURCE: Ormat Nevada 2007

Blow out prevention equipment (BOPE) is used during drilling to protect the natural and human environment surrounding the operation. BOPE is installed on a wellhead to prevent the escape of pressure either in the annular space, between the casing and the drill pipe, or in an open hole (i.e. hoe with no drill pipe) during drilling and well completion operations. **Figure A-4** depicts a schematic of a well with BOPE installed. If a resource is not viable, an exploration well is sealed and capped, if the resource is found to be viable, the well site could be used for production. Well drilling for production wells is the same as for exploration wells. Production wells are similar to exploration wells;

however, they are usually a little bigger and deeper. **Figure A-5** shows a typical production well cross section.

Production wells bring the geothermal fluid to the surface where it can be piped to a geothermal power plant to generate electricity.

Injection wells will also be drilled to inject used geothermal water back into the geothermal reservoir. The injected water will be reheated, and assist in maintaining pressure as well as sustaining the reservoir. Injection wells have the same construction as exploration and production wells.

Well logging

Well logs and surveys are typically run during the drilling of any production wells to:

- Identify any groundwater aquifers which may be present,
- Determine lithology and geologic structure,
- Identify zones suitable for production and injection, and
- Gather data on formation properties during well tests.

Well testing

A well test is conducted in order to evaluate economic production capability of each well. The long term test would consist of pumping the geothermal fluids from the well for approximately 30 to 90 days, through on-site test equipment. Geothermal fluids produced from the well would flow through various testing apparatus, including a weir box to measure the volume of fluid flow, and accumulate in the well-pad reserve pit. The fluid would then either evaporate or be transferred, by temporary piping, for injection in an injection well in the development area. All surface test equipment and temporary pipelines would be removed at the completion of testing.

The production of hot geothermal fluid from each lineshaft turbine pump will be flow-rate controlled. Downhole pumps in the production wells will deliver the geothermal fluid to the plant via a pipeline gathering system at about 230 pounds per square inch, gauge.

Figure A-4: Typical Blow Out Prevention Equipment.

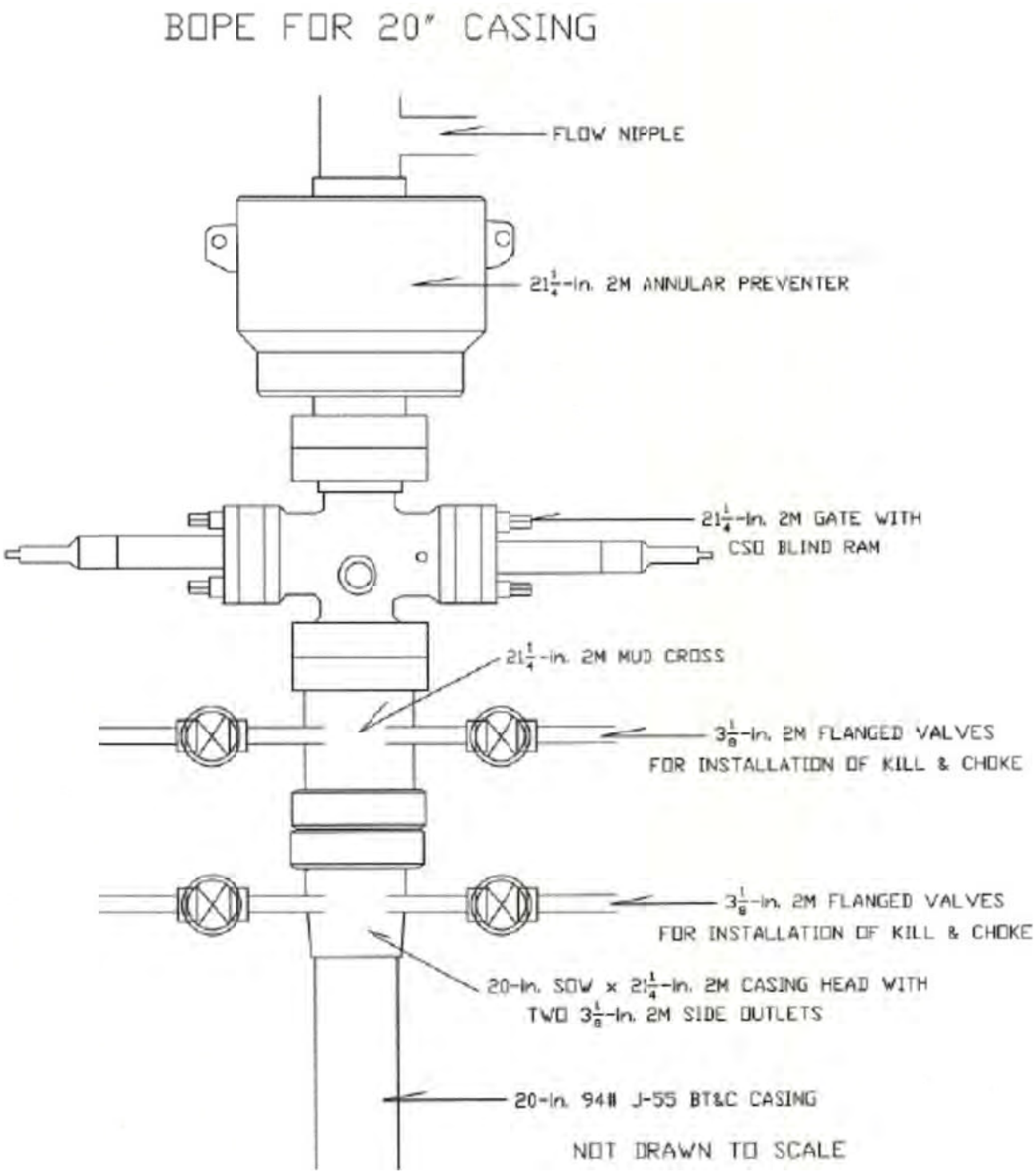
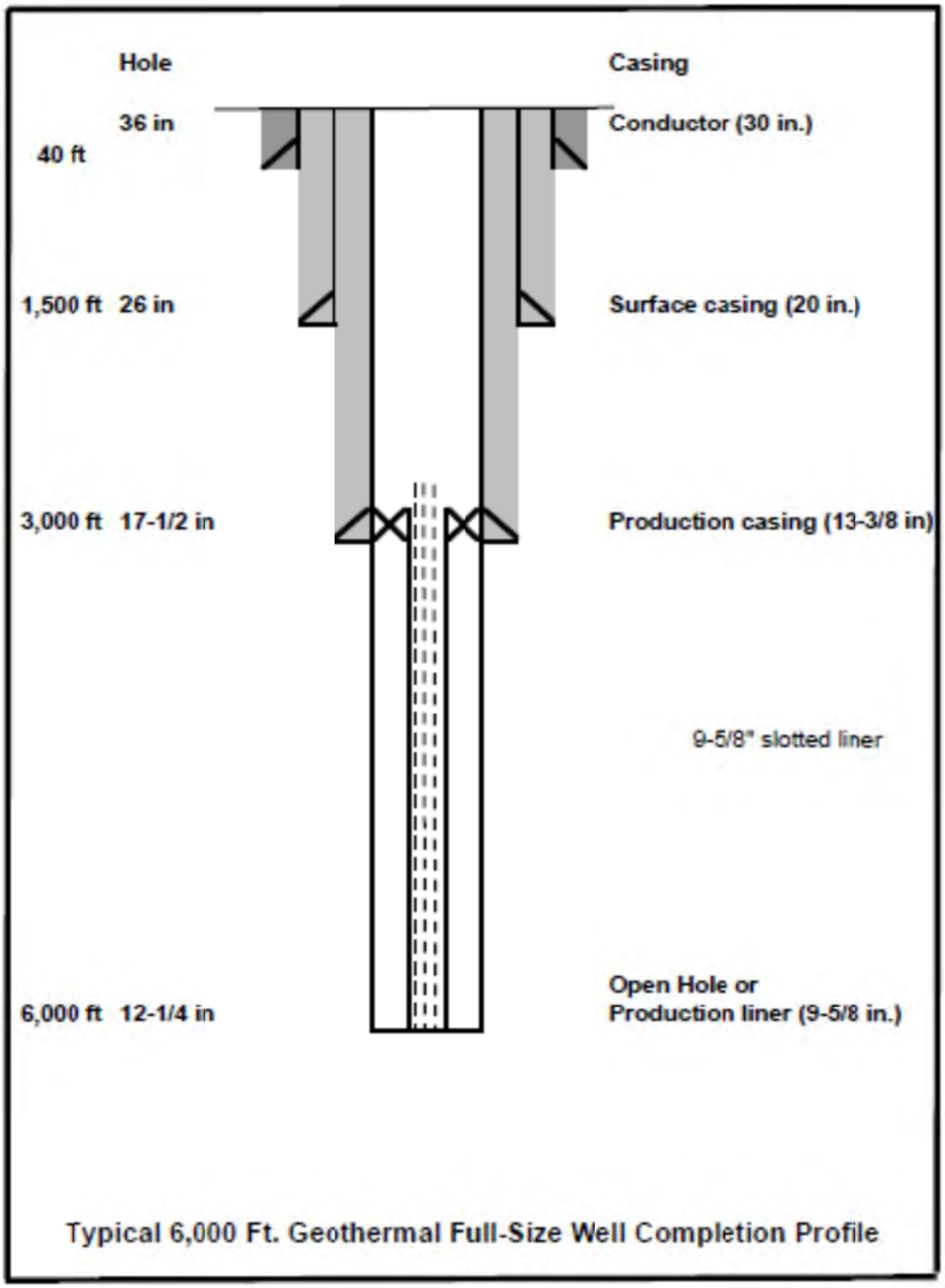


Figure A-5: Typical Production Well Schematic



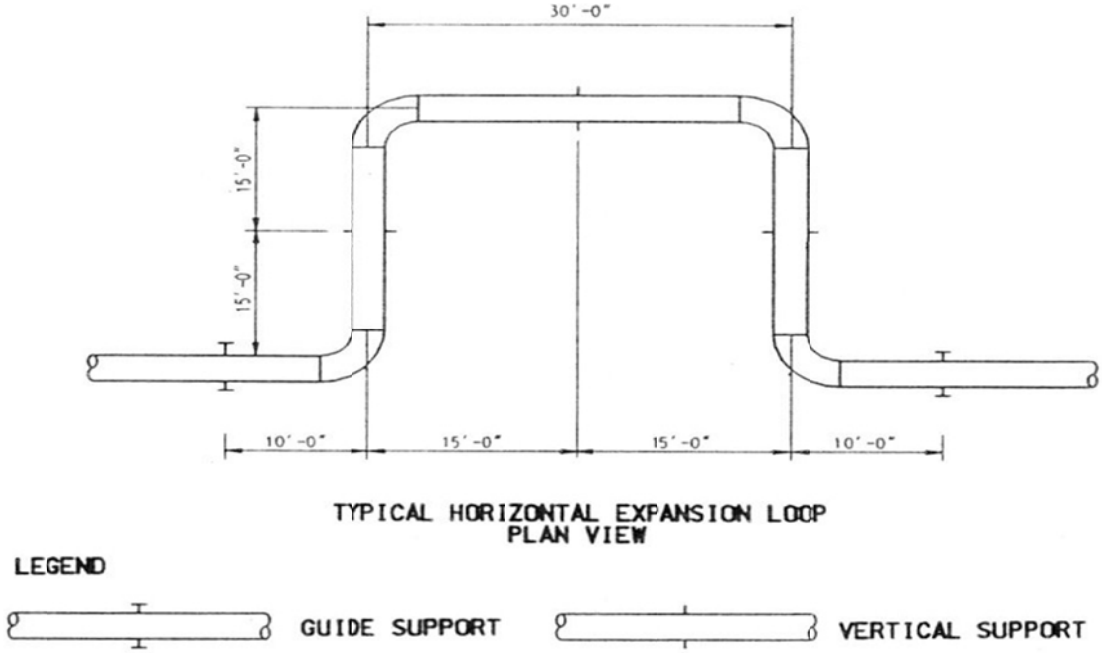
Pipelines

Pipelines, consisting of seamless steel pipe and including insulation, will vary in diameter from 12 to 30 inches depending upon individual well productivity (**Figure A-6**). In general, the pipeline will be located 5 feet from one edge of a 20-foot right of way, with the remaining 15 feet reserved as a pathway for construction equipment and inspection traffic. Horizontal expansion loops (typically a square bend in the pipeline approximately 30 feet by 30, as shown in **Figure A-7**, will be constructed every 300 to 450 feet along the pipeline route to allow for thermal expansion. Vertical expansion loops may be desirable at specific locations such as the power plant pad and at road crossings and livestock or wildlife. The top of pipes are typically 3 feet above the surface except for terrain undulations or areas where livestock or wildlife crossings are desired.

Figure A-6: Actual Geothermal Pipeline

The pipeline will be located above ground level on a series of sliding pipe supports (sleepers), and would be colored to blend in with the terrain. Surface piping infrastructure for plant operations stands off the ground 18 to 36 inches on "T" shaped stands placed 40 feet apart. Electrical and controls conduits are run in a small catwalk immediately adjacent to the pipe.

Figure A-7: Typical Pipeline loop.



TYPICAL PHASES IN GEOTHERMAL DEVELOPMENT

Geothermal resource use involves four sequential phases: (1) exploration, (2) drilling, (3) utilization, and (4) reclamation and abandonment. The success or failure of each phase affects the implementation of subsequent phases, and, therefore, subsequent environmental impacts. Development of geothermal resources is unique to the industry, but many activities are similar in scope to other fluid minerals (e.g., oil and gas), such as surveying, drilling, site-development (well pads and roads), and reclamation and abandonment.

Table A-2 provides the estimated acreages of land disturbance for each phase in geothermal development for a typical power plant. The actual area of disturbance varies greatly depending upon site conditions and the type and size of power plant being constructed; therefore, a range is provided. Acreages are not provided for the Reclamation and Abandonment phase since this phase involves the return of previously disturbed lands to their existing conditions. The total potential amount of area disturbed under the utilization phase includes development activities. Much of the land would be reclaimed after the initial exploration, drilling, and construction; therefore, the actual amount of land occupied during operation, would be less. A typical development generally requires several leases or the use of private or other adjacent lands. The details of each phase of development are described below.

Table A-2
Typical Disturbances by Phase of Geothermal Resource Development

Development Phase	Disturbance Estimate per Plant
Exploration	**2 – 7 acres**
Geologic mapping	negligible
Geophysical surveys	30 square feet[1]
Gravity and magnetic surveys	negligible
Seismic surveys	negligible
Resistivity surveys	negligible
Shallow temperature measurements	negligible
Road/access construction	1– 6 acres
Temperature gradient wells	1 acre[2]
Drilling Operations and Utilization	**51 – 350 acres**
Drilling and well field development	5 – 50 acres[3]
Road improvement/construction	4 – 32 acres[4]
Power plant construction	15 – 25 acres[5]
Installing well field equipment including pipelines	5 – 20[6]
Installing transmission lines	24 – 240[7]
Well workovers, repairs and maintenance	negligible[8]
TOTAL	**53 – 367 acres**

[1] Calculated assuming 10 soil gas samples, at a disturbance of less than three square feet each.
[2] Calculated assuming area of disturbance of 0.05 to 0.25 acre per well and six wells. Estimate is a representative average disturbance of all well sites. Some wells may require a small footprint (e.g., 30x30 feet), while others may require larger rigs and pads (e.g., 150x150 feet).
[3] Size of the well pad varies greatly based on the site-specific conditions. Based on a literature review, well pads range from 0.7 acres up to 5 acres (GeothermEx 2007; FS 2005). Generally a 30MW to 50 MW power plant requires about five to 10 well pads to support 10 to 25 production wells and five to 10 injection wells. Multiple wells may be located on a single well pad.
[4] One-half mile to nine miles; assumes about ¼ mile of road per well. Estimates 30-foot wide surface disturbance for an 18 to 20 foot road surface, including cut and fill slopes and ditches.
[5] 30-MW plant disturbs approximately 15 acres; 50 MW plant disturbs approximately 25 acres.
[6] Pipelines between well pad to plant assumed to be ¼ or less; for a total of 1½ to seven miles of pipeline in length, with a 25-foot-wide corridor
[7] Five to 50 miles long, 40-foot-wide corridor.
[8] Disturbance would be limited to previously disturbed areas around the well(s).

Phase One: Geothermal Resource Exploration

Before geothermal resources are developed, a geothermal resource developer explores for evidence of geothermal resources on leased or unleased land. Exploration includes ground disturbance but does not include the direct testing of geothermal resources or the production or utilization of geothermal resources. Exploration operations include, but are not limited to, geophysical operations, drilling temperature gradient wells, drilling holes used for explosive charges for seismic exploration, core drilling or any other drilling method, provided the well does not reach the geothermal resource. It also includes related construction of roads and trails, and cross-country transit by vehicles over public land. Exploration involves first surveying and then drilling

temperature gradient wells. It generally takes between one and five years to complete exploration.

Surveying includes conducting or analyzing satellite imagery and aerial photography, volcanological studies, geologic and structural mapping, geochemical surveys, and geophysical surveys of leasable areas that could support geothermal resource development. The surveys consist of collecting electrical, magnetic, chemical, seismic, and rock data. For example, water samples from hot springs could be used to determine the subsurface characteristics of a particular area. Once the data is compiled, geologists and engineers examine the data and make inferences about where the higher temperature gradients may occur. High temperature gradients can indicate the location of potential underground geothermal reservoirs capable of supporting commercial uses.

Surveys may require creating access using four-wheel drive vehicles, or by helicopters or on foot to areas with no roads or very poor roads. Cutting of vegetation may be required in some areas to facilitate access. In some cases, gas collectors may be installed to measure soil gases. These collectors have partially buried sensors and may disturb small areas of less than three square feet (BLM 2007b).

While not widely used for geothermal surveys, seismic surveys have the greatest survey impact on the local environment. These surveys typically involve setting up an array of geophones and creating a pulse or series of pulses of seismic energy. The pulse is created either by detonating a small charge below the ground surface (requires drilling a narrow "shot hole") or by a vibroseis truck that is driven through the survey area. Data is transmitted from the geophones to a central location. The geophones may be installed on the ground's surface, in small excavations made specifically for burying the geophones, and/or in existing wells. These surveys are typically undertaken over the course of a few days. In areas where there is a lot of natural seismic activity, longer term installation of geophones may be undertaken to record naturally occurring earthquakes. Such cases do not involve a vibroseis truck (BLM 2007b).

Resistivity surveys include various methodologies from laying out long cables (up to 1,000 feet or more) on the land surface, or setting up equipment repeatedly in small areas (a few tens of square feet at the most for each measuring site). Minor, temporary disturbances are associated with each site for the burial of sensors (BLM 2007b).

The second step of the exploration phase is to drill temperature gradient wells on leased or unleased land. This process confirms a more precise location of high temperature gradients. Temperature gradient wells can be drilled using a truck-mounted rig and range from 200 feet to over 4,000 feet deep. The number of gradient wells also varies, depending on the geometry of the system being investigated and the anticipated size of power development. Geologists

examine either rock fragments or long cores of rock that are brought up from deep within the well. Water samples are taken from any groundwater encountered during drilling. Also, temperatures are measured at depth. Both well temperatures and the results of rock sample analyses are used to determine if additional exploration is necessary to identify the presence and characteristics of an underground geothermal reservoir. After collecting the desired materials and data, the wells are completed with sealed, water-filled tubing from surface to bottom, often with cement around the tubing (BLM 2007b).

Most temperature gradient wells are drilled with a small rotary rig (often truck-mounted) similar to that used for drilling water wells, or a diamond-coring rig, similar to that used for geologic sampling in mineral exploration and civic works projects. Neither rig of this size requires construction of a well pad or earth moving equipment unless the site is sharply graded. Support equipment is needed, including water trucks, tanks for mixing and holding drilling fluids, personnel and supply transport vehicles, and sometimes a backhoe for earth-moving activities is needed to prepare the drilling site. A temperature gradient drilling operation can be run by about three on-site personnel and others traveling to the site periodically with materials and supplies (BLM 2007b).

Temperature-gradient well drilling requires road access. Whenever possible, a driller would access the temperature gradient well site using existing roads. When existing roads are not available, new access roads may need to be constructed for the truck-mounted rig to reach the site; this could require one to six acres of disturbance.

Preparing the site for drilling could include leveling the surface and clearing away vegetation. Several temperature gradient wells are usually drilled to determine both the areal extent of the temperature anomaly and where the highest temperature gradient occurs. Each drill site could disturb approximately 0.10 acres, and the drill rig could be approximately 60 feet tall. During exploration, a driller is not permitted to produce any fluids out of, or inject any fluids into, the well; therefore, the site may also host a sump or tanker truck. Additionally, a diesel generator may also be used at the site to power equipment. The well site itself involves excavation of a small cellar (typically less than three feet square and less than three feet deep) to allow the conductor casing to be set beneath the rig. Drilling may last for several weeks.

Temperature gradient wells are not intended to directly contact the geothermal reservoir, and therefore produce no geothermal fluids. In areas of known artesian pressures, any drilling expected to penetrate the groundwater table would include BOPE. In cases where a temperature gradient well does penetrate a geothermal zone, any release of geothermal fluids at the surface is likely to be minimal due to the small well diameters and the use of BOPE (BLM 2007b).

Drilling fluids may include drilling mud (bentonite clay, activated montmorillonite clay and crystalline silica-quartz), drilling mud additives (caustic soda, sodium bicarbonate, and anionic polyacrylamide liquid polymer), cement (Portland cement and calcium chloride), fuel (diesel), lubricants (usually petroleum-based) and coolants. The specific fluids and additives depends on a variety of factors, including the geologic formations being penetrated and the depth of the well. Releases of drilling muds are not permitted; a sump and a tanker truck are required to capture all fluids. The risk of spills of other fluids is similar to that of any other project involving the use of vehicles and motorized equipment (BLM 2007b).

All surface disturbances would be reclaimed to the satisfaction of BLM. If a temperature gradient well was unsuccessful, it would be abandoned, and the drill site would be reclaimed. Abandonment includes plugging, capping, and covering the wells. Reclamation includes removing all surface equipment and structures, regrading the site to predisturbance contours, and replanting native or appropriate vegetation to facilitate natural restoration.

Phase Two: Drilling Operations

Once exploration has confirmed a viable prospect for commercial development and necessary leases have been secured, the drilling of exploration wells to test the reservoir can proceed. Drilling Operations include flow testing, producing geothermal fluids for chemical evaluation or injecting fluids into a geothermal reservoir. This would also involve the construction of sumps or pits to hold excess geothermal fluids. It could involve development of minor infrastructure to conduct such operations.

Drilling is an intense activity that requires large equipment (e.g., drill rig) and can take place 24 hours a day. A drilling operation generally has from 10 to 15 people on site at all times, with more people coming and going periodically with equipment and supplies. Getting the rig and ancillary equipment to the site may require 15 to 20 trips by full-sized tractor-trailers; with a similar amount for de-mobilizing the rig. There would be 10 to 40 daily trips for commuting and hauling in equipment (BLM 2007b).

If a reservoir is discovered, characteristics of the well and the reservoir are determined by flow testing the well. If the well and reservoir were sufficient for development, a wellhead, with valves and control equipment, would be installed on top of the well casing. Excess geothermal fluids are stored in temporary pits or sumps, generally lined with plastic (small sumps) or clay (large sumps). The water is left to evaporate and any sludge is removed and properly disposed.

Phase Three: Utilization

Utilization and production is the next phase after a viable reservoir is determined and includes the infrastructure needed for commercial operations, including access roads, construction of facility structures, building electrical generation facilities, drilling and developing well fields, and installing pipelines,

meters, substations, and transmission lines. The utilization phase could last from 10 to 50 years and involves the operation and maintenance of the geothermal field(s) and generation of electricity.

The type of development utilization that occurs is based on the size and temperature of the geothermal reservoir. Geothermal resources can be classified as low temperature (less than 90°C, or 194°F), moderate temperature (90°C to 150°C, or 194 to 302°F), and high temperature (greater than 150°C, or 302°F). Only the highest temperature resources are generally used for generating electrical power; however, with emerging technologies and in colder climates such as Alaska, even the lower temperature resources are proving usable for electrical generation.

High temperature reservoirs are suitable for the commercial production of electricity. Three types of power plants that harness geothermal resources are dry steam plants, flash steam plants, and binary-cycle plants. Occasionally a hybrid between flashed steam and binary system is also used. Dry steam power plants use the steam from the geothermal reservoir as it comes from the wells and route it directly through turbine/generator units to produce electricity. Flash steam power plants use water at temperatures greater than 182°C (360°F). Water is pumped under high pressure to the generation equipment at the surface, the pressure is suddenly reduced, allowing some of the hot water to convert, or "flash," into steam, and the steam is used to power the turbine/generator units to produce electricity. Binary-cycle power plants use water from the geothermal reservoir to heat another "working fluid." The working fluid is vaporized and used to turn the turbine/generator units. The geothermal water and the working fluid never come in contact with each other. Binary-cycle power plants can operate with lower water temperature 74°C to 182° C (165°F to 360°F) and produce few air emissions. See Chapter 1 for a more detailed discussion.

Development of the lease would involve the following construction and operations:

- Access roads—New access roads to accommodate the larger equipment associated with the development phase could be constructed. In general, a plant can require ½ mile to nine miles of roads in order to access the site, well pads, and power plant. Depending on the type and use-intensity of the road, the areas of surface disturbance is about 30-feet wide for an 18 to 20 foot wide road surface, including cut and fill slopes and ditches.
- Drill site development—Multiple wells may be drilled per lease. Production-size wells can be over two miles (10,560 feet) deep. The number of wells is dependent upon the geothermal reservoir characteristics and the planned power generation capacity. For example, a 50MW (net) power plant could require up to 25

production wells and 10 injection wells. It is common that multiple wells would be installed on a well pad. The size of the well pad is dependent upon site conditions and on the number of wells for the pad, but they are typically about one to five acres, including minor cut and fill. In order to drill these deep holes, a large drilling rig or derrick would be erected. Various temporary support facilities may be located on site, including generators, mud tanks, cement tanks, trailers for the drillers and mud loggers, housing trailers, and storage sheds. As appropriate, facilities can be painted to blend in with the surrounding environment. Drilling operations can occur 24 hours a day.

- Wellfield equipment—A geothermal power plant is typically supported by pipeline systems in the plant's vicinity. The pipeline systems include a gathering system for produced geothermal fluids, and an injection system for the reinjection of geothermal fluids after heat extraction takes place at the plant. Pipelines are usually 24 to 36 inches in diameter, but can be as small as 8 inches depending on the type of pipeline. Pipelines transporting hot fluids or steam to the plant are covered with insulation, whereas injection pipelines are generally not. When feasible, they would parallel the access roads and existing roads to the destination of the geothermal resource's steam or water. Pipelines are typically constructed on supports above ground, resulting in little if any impact to the surrounding area once construction is complete and the corridor has been revegetated. The pipelines typically have a few feet of clearance underneath them, allowing small animals to easily cross their path. The pipelines are typically painted to blend in with the surrounding environment. In general, plants have about 1½ to seven miles of pipes with a corridor width of about 25 feet.
- Power plant—A 50 MW plant would utilize a site area of up to 20 to 25 acres to accommodate all the needed equipment, including the power plant itself, space for pipelines geothermal fluids and reinjection, a switch yard, space for moving and storing equipment, and buildings needed for various purposes (power plant control, fire control, maintenance shop, etc.) The power plant itself would occupy an estimated 25 percent of this area for a water-cooled plant, or about 50 percent for an air-cooled plant. Where topography permits, the power plant could be situated so as to be less visible from nearby roads, trails, scenic vistas or scenic highways. The site of the plant requires reasonable air circulation to allow for efficient operation of the plant's condensers. A smaller 20-MW plant would typically require approximately five to ten acres for the entire complex.
- Electric transmission lines—Transmission lines may range in length from 5 miles to 50 miles with a corridor width of approximately 40

feet. Wooden poles most likely support them, and about 5 acres could be disturbed per mile of transmission line.

- Reclamation—When a production well is successful, a wellhead with valves and control equipment is installed on top of the well casing. If a production well is unsuccessful, the production well would be plugged and capped, and the site would be reclaimed.

The number of personnel required during construction varies significantly, but at any one point there may be a few hundred laborers and professionals on site with attendant vehicle traffic. The number of people required for routine operation of a power plant is typically three per shift; however, additional personnel (as many as 12 total, depending on plant size) may be on site during the day for maintenance and management (BLM 2007b)

Activities associated with operation and maintenance and energy production would involve managing waste generated by daily activities, managing geothermal water, landscaping, and the maneuvering of construction and maintenance equipment and vehicles associated with these activities.

Phase Four: Reclamation and Abandonment
This phase involves abandoning the well after production ceases and reclaiming all disturbed areas in conformance with BLM standards. Abandonment includes plugging, capping, and reclaiming the well site. Reclamation includes removing the power plant and all surface equipment and structures, regrading the site and access roads to predisturbance contours, and replanting native or appropriate vegetation to facilitate natural restoration.

Geothermal Fluid Production and Associated Waste
Geothermal fluid production and associated waste production is likely to occur for short periods as wells are tested to determine reservoir characteristics. If geothermal fluids are discovered in commercial quantities, development of the geothermal field is likely. The rate of fluid production from a geothermal reservoir is unknown until the development testing phase is completed. During the initial stages of testing, one well is likely to be tested at a time. If testing is successful and the well and reservoir are sufficient for development, wellheads, valves, and control equipment would be installed on top of the well casing.

Using data from other areas of geothermal development, it appears that production of geothermal fluids can be expected to vary widely from one to six million gallons per well, per day. Assuming five million gallons per day, per well as an average production figure, a lease with two producing wells would produce 10 million gallons of fluid per day.

Most geothermal fluids produced are reinjected back into the geothermal reservoir, via reinjection wells. In flash steam facilities about 15 to 20 percent of the fluid can be lost due to flashing to steam and evaporation through cooling

towers and ponds. Binary power plants utilize a closed loop system, therefore, well production and reinjected operate with no fluid loss. Fluids can also be lost due to pipeline failures or surface discharge for monitoring/testing the geothermal reservoir.

The routinely used chemicals for a binary geothermal plant include the hydrocarbon working fluid (such as iso-butane or n-pentane) and the lubricating oil used in the downhole pumps. If a well's pressure falls below the "bubble point," if it possible that downhole scaling might occur. This requires either a mechanical clean-out with a drilling rig or a coiled-tubing unit, or an "acid job," during which acid (typically hydrochloric acid or less commonly hydrogen fluoride) is injected into the wellbore to dissolve the scale. If scaling is persistent, the operator may choose to adopt routine injections of a scale-inhibitor chemical, such as polymaleic anhydride or polyacrylic acid, used in dosages of one to 10 parts per million (BLM 2007b).

GEOTHERMAL COMMERCIAL ELECTRICAL GENERATION

Commercial electrical generation from geothermal resources is also called *indirect use*. Electrical generation uses geothermally heated fluid to turn a turbine connected to a generator. As discussed above, the fluid may be the naturally occurring steam or water in the geothermal reservoir or another fluid which has the geothermal heat transferred through a heat exchange system.

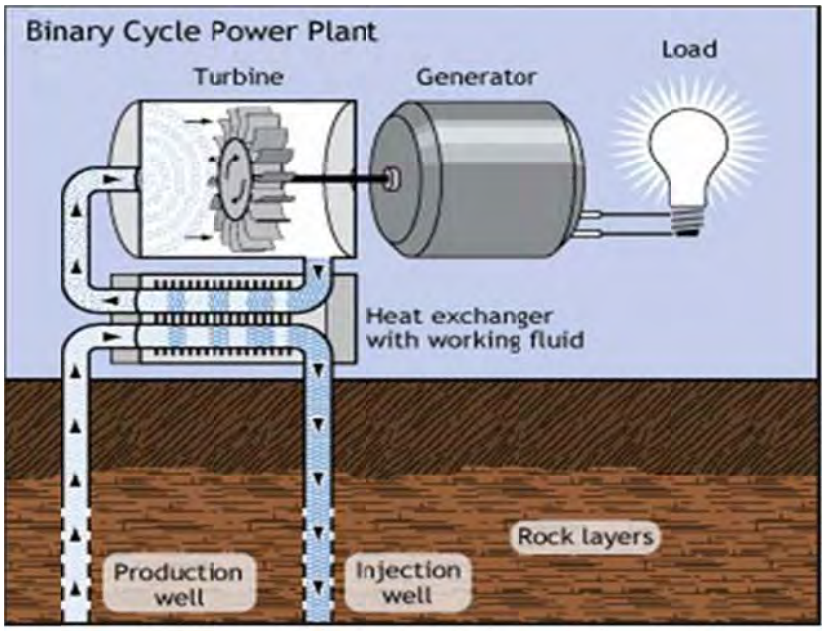
Geothermal power plants can be small (300 kilowatts), medium (10 to 50 megawatts) and large (50 megawatts and higher) (Nemzer et al. 2007). Generation capacity is guided by the number of turbines within a plant. In general, commercial electrical generation requires hot geothermal reservoirs with a water temperature above 200°F (93°C); however, new technologies have proven that lower-temperature water (e.g., 165°F [74°C]) can also be used for electrical generation.

The two types of geothermal plant systems brought forth in this proposal are binary-cycle and flash steam power plants.

Binary Cycle Power Plants

Binary-cycle power plants typically use cooler geothermal fluids than flash steam plants (165 to 360°F [74 to 182°C]). The hot fluid from geothermal reservoirs is passed through a heat exchanger, which transfers heat to a separate pipe containing fluids with a much lower boiling point. These fluids, usually iso-butane or iso-pentane, are vaporized to power the turbine (**Figure A-8**, Binary-cycle Power Plant). The advantage of binary-cycle power plants is their lower cost and increased efficiency. These plants also do not emit any excess gas and, because they use fluids with a lower boiling point than water, are able to use lower-temperature geothermal reservoirs, which are much more common. Most geothermal power plants planned for construction in the US are binary-cycle (US DOE 2007a).

Figure A-8 Binary Cycle Power Plant



Typical Binary power plant equipment includes:

- Shell and tube heat exchangers
- Three turbo-expander generators
- Condensers
- Pentane accumulators (23,000 gallon storage vessels)
- Pentane transfer and feed (circulating) pumps
- Air compressors
- Vapor recovery unit
- Lubricant coolers
- Firewater storage tank and diesel-powered firefighting pump
- Diesel-fueled emergency generator and potentially a Zero demand generator
- Transformers
- Electrical room and operations office

The turbo-expanders will be located outdoors. A typical turbine generator skid consists of two turbines directly coupled to one generator, approximately 20 feet high and 40 feet long by 20 feet wide.

The layouts of a Binary power plant sites proposed by Ormat and Vulcan are shown in **Figures A-9 and A-10**.

Figure A-9: Air Cooled Binary Power Plant Schematic Proposed by Ormat Industries.

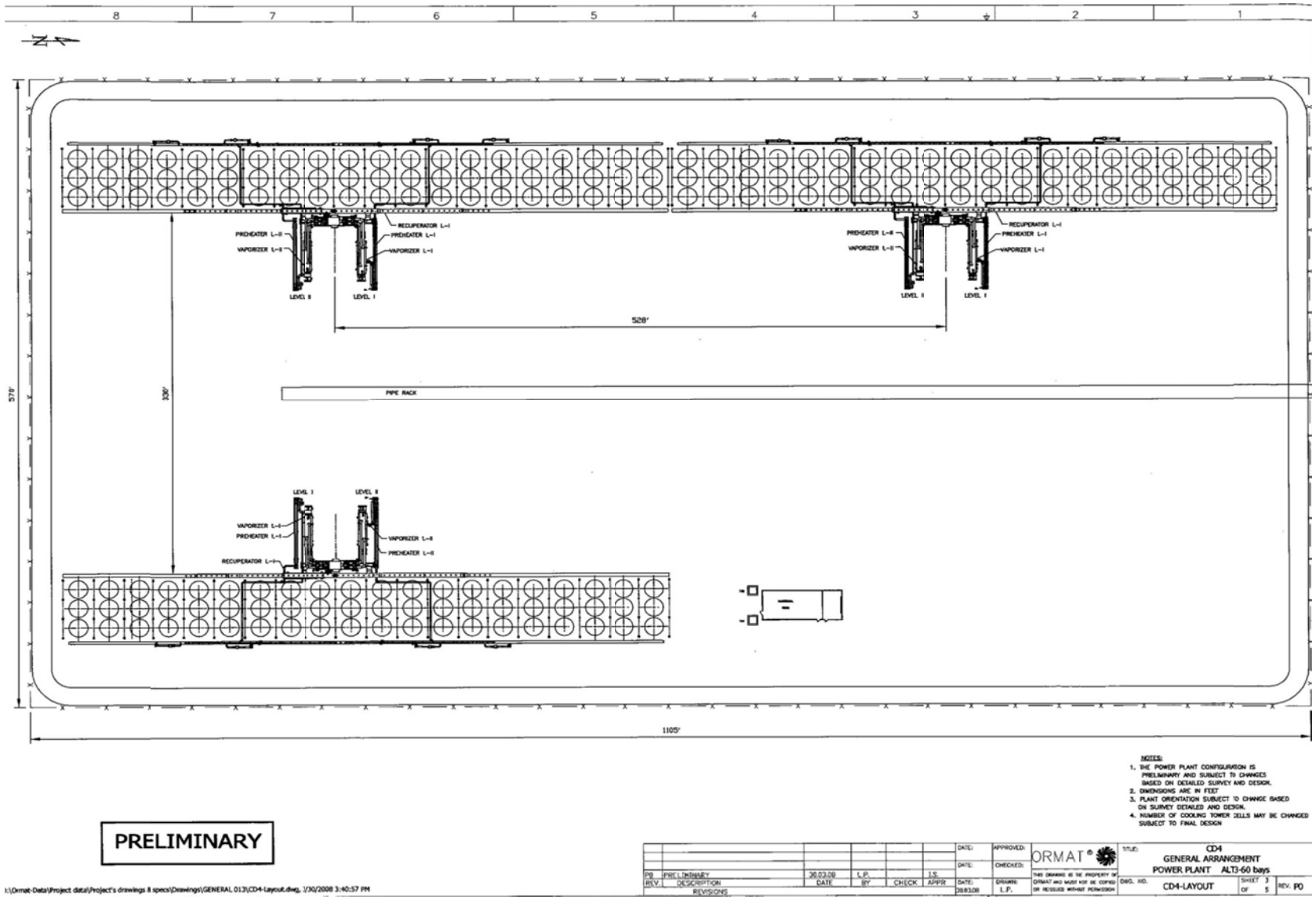
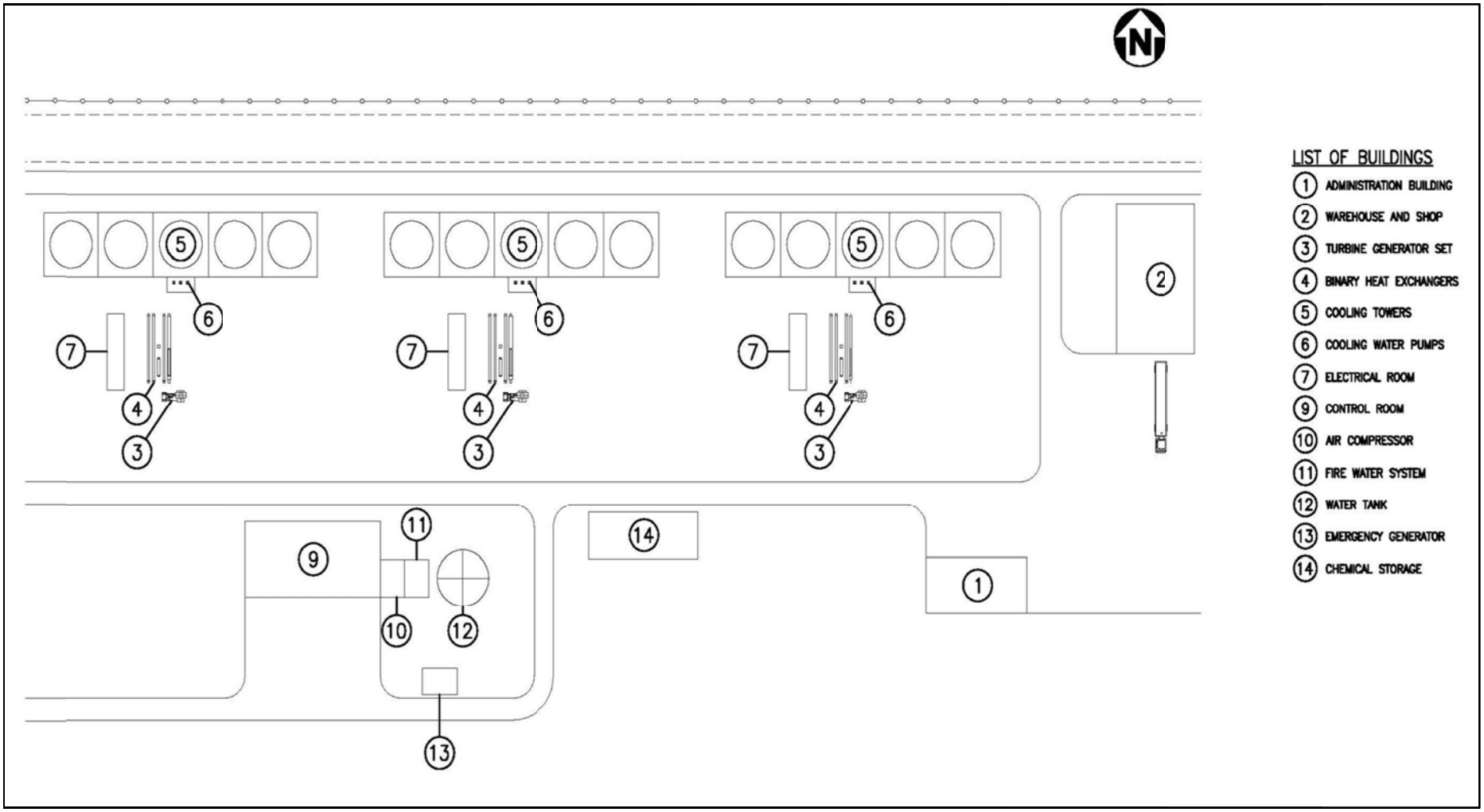


Figure A-10: Wet Cooled Binary Power Plant Schematic Proposed by Vulcan Power.



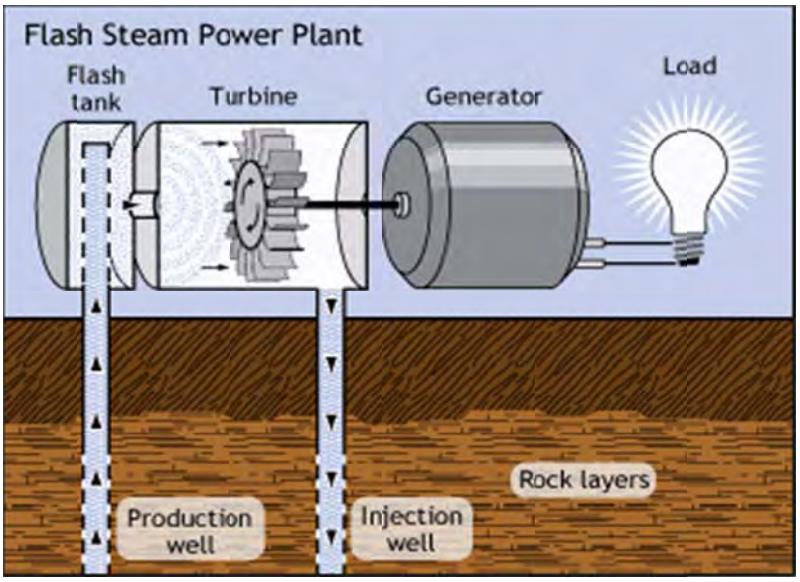
Flash Steam Power Plants

Flash steam power plants use hot water above 360°F (182°C) from geothermal reservoirs. The high pressure underground keeps the water in the liquid state, although it is well above water's boiling point at standard atmospheric pressure. As the water is pumped from the reservoir to the power plant, the drop in pressure causes the water to convert, or "flash," into steam to power the turbine (**Figure A-11**, Flash Steam Power Plant). Any water not converted into steam is injected back into the reservoir for reuse. Flash steam plants emit small amounts of gases and steam. Flash steam plants are the most common type of geothermal power generation plants currently in operation (US DOE 2007a).

The cooling water and condensate mixture collects in the hot well section of the condenser. Hot well pumps would take suction from the lower hot well section of the condenser and deliver the water to the top of the cooling tower. The majority of the water would be cooled and then circulated back to the condenser.

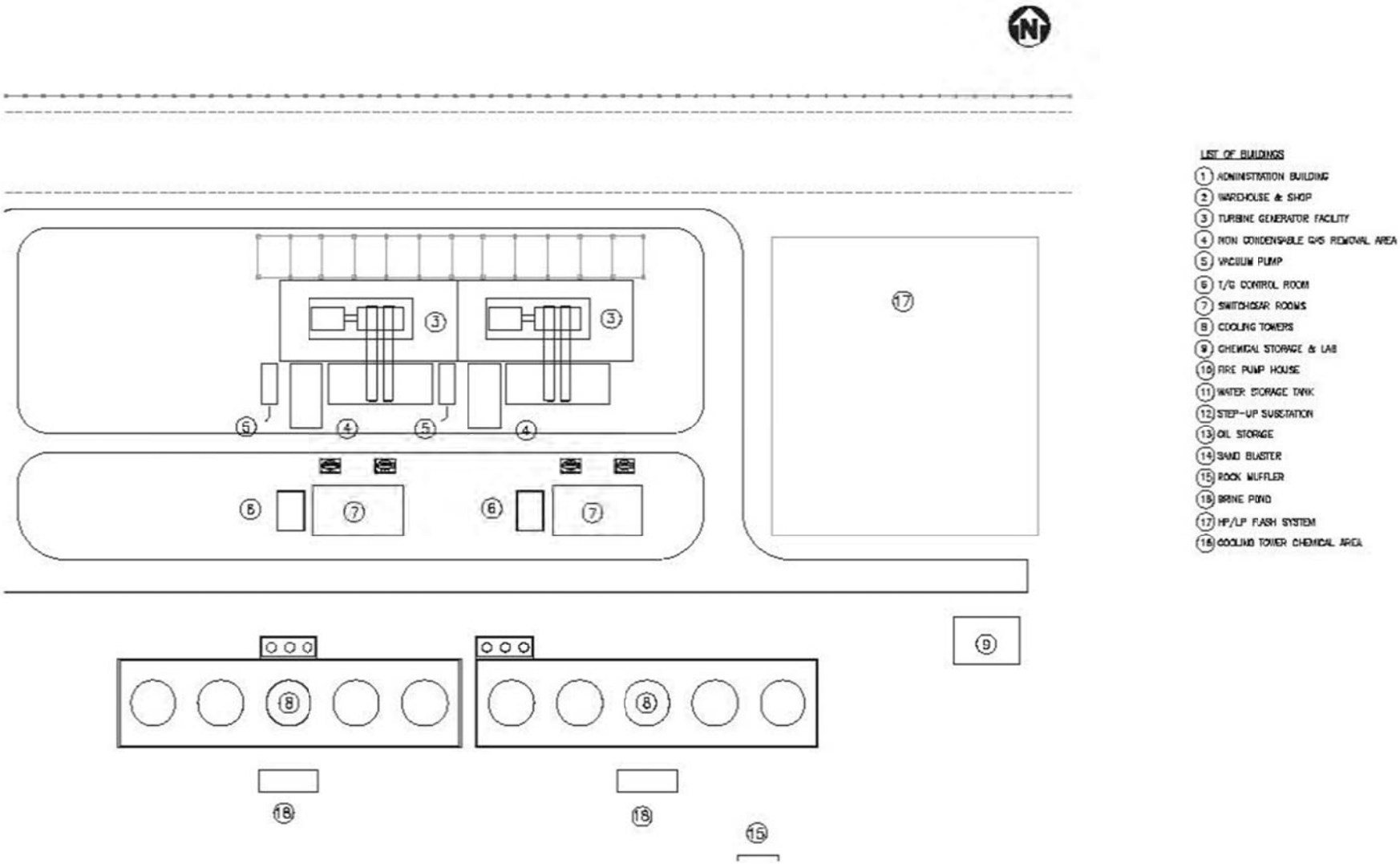
The main circulating water pumps would take water from the cooling tower basin to a direct condenser where the water would be used to condense the steam discharged from the turbine by means of direct contact. Alternatively, the condenser may be installed below grade so that the cooling water could flow by gravity from the cooling tower basin to the condenser. This option eliminates costly pumps that require a significant amount of power.

Figure A-11 Flash Steam Power Plant



Typical equipment used at a flash power plant is similar to that used in a Binary system. The typical layout of a flash steam power plant site is shown in **Figure A-12**.

Figure A-12: Proposed Flash Steam Schematic by Vulcan Technologies



Other types of technologies that harness geothermal energy include direct use, dry-steam plants and enhanced geothermal systems. None of these technologies are proposed in this EIS and are therefore not described in further detail.

Geothermal Power Plant Cooling Systems

A cooling system is essential for the operation of any modern geothermal power plant. Cooling towers prevent turbines from overheating and prolong facility life. Most power plants, including most geothermal plants, use water cooling systems. Water cooled systems generally require less land than air cooled systems, and are considered overall to be effective and efficient cooling systems. The evaporative cooling used in water cooled systems, however, requires a continuous supply of cooling water and creates vapor plumes in climatic conditions where the ambient temperature drops, wind is minimal and humidity increases. Usually, some of the spent steam from the turbine (for flash- and steam-type plants) can be condensed for this purpose.

Air cooled systems, in contrast to the relative stability of water cooled systems, can be extremely efficient in the winter months, but are less efficient in hotter seasons when the contrast between air and water temperature is reduced, so that air does not effectively cool the organic fluid. Air cooled systems are beneficial in areas where extremely low emissions are desired, or in arid regions where water resources are limited, since no fluid needs to be evaporated for the cooling process. **Figure A-13** shows an Air-Cooled Geothermal Power Plant, and **Figure A-14** shows a Dry/Wet Geothermal Binary Plant.

Air cooled systems are preferred in areas where the viewshed is particularly sensitive to the effects of vapor plumes, as vapor plumes may be emitted into the air by wet cooling towers and not air cooling towers. Most geothermal air cooling is used in binary facilities.

TRANSMISSION

Once power is generated, it would be routed to the main transformer from the motor control center of the geothermal power plant. There the voltage would be stepped up to the appropriate transmission line voltage (230 kilovolts [kVs]) and would be connected to the electrical interconnect substation. The substation connects the power plant to the distribution grid via a 230-kV transmission line. An overview of the transmission system is as follows:

The three main structural elements that make up an electrical distribution system are: (1) transmission lines, which convey high voltage electricity from power generation facilities; (2) substations, which reduce the voltage in the transmission lines to distribution levels; and (3) distribution lines, which convey the electricity to customers. (The Proposed Action evaluated in this EIS involves construction of transmission lines and substations).

Figure A-13: Air Cooled Geothermal Power Plant cooling fans and pipelines.

Figure A-14: A photo of a dry/wet cooled Geothermal Binary Power Plant.

Transmission Lines

Transmission lines are high-voltage lines (60-kV or greater) that convey bulk power from remote power sources to the electrical service area. These lines may be overhead or underground; underground transmission lines are discussed separately below. Overhead high-voltage conductors are approximately an inch in diameter and are made of aluminum strands or a mixture of aluminum and steel strands. The lines are isolated electrically by the surrounding air and are not wrapped with insulation material.

Support structures for overhead transmission lines range from single wood or metal poles and H-frame towers between 50 and 90 feet tall for lower voltage lines (i.e., 60-kV and 120-kV), to metal H-framed or lattice frame towers between 75 and 130 feet tall for higher voltage lines (i.e., 345-kV). As described in Chapter 2 of the EIS, SPPC proposes to use steel or wood H-frame tangent structures, steel or wood three-pole dead–end heavy-angle structures, steel single-pole heavy-angle dead-end structures, and steel single-pole staggered structures (**Chapter 2, Figures 2-2 to 2-5**). SPPC's transmission system consists of approximately 4,000 miles of high-voltage power lines.

It is not desirable for circuits that serve the same substation to be located or double circuited in close proximity to each other (e.g., in the same corridor or on the same pole). This results in less reliability because both circuits could be compromised by the same event (e.g., wind storm or lighting strike). In addition, safety issues would increase from maintenance activities, including working on energized lines, because one circuit would always have to be carrying power. In cases where the circuits are serving separate substations, double circuit configurations would not have the same reliability issues provided that they are each serving other load centers and there is existing redundancy built into the distribution system.

In some cases, these circuits can be located on the same structure. Transmission lines, including those constructed by SPPC, are designed in accordance with requirements of the National Electrical Safety Code, which address design issues such as the following:

- Clearances between the lines and other features, such as ground or water surfaces, roadways, railways, other conductors or communication wires, and buildings;
- Use of shield wires along the top of the transmission line to shield the conductors from lightning strikes;
- If an energized line falls to the ground, high-speed relay equipment will sense this condition and actuate breakers that would de-energize the line in a tenth of a second to half a second;

- Connection of metallic parts to an electrode in the ground (grounding) in order to safeguard employees and the public from the hazard of electric potential; and
- Standards for mechanical and structural design, selection of materials, and construction practices to ensure that towers, conductors, and insulators are strong enough to withstand normal and unusual loads, such as ice and wind, to ensure that pole spans are adequate to prevent conductor or structure failure, and to ensure that adequate clearances are maintained.

Substations

Because electricity in the transmission lines is at voltages greater than what the customer can use, the transmission lines are first directed through substations, which regulate or reduce the electric voltage to levels that can be conveyed to the customer. Substations generally consist of a control building and steel structures that support the necessary electrical equipment, including the terminals to receive transmission lines and transformers that convert power to a different voltage. The substation contains the high-voltage disconnects and protective relays used to separate the geothermal facility from the utility transmission line if a problem exists in either system.

Each substation consists of a 13.8-kV circuit breaker, a 13.8-kV/230-kV transformer, a 230-kV potential and current transformers for metering and system protection, and a 230-kV circuit breaker to protect the substation. A typical substation is shown in **Figure A-15** and a cross section of a typical geothermal substation is located in **Figure A-16**.

Distribution Lines

Electricity from substations is conveyed to the customer through medium voltage 25-kV distribution lines. Because distribution lines carry lower voltages, they require less substantial lines and support structures than transmission lines. Distribution conductors are generally half an inch to an inch in diameter and are supported by wood poles approximately 40 feet tall. Because distribution lines are most prevalent in highly developed areas and they operate at lower voltages, distribution lines are more easily and frequently placed underground. Because distribution lines serve all electrical customers, they are the largest component of the electrical system. SPPC's distribution system consists of approximately 13,500 miles of overhead and underground lines.

Underground Transmission Lines

Underground construction of transmission lines generally involves placing the transmission line beneath the ground in a concrete encased polyvinyl chloride conduit system. Underground construction is an effective technique to avoid certain potential hazards associated with overhead lines, such as downed lines or interference with aircraft (**Table A-3**). It is also effective in avoiding certain

Figure A-15: A typical substation.

Figure A-16: A cross section of the typical geothermal power plant substation.

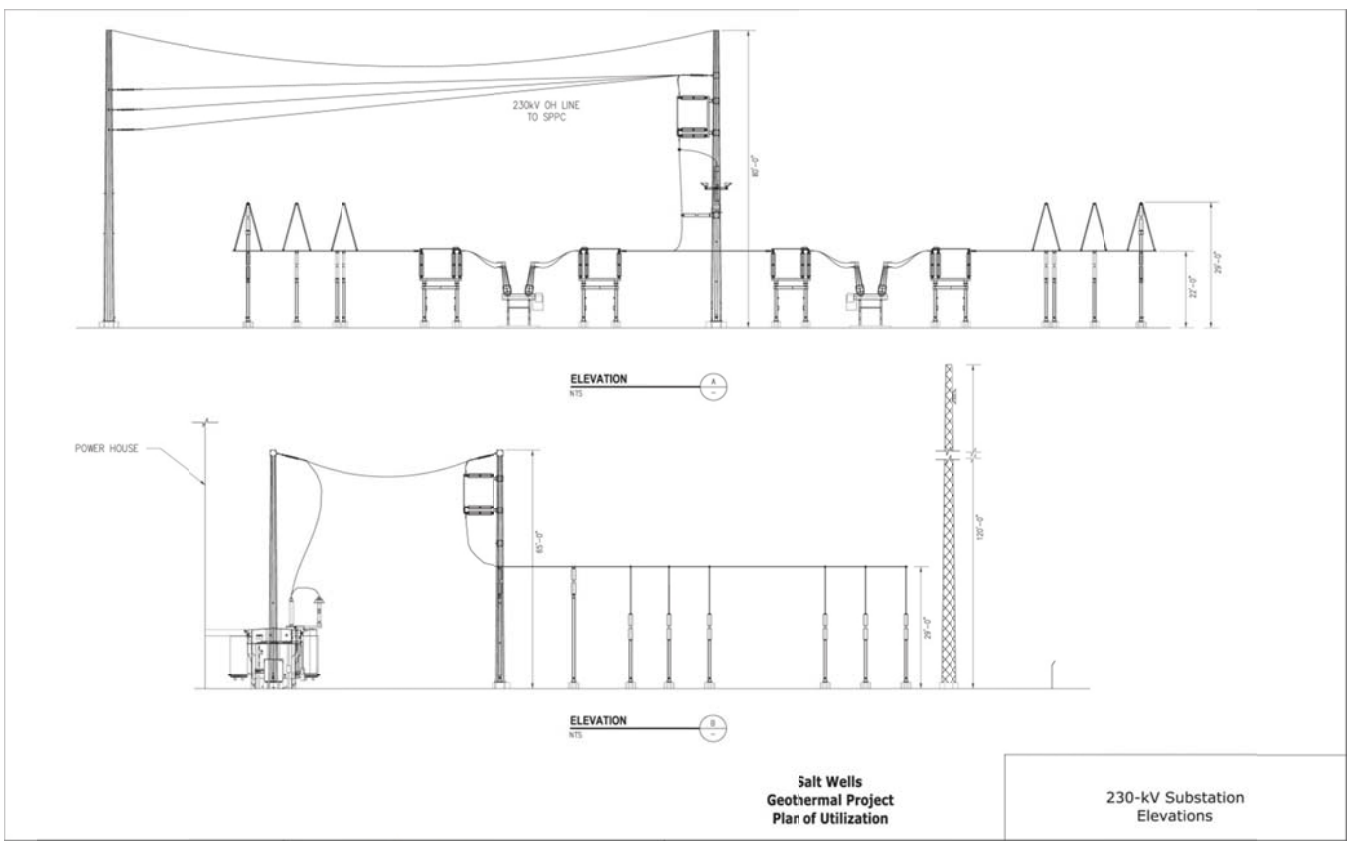


Table A-3
Relative Reliability of Overhead and Underground Transmission Lines

Failure Type	Overhead	Underground
Frequency of Failure		
Insulation failure	Lower	Higher
Splice failure	Lower	Higher
Termination failure	Lower	Higher
Dig-in	None	Higher
Tree contact	Higher	None
Vehicle accident	Higher	None
Fire and smoke	Higher	Lower
Storm (high wind)	Higher	None
Storm (lightning)	Higher	Lower
Moisture/Erosion Damage	None	Higher
Bird contact	Higher	None
Time to Address Failure		
Locate fault	Faster	Slower
Repair fault	Days	Weeks
Temporary fix (if required)	Faster	None

Source: SPPC 2002, 2004

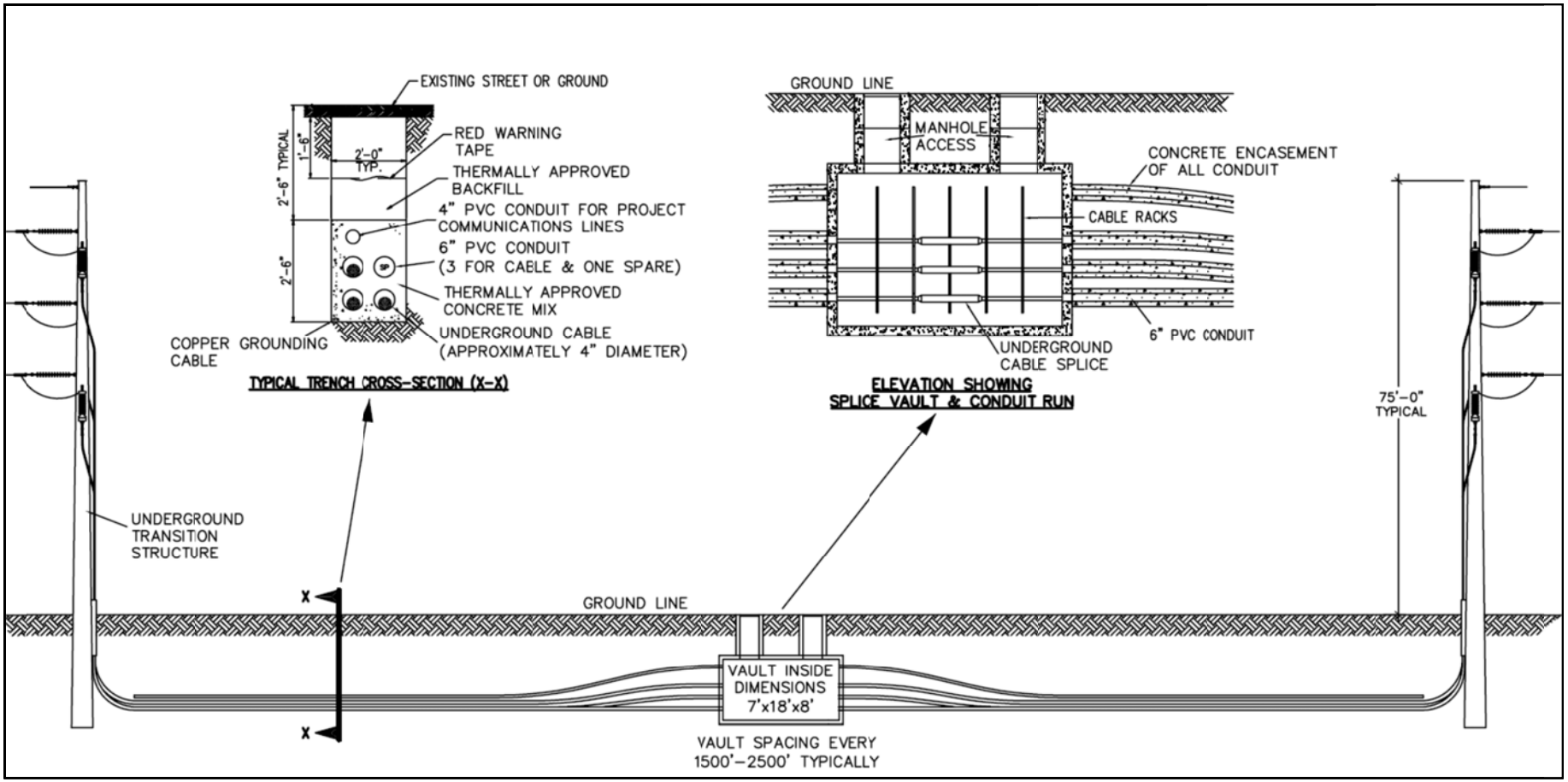
impacts associated with overhead power lines, such as visual impairment. Underground construction does have certain associated impacts that are greater than aboveground construction due to the amount of ground disturbance associated with trenching.

An underground transmission system consists of the electrical cable, cable duct bank systems (conduits), splice vaults, and transition structures (**Figure A-17**).

Underground Conductor
A 120-kV underground cable consists of an aluminum or copper conductor wire covered with insulating and protective materials approximately four inches in diameter, which is larger than overhead cables of comparable capacity. Unlike overhead conductors, underground cables must be covered with electrical insulation and a moisture impervious sheath for electrical properties and to protect them from moisture intrusion or other physical contact.

Cable Duct Bank Systems
Cable duct bank systems are plastic conduits that house the underground cable. For a 120-kV transmission line, a duct bank system would typically consist of four 6-inch conduits, three for the cable and an unused conduit for emergency repair or replacement, and one 4-inch conduit for project or other communication purposes. The conduits are encased in thermally engineered concrete and are backfilled with soil that meets prescribed thermal properties.

Figure A-17: Typical underground 230-kV transition system



The ground surface above the trench is restored to preexisting conditions (typically street pavement or native vegetation).

Splice Vaults

Splice vaults are compartments approximately 8 feet wide, 9 feet deep, and 19 feet long that provide access for installing and splicing cable. Splice vaults are generally located every 1,500 to 2,500 feet along the line, depending on the length of the cable to be installed and the availability of a suitable location for the facility.

Transition Structures

There is a common misconception that "undergrounding" entails directing lines underground straight off of an aboveground transmission line. However, in order to run a line underground, a transmission line must first travel through a transition structure. Also referred to as riser poles or termination structures, transition structures are poles located at each end of the underground cable section to transition the underground cable to overhead lines or substation equipment. Transition structures are about the same height as poles on an overhead section of line (approximately 75 feet) and are highly visible to surrounding receptors (**Figure A-18**). Termination structures are made of self-weathering steel, are set in a concrete foundation, and are installed in much the same way as other overhead transmission line poles. For visual comparison **Figure A-19** simulates a 120-kV overhead transmission line wood pole in the same location as Figure A-18.

Underground construction trenches are typically two feet wide and five feet deep, although the trench must often be deeper or wider to avoid existing utilities. Approximately 25 feet of ground disturbance on either side of the trench (or 50 to 60 feet total) is also required, in flat terrain, to permit use of equipment along the trench and for placing excavated material. Width requirements can be reduced to between 20 and 30 feet if the excavated materials are hauled offsite. The area under construction at any one time is typically 300 feet long. Traffic control is required for construction within city or county streets.

Figure A-18: View of a typical underground transition structure

Figure A-19: Simulated view of a 120-kV pole in the same location as an underground transition structure.

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APPENDIX B
LEASE STIPULATIONS AND CONDITIONS OF APPROVAL

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APPENDIX B
LEASE STIPULATIONS AND CONDITIONS OF APPROVAL

STANDARD STIPULATIONS FOR ALL GEOTHERMAL LEASES IN THE CARSON CITY FIELD OFFICE

The following Standard Stipulations for all Geothermal Leases in the Carson City Field Office apply to Vulcan lease numbers N-79310, N-79662, N-79663, N-79665, N-79666, N-79667, and N-79668:

- Native American Consultation. All development activities proposed under the authority of this lease are subject to the requirement for Native American consultation prior to BLM authorizing the activity. Depending on the nature of the lease developments being proposed and the resources of concerns to tribes potentially effected, Native American consultation and resulting mitigation measures to avoid significant impacts may extend time frames for processing authorizations for development activities, as well as, change in the ways in which developments are implemented.
- Riparian Areas. No surface occupancy within 650 feet (horizontal measurement) of any surface water bodies, riparian areas, wetlands, playas or 100-year floodplains to protect the integrity of these resources (as delineated by the presence of riparian vegetation and not actual water). Exceptions to this restriction may be considered on a case-by-case basis if the BLM determines at least one of the following conditions apply: 1) additional development is proposed in an area where current development has shown no adverse impacts, 2) suitable off-site mitigation will be provided if habitat loss is expected, or 3) BLM determines development proposed under any plan of operations ensures adequate protection of the resources.
- Endangered Species. The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed

activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modifications of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act, 16 USC 1531, as amended, including completion of any required procedure for conference or consultation.

- Sage Grouse. The following stipulations apply to protect sage grouse and their habitat. Known habitat is defined as those areas where sage grouse have been observed. Potential habitat is those areas where sage grouse may occur.
  - Known Breeding Habitat and Leks: February through June, but may vary on site specific basis.
    a. Avoid all activity within 3.3 km (2 miles) of known leks during the mating season - March through May, or as determined by Field Office and Wildlife Personnel. No surface occupancy within 3.3 km (2 miles) of known leks at all times.
  - Nesting Habitat and Brood-rearing habitats: (April through August per Interim NY Guidelines) and Winter Habitats (October through March).
    a. Known Habitat. Avoid all development or exploration activities within 3.3 km (2 miles) or other appropriate distance based on site-specific conditions, of leks, or within 1 km. (0.6 mi.) of known nesting, brood-rearing and winter habitat.
    b. Potential Habitat. Avoid permanent occupancy of potential habitat.
  - General Sage Grouse Stipulations
    a. Prior to entry on any lease areas that include known or potential habitat, the lessee (operator) shall contact the appropriate BLM Field Office to discuss any proposed activities.
    b. All power poles and potential raptor perches will be designed or retrofitted to eliminate use by raptors and ravens.

c. All surface disturbance occurring in potential or known habitat shall be reclaimed as soon as possible in such a way as to result in conditions suitable for sage grouse habitat.

d. All areas of disturbance will be graded and reseeded with a seed mixture appropriate for the soils, climate, and landform. Attempt to restore the ecological processes and potential natural vegetation, and prevent the invasion of noxious weeds or other invasive species.

- Migratory Birds. Surface disturbing activities during the migratory birds nesting season (March to July) may be restricted in order to avoid potential violation of the Migratory Bird Act. Appropriate inventories of migratory birds shall be conducted during analysis of actual site development. If active nests are located, the proponent will coordinate with BLM to establish appropriate protection measures for the nesting sites which may include avoidance or restricting or excluding development during certain areas to times when nests and nesting birds will not be disturbed. During development and production phases, if artificial ponds potentially detrimental to migratory birds are created, these shall be fitted with exclusion devices such as netting or floating balls.
- Noxious Weeds. During all phases of exploration and development, the lessee will maintain a noxious weed control program consisting of monitoring and eradication for species listed on the Nevada Designated Noxious Weed List (NRS 555.010).
- Surface Occupancy. Surface Occupancy and use is subject to all valid existing surface rights.

The lands subject to this stipulation are described as: All potential KGRA and noncompetitive lease sections.

BUREAU OF RECLAMATION SPECIAL STIPULATIONS

The following Bureau of Reclamation Special Stipulations apply to Vulcan lease number N-79664 and Ormat lease numbers NVN-79104, NVN-79105, and NVN-79106:

- The Lessor reserves the ownership of brines and condensates and the right to receive or take possession of all or any part thereof following the extraction or utilization by Lessee of the heat energy and byproducts other than demineralized water associated therewith subject to such rules and regulations as shall be prescribed by the Secretary of the Interior. If the Lessor elects to take the brines and condensates, the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering system after separation of the steam and brine

products or from the disposal system as specified by the Lessor for the extraction of said brines and condensates by such means as the Lessor may provide and without cost to the Lessee.

- There is not obligation on the part of the Lessor to exercise its reserved rights. The Lessor shall not be liable in any manner if those rights are not exercised, and, in that event, the Lessee shall dispose of the brines and condensates in accordance with applicable laws, rules and regulations.
- The Lessor reserves the right to conduct on the leased lands, testing and evaluation of geothermal resources which the Lessor determines are required for its desalinization research programs for utilization of geothermal fluids. These programs may include shallow temperature gradient hole underground exploration, if they are conducted in a manner compatible with lease operations and the production by Lessee of geothermal steam and associated geothermal resources.
- Lessor reserves the right to erect, maintain, and operate any and all facilities, pipelines, transmission lines, access roads, and appurtenances necessary for desalinization on the leased premises. Any desalting plants, piping, wells, or other equipment installed by the Lessor on the leased premises shall remain the property of the Lessor; and the Lessee shall conduct his operations in a manner compatible with the operation and maintenance of any desalting plants, piping, wells, or other equipment installed by the Lessor. Any brines and condensates removed by the Lessor shall be replaced without cost to the Lessee with fluids as compatible with reservoir fluids as the brines or condensates that the Lessor removed and where the Lessor and Lessee determine that they are needed by the Lessee for his operation or for reinjection into the geothermal anomalies.
- The Lessor and the Lessee, if authorized by law, may enter into cooperative agreements for joint development and production of geothermal resources from the leased premises consistent with applicable laws and regulations. Any geophysical, geological, geochemical, and reservoir hydraulic data collected by either the Bureau of Reclamation or the Lessee will be made available upon request to the other party, and the data furnished to Reclamation by the Lessee shall be considered confidential so long as the following conditions prevail:
  - Until the Lessee notifies Reclamation that there is no requirement to retain the submitted data in confidential status or until Lessee relinquishes all interest in the leased area from where the information was obtained.

- Reclamation shall not incorporate data received from the Lessee in its publications or reports during the period that confidential data are being retained without written authorization from the Lessee.
- Information obtained by Reclamation, and upon request submitted to the Lessee, shall not be used in publications or reports issued by Lessee without written consent of Reclamation until the data have been published or otherwise given distribution by Reclamation.

- The United States reserves the right to flood, seep and overflow the lands, permanently or intermittently, in connection with the operation or maintenance of the Newlands Project. Prior to use of operation or maintenance roads within the Newlands Project, the Lessee will notify the Project Manager in order to be appraised of areas that should be avoided to prevent interference with the operation and maintenance of the project. There is also reserved to the United States, the right of its officers, agents, employees, licensees and permittees, at all proper times and places freely to have ingress to, passage over, and egress from all of said lands for the purpose of exercising, and protecting the rights reserved herein. The Lessee further agrees that the United States, its officers, agents and employees and its successors and assigns shall not be held liable for any damage to the Lessee's improvements or works by reason of the exercise of the rights here reserved; nor shall anything contained in this paragraph be construed as in any manner limiting other reservations in favor of the Unites States contained in this lease.

SPECIAL STIPULATIONS FOR ALL LEASES IN THE CARSON CITY FIELD OFFICE MANAGEMENT AREA

The following Special Stipulations for All Leases in the Carson City Field Office Management Area apply to Ormat lease numbers NVN-79104, NVN-79105, and NVN-79106:

- Surface occupancy. No surface occupancy or disturbance will be allowed within 650 feet (horizontal measurement) of any surface water bodies, riparian areas, wetlands, playas, or 100-year floodplains to protect the integrity of these resources (as delineated by the presence of riparian vegetation and not actual water). Other buffer zones and areas of restricted surface occupancy may be required to protect other resource values, including but not limited to, critical or rare or endangered species habitat.
- Endangered Species Act Section 7 Consultation. The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status

species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modifications of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act, 16 USC § 1531 et seq., as amended, including completion of any required procedure for conference or consultation.

- Archaeology (BLM IM 2005-003). This lease may be found to contain historic properties or resources protected under the National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, EO 13007, or-other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require exploration or development proposals to be modified to protect such properties, or it may disapprove any activity that is likely to result in adverse effects that could not be successfully avoided, minimized, or mitigated.

  To secure specific compliance with the stipulations under Section 6, paragraph (2) of the geothermal resources lease form, the lessee shall, prior to operations, furnish to the AO a certified statement that either no archaeological values exist or that they may exist on the leased lands to be disturbed or occupied, to the best of the lessee's knowledge and belief, and that they might be impaired by geothermal resource operations. Such a certified statement must be completed in compliance with the BLM Nevada State Protocol by an archaeologist permitted by BLM for the Carson City Field Office. If the lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the lessee will engage a qualified archaeologist, acceptable to the AO, to survey and salvage, in compliance with the BLM Nevada State Protocol, in advance of any operations, such archaeological values on the lands involved.

  The responsibility for the cost for the certificate, survey and salvage will be borne by the lessee, and such salvaged property shall remain the property of the Lessor or the surface owner.

Surface occupancy and use is subject to all valid existing surface rights.

The lands subject to this stipulation are described as all potential lease sections.

- Water Resources. As exploration and development activities begin, the lessee will institute and pay for a hydrologic monitoring program, which will be site specific and its intensity will be commensurate with the level of exploration. For example, if the proponent were to conduct seismic studies, the monitoring would be limited to identifying water resources to be monitored as activities continue; if a drilling program were to be undertaken, the number of aquifers encountered, their properties, their quality, and their saturated thickness would be documented. The information collected would be submitted to the BLM and would be used to support future NEPA documentation as development progresses. Adverse impacts on surface expressions of the geothermal reservoir (hot springs), and threatened and endangered species habitat are not acceptable. The lessee will monitor the quality, quantity, and temperature of any hot springs or other water resource within the project area when conducting activities that could affect those resources. If adverse impacts do occur, the BLM will require the lessee to take corrective action to mitigate the impact. Corrective action may include shutting down the operation. These are lease stipulations, not operational, and the information gathered under the monitoring stipulation will be used to identify future impacts at the operational stage.
- Native American Consultation. All proposed exploration and development is subject to the requirement for Native American consultation before the BLM will authorize the activity. Depending on the nature of the proposed lease development and the resource of concern, the time to complete Native American consultation and to conduct any mitigation measures may extend the time for authorization. It may also change the ways in which developments are implemented. New lease applications would require Native American consultation.

CONTINGENCY RIGHTS STIPULATIONS

The following Contingency Rights stipulation applies to Ormat lease numbers NVN-79104, NVN-79105, and NVN-79106:

- BLM has reviewed existing information and planning resources documents and, except as noted in other attached stipulations, knows of no reason why normal development, subject to the controls of applicable laws and regulations and the lease terms and conditions, cannot proceed on the leased lands. However, specific

development activities could not be identified prior to lease issuance since the nature and extent of geothermal resources were not known and specific operations have not been proposed. The lessee is hereby made aware that consistent with 43 CFR 3200.4, all post lease operations will be subject to appropriate environmental review and may be limited or denied only if unmitigable and significant impacts on other land uses or resources would result.

MATERIAL SITE STIPULATIONS

The following Material Site stipulation applies to Ormat lease numbers NVN-79104, NVN-79105, and NVN-79106:

- The Lessee accepts this lease subject to the right of the State of Nevada to remove material from the land embraced in Material Sites and agrees that operations performed by the lessee will not interfere with operations of the State of Nevada, Department of Transportation.

NO SURFACE OCCUPANCY STIPULATIONS

The following No Surface Occupancy stipulation applies to Ormat lease numbers NVN-79104 and NVN-79105:

- No surface occupancy due to high resource values on the following lands:
  - NVN-79104

    T. 18 N., R. 30 E., MDM, Nevada
    sec. 28, all;
    sec. 32, E2, NW;
    sec. 33, all.
  - NVN-79105

    T. 18 N., R. 30 E., MDM, Nevada
    sec. 19, E2;
    sec. 20, all;
    sec. 29, all;
    sec. 30, NE.

Should the operator determine the occupancy of additional surface is needed for resource development in the public interest, the current No Surface Occupancy stipulation may be revised if both BLM and the operator mutually agree.

The following **Conditions of Approval** apply to Ormat Lease numbers NVN-79104 and NVN-79105.

CONDITIONS OF APPROVAL AND STANDARD OPERATING PROCEDURES GEOTHERMAL DRILLING PERMIT

ORMAT CARSON LAKE GEOTHERMAL EXPLORATION PROJECT CHURCHILL COUNTY, NEVADA

GEOTHERMAL LEASE NVN-79104
Production Well 84-31 (Site I), MDBM T18N, R30E, Section 31 S
Production Well 51-31 (Site E), MDBM T18N, R30E, Section 31 S

GEOTHERMAL LEASE NVN-79105
Production Well 88-30 (Site D), MDBM T18N, R30E, Section 31 S

CARSON LAKE GEOTHERMAL EXPLORATION PROJECT ENVIRONMENTAL ASSESSMENT, EA-NV-030-07-006, July 25, 2008

A COPY OF THESE CONDITIONS OF APPROVAL MUST BE FURNISHED TO YOUR FIELD REPRESENTATIVE TO INSURE COMPLIANCE

Agency Contacts

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July 22, 2008
Ormat Carson Lake Geothermal Exploration Project

CONDITIONS OF APPROVAL (COAs)

Pre-Construction

Proposed surface disturbance and vehicular travel will be limited to the approved well location and access route.

Any changes in well location, access, or site expansion must be approved by the Authorized Officer (AO) in advance.

Well Pad and Facility Construction

1. A site diagram depicting the location of production facilities, recontoured slopes and stabilization measures shall be approved by the authorized officer prior to installation of production facilities.

2. The design of all facilities, including well pads, roads, pumps, and pipelines, shall be approved by the authorized officer prior to construction to avoid unnecessary conflicts with visual resources management objectives.

3. Drainage from disturbed areas will be confined or directed so that erosion of undisturbed areas is not increased. In addition, no runoff water (including that from roads) will be allowed to flow into intermittent or perennial waterways without first passing through a sediment-trapping mechanism. Erosion control structures may include: waterbars, berms, drainage ditches, sediment ponds, or other devices.

4. Access road construction for exploratory wells should be planned such that a permanent road can later be constructed in the event of field development.

5. As required, fill slopes surrounding culverts will be rip-rapped with a well graded mixture of rock sizes containing no material greater than two feet or smaller than three inches. The ratio of maximum to minimum dimension of any rock shall not exceed 6:1.

6. Trash will be retained in portable trash cages and hauled to an authorized disposal site for disposal. Burning will not be allowed on the well site.

7. No drilling or storage facilities will be allowed within 650 feet of any pond, reservoir, canal, spring or stream. Other protective areas near water may be required to protect riparian habitat and T&E

species.

8. To maintain esthetics values, all semi-permanent and permanent facilities will be painted to blend with the natural surroundings. The Standard Environmental Colors will be used for color selection.

9. Mud, separation pits and other containments used during the exploration or operation of the lease for the storage of oil and other hazardous materials shall be adequately fenced, posted or covered.

10. Lessee/operator shall comply with all regulatory requirements for storage and handling of hazardous materials and wastes.

11. If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work that might further disturb such materials, and contact the authorized officer. Within five working days the authorized officer will inform the operator as to:

    - whether the materials appear eligible for the National Register of Historic Places;

    - the mitigation measures the operator will likely have to undertake before the site can be used (assuming in situ preservation is not necessary); and,

    - a time frame for the authorized officer to complete an expedited review under 36 CFR 800.11 or other applicable Programmatic Agreement, to confirm, through the State Historic Preservation Officer, that the findings of the authorized officer are correct and that mitigation is appropriate.

12. If the operator wishes, at any time, to relocate activities to avoid the expense of mitigation and/or the delays associated with the process described in item 11 above for inadvertent discovery of cultural resources, the authorized officer will assume responsibility for whatever recordation and stabilization of the exposed materials may be required. Otherwise, the operator will be responsible for mitigation costs. The authorized officer will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the authorized officer that the required mitigation has been completed, the operator will then be allowed to resume construction.

13. Field development construction activities within 2 miles of a sage grouse lek will require all motorized equipment to have noise abatement devices to preclude excessive noise during the sage grouse strutting period.

14. Fences shall be flagged with bright colored flagging at least every rod from visibility to wild horses. All fences should be constructed using green steel posts with white or silver tops to increase visibility. Fences should also avoid obvious horse migration routes (deep trails, stud piles) if at all possible.

15. Spring and water developments on public lands may be used only with the prior written approval of the AO or the water rights holder.

16. Fences shall not be cut without prior approval of the AO. Before cutting any fences, the operator shall firmly brace the fence on both sides of the cut; a temporary gate will be installed for use during the course of operations unless the fence is immediately repaired. Upon completion of operation, fences hall be restored to at least their original condition.

17. As directed by the AO, cattle guards will be installed whenever access roads are through pasture gates or fences. These cattle guards shall be maintained. This includes cleaning out under cattle guard bases when needed.

Field Operation

1. Operations shall be done in a manner which prevents damage, interference, or disruption of water flows and improvements associated with all springs, wells, or impoundments. It is the operator's responsibility to enact the precautions necessary to prevent damage, interference, or disruptions.

2. The operator shall regularly maintain all roads used for access to the lease operation. A maintenance plan may be required. A regular maintenance program may include, but not be limited to, upgrading of existing roads, blading, ditching, culvert, drainage installation, and graveling or capping of the roadbed.

3. Management actions within riparian areas will be designed to maintain or, where possible, improve riparian habitat condition.

4. Noxious weeds which may be introduced due to soil disturbance and reclamation will be treated by methods to be approved by the

authorized officer. These methods may include biological, mechanical, or chemical. Should chemical methods be approved, the lessee must submit a Pesticide Use Proposal to the authorized officer 60 days prior to the planned application date.

5. There will be no discharges into any Bureau of Reclamation water delivery or drainage facilities.

6. The operator shall not use Bureau of Reclamation operation and maintenance roads for lease related access without prior written approval from the Bureau of Reclamation.

7. Operations shall be done in a manner that prevents damage, interference, or disruption of water flows, and improvements associated with all springs, wells, impoundments, or Newlands Project facilities. It is the operator's responsibility to enact the precautions necessary to prevent damage, interference, or disruptions. Monitoring wells may be required al all sites where exploration or development will occur to assess long-term impacts to quantity and quality in accordance with applicable State and federal requirements.

Reclamation and Abandonment

1. The operator or contractor will contact the AO 48 hours prior to reclamation work.

2. Restoration work may not begin on the well site until the reserve pits are completely dry.

3. Disturbed areas will be recontoured to blend as nearly as possible with the natural topography prior to revegetation. This includes removing all berms and refilling all cuts. Compacted portions of the pad will be ripped to a depth of 12 inches unless in solid rock.

4. Site preparation for reclamation may include contour furrowing, terracing, reduction of steep cut and fill slopes, installation of water bars, etc.

5. All portions of the access roads not needed for other uses as determined by the authorized officer will be reclaimed.

6. The stockpiled topsoil will be spread evenly over the disturbed area.

7. The operator will be required to construct waterbars and re-open drainages on abandoned access roads and pipeline routes to

minimize erosion as required. Water bars will be spaced appropriately dependant upon topography and slope. Pipeline routes shall be water-barred perpendicular to the fall-line of the slope.

8. The area is considered to be satisfactorily reclaimed when all disturbed areas have been recontoured to blend with the natural topography, erosion stabilized and an acceptable vegetative cover has been established.

9. Rehabilitation shall be planned on the sites of both producing and abandoned wells. The entire site or portion thereof, not required for the continued operation of the well, should be restored as nearly as practical to its original condition. Final grading of back-filled and cut slopes will be done to prevent erosion and encourage establishment of vegetation.

10. Petroleum products such as gasoline, diesel fuel, helicopter fuel, crankcase oil, lubricants, and cleaning solvents used to fuel, lubricate, and clean vehicles and equipment will be containerized in approved containers.

11. Hazardous material shall be properly stored in separate containers to prevent mixing, drainage or accidents. Hazardous materials shall not be drained onto the ground or into streams or drainage areas.

12. Totally enclosed containment shall be provided for all solid construction waste including trash, garbage, petroleum products and related litter will be removed to an authorized sanitary landfill approved for the disposal of these classes of waste.

13. All construction, operation, and maintenance activities shall comply with all applicable federal, state, and local laws and regulations regarding the use of hazardous substances and the protection of air and water quality.

14. In construction areas where recontouring is not required, vegetation will be left in place wherever possible and the original contour will be maintained to avoid excessive root damage and allow for resprouting.

15. Watering facilities (e.g., tanks, developed springs, water lines, wells, etc.) will be repaired or replaced if they are damaged or destroyed by construction activities to its predisturbed condition as required by the authorized officer.

16. When sites are abandoned, they will be inventoried for the presence of noxious weeds and treated if noxious weeds are present.

17. Seed and mulch used to reclaim disturbed areas must be weed free. Mulching of the seedbed following seeding may be required under certain conditions (i.e., expected severe erosion), as determined by the authorized officer.

18. Seed will be broadcast between October 1 and March 15 using a site-specific seed mixture and depth of planting as determined by the authorized officer. Seed may be applied with a rangeland drill at half the rate of broadcast seeding. All seeding application rates will be in pounds of pure live seed per acre. Seed should be adapted varieties.

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7/22/10

Determination of NEPA Adequacy (DNA)
U.S. Department of the Interior
Bureau of Land Management

FIELD OFFICE: Stillwater Field Office, Carson City District

TRACKING NUMBER: DNA No., DOI-BLM- NV-C010-2010-0012-DNA

CASEFILE PROJECT NUMBER & LOCATION:
N30-09-019 GDP 11-32; T18N R30E, NW¼NW¼, Section 32; Geothermal Unit NVN 085819X; Lease NVN 079104; UTM NAD 83 North: 4360767(m) East: 358105(m).

PROPOSED ACTION TITLE/TYPE: Geothermal Drilling Permit

APPLICANT (if any): Ormat Nevada, Inc. (Ormat)

A. Description of the Proposed Action and any applicable mitigation measures

Ormat proposes to drill one exploration/production well (GDP 11-32) on geothermal leased lands, NVN 079104. The purpose of this drilling program is to (1) construct a drilling pad (300' x 450 ' = 3.10 acres) including a containment basin and access road (800'x 25' = 0.5 acres) for a total of 3.60 acres; (2) drill a new vertical production well to a total depth of approximately 1500 feet; (3) test the well to determine reservoir characteristics; (4) measure the well's temperature profile; and (5) utilize the well to generate electricity. The location for the production well is based on the geology and known geothermal reservoir data obtained from previous wells drilled.

If the well is unsuccessful, it will be either re-drilled or abandoned in accordance with state regulation. Ormat anticipates drilling to commence as soon as the required permits are obtained.

B. Land Use Plan (LUP) Conformance

LUP Name: Carson City Field Office Consolidated Resource Management Plan
Date Approved: May 9, 2001

The proposed action is in conformance with the applicable LUP because it is specifically provided for in the following LUP decisions:

Objective 1: Encourage development of energy and mineral resources in a timely manner to meet national, regional and local needs consistent with the objectives for other public land uses.

Objective 2: Oil, gas, and geothermal exploration and production upon BLM land are conducted through leases with the Bureau and are subject to terms and stipulations to comply with all applicable federal and state laws pertaining to various considerations for sanitation, water quality, wildlife, safety, and reclamation. Stipulations may be site specific and are derived from the environmental analysis process.

C. Identify applicable National Environmental Policy Act (NEPA) documents and other related documents that cover the proposed action.

List by name and date all applicable NEPA documents that cover the proposed action.
1) Carson City Field Office Carson Lake Geothermal Exploration Project Environmental Assessment, EA-NV-030-07-006, approved July 25, 2008

List by name and date other documentation relevant to the proposed action (e.g., biological assessment, biological opinion, watershed assessment, allotment evaluation, and monitoring report). Not applicable.

D. NEPA Adequacy Criteria

1. Is the new proposed action a feature of, or essentially similar to, an alternative analyzed in the existing NEPA document(s)? Is the project within the same analysis area, or if the project location is different, are the geographic and resource conditions sufficiently similar to those analyzed in the existing NEPA document(s)? If there are differences, can you explain why they are not substantial?

Yes, the proposed action, geothermal exploration/production well drilling, is the same as that analyzed in EA-NV-030-07-006 and approved July 25, 2008 (EA). The EA analyzed 11 well pads and associated access roads, and drilling and testing up to 3 geothermal exploration wells at each pad. The proposed pad for GDP 11-32 is located between pads analyzed in the previous EA (see map). Well Pad D (88-30) is located 1200 feet north east of GDP 11-32 and Well Pad I (84-31) is located 2,000 feet south of GDP 11-32. Well Pad I (84-31) was completed and the Well Completion Report was submitted on February 9, 2009. The effected environment has not changed since the analysis was conducted in 2007. A site specific cultural survey (see attached Map from WCRM) and report have been completed for GDP 11-32. No significant impacts were found, however, a monitor during construction will be required.

2. Is the range of alternatives analyzed in the existing NEPA document(s) appropriate with respect to the new proposed action, given current environmental concerns, interests, and resource values?

Yes, environmental concerns, interests, and resource values have not changed at all since the completion of the 2008 EA. The range of alternatives in the 2008 EA is still appropriate since the environmental constraints of geothermal drilling have not changed.

3. Is the existing analysis valid in light of any new information or circumstances (such as, range- land health standard assessment, recent endangered species listings, updated lists of BLM-sensitive species)? Can you reasonably conclude that new information and new circumstances would not substantially change the analysis of the new proposed action?

The anticipated impacts to the resources have not significantly changed since the 2008 EA was completed. The proposed action will not have any adverse effect on the human health or environment of minority and low income populations. The proposed action

describes measures (conditions of approval, COAs) that will be taken which will limit the spread of noxious weeds and prevent any cumulative impacts.

4. Are the direct, indirect, and cumulative effects that would result from implementation of the new proposed action similar (both quantitatively and qualitatively) to those analyzed in the existing NEPA document?

Yes, the methodology and analytical approach used in the 2008 EA where the analyzed action is the same as the proposed action remains appropriate, as geothermal drilling and its potential impacts are minimized when standard operating procedures, conditions of approval, monitoring, and mitigation are followed as described in the current proposed action and the existing NEPA document.

Yes, the EA analyzed cumulative impacts on relevant resources. The cumulative impacts to public lands resulting from geothermal leasing would remain unchanged from that analyzed in the EA. As disclosed in that EA, there would be no resource specific cumulative impacts, excepting cultural resources.

The disturbance permitted in the EA totaled 25.16 acres. To date, only 2.3 acres have been disturbed.

All future exploration and development proposals would be subject to separate NEPA review at which time cumulative impacts would be analyzed in detail. Any proposal for exploration or development may be modified or denied by the BLM in order to prevent irreparable and / or undue degradation or harm to one or more resources. The Contingency Rights Stipulation on the lease ensures that BLM maintains the authority needed to protect the resources.

5. Are the public involvement and interagency review associated with existing NEPA document(s) adequate for the current proposed action?

Yes, public involvement associated with the 2008 EA remains adequate. Consultation with other agencies, the general public, and Native American Tribes was conducted for that document. The Fallon Paiute-Shoshone was consulted for the 2008 EA. The Fallon Paiute-Shoshone requested information regarding any future project and will be notified via letter of the proposed new drilling project and site. Consultation will continue with tribal representatives on future geothermal projects in this area. In addition, geothermal exploration companies must apply to the county government for a special use permit for any drilling proposed in the county and the public is aware of these proposals via the local county process.

The proposed drill site and road are located in an area designated as No Surface Occupancy under Special Stipulations for NVN 079104. In addition, they required Native American consultation before BLM authorizes any exploration and development activity. Attached is an April 27, 2010 Memorandum to the Lease File NVN 079104 from the Stillwater Field Office Manager regarding the "Decision to Revise the No Surface Occupancy Stipulation". It discusses the consultation with Rochanne Downs (Fallon Paiute-Shoshone Tribe, Vice Chairman) and with Ormat regarding the rescission

of the No Surface Occupancy designation for this proposal. Also attached is a letter dated May 5, 2010 from the Stillwater Field Manager to Ormat regarding these discussions and decision. A copy was sent to Rochanne Downs.

E. Persons/Agencies/BLM Staff Consulted

Name	Title	Resource/Agency Represented
Carla James	Resource Staff Supervisor	Stillwater Field Office
Desna Young	NEPA Coordinator	Stillwater Field Office
Jason Wright	Archaeologist	Stillwater Field Office JKW

Note: Refer to the EA/EIS for a complete list of the team members participating in the preparation of the original environmental analysis or planning documents.

Conclusion (If you found that one of more of these criteria is not met, you will not be able to check this box.)

Based on the review documented above, I conclude that this proposal conforms to the applicable land use plan and that the NEPA documentation fully covers the proposed action and constitute BLM's compliance with the requirements of the NEPA.

Carla James 07-19-10

Carla James, Project Lead and Resource Staff Supervisor
Stillwater Field Office, Carson City District

D. Young 07.19.10

Desna Young, NEPA Coordinator
Stillwater Field Office, Carson City District

Teresa J. Knutson

Teresa J. Knutson
Stillwater Field Manager, Carson City District

07/22/2010
Date

Note: The signed Conclusion on this Worksheet is part of an interim step in the BLM's internal decision process and does not constitute an appealable decision. However, the lease, permit, or other authorization based on this DNA is subject to protest or appeal under 43 CFR Part 4 and the program-specific regulations.

CONDITIONS OF APPROVAL AND STANDARD OPERATING PROCEDURES
GEOTHERMAL DRILLING PERMIT

ORMAT NEVADA, INC. CARSON LAKE GEOTHERMAL EXPLORATION PROJECT
CHURCHILL COUNTY, NEVADA

Bunejug Geothermal Unit NVN 085819X: Churchill County, Nevada
GEOTHERMAL LEASE NVN 079104
Production Well 11-32, MDBM T18N, R30E, Section 32 NW1/4NW1/4

CARSON LAKE GEOTHERMAL EXPLORATION PROJECT
ENVIRONMENTAL ASSESSMENT, EA-NV-030-07-006;
DETERMINATION OF NEPA ADEQUACY, DOI-BLM-NV-C010-0012-DNA

A COPY OF THESE CONDITIONS OF APPROVAL MUST BE FURNISHED TO YOUR FIELD REPRESENTATIVE TO INSURE COMPLIANCE

Agency Contacts

BUREAU OF LAND MANAGEMENT

Nevada State Office
PO Box 12000 (1340 Financial Blvd)
Reno NV. 89520-0006
(775) 861-6400

Petroleum Engineer: John Menghini
Office Telephone: (775) 861-6573

Cell: (775) 223-1359
jmenghin@nv.blm.gov

NEVADA DIVISION OF MINERALS

Nevada Division of Minerals
400 W. King Street # 106
Carson City, NV 89703
(775) 684-7040

Oil, Gas and Geothermal Program Lead:
Lowell Price
Office Telephone: (775) 684-7045
Cell: (775) 721-1774
Fax: (775) 684-7052
clmorris@govmail.state.nv.us

July 20, 2010
Cason Lake Basin Project LLC

CONDITIONS OF APPROVAL (COAs)

Stipulations:
All applicable standard operating procedures (SOPs) and Conditions of Approval (COAs) upon the issuance of Geothermal Lease NVN 079104 have been carried forward in this Determination of NEPA Adequacy. In addition are the COAs listed below which should include the SOPs, BMPs, and mitigation proposed in the Ormat Carson Lake Geothermal Project Plan of Exploration, Geothermal Drilling Permits, and in the EA-NV-030-07-006.

Term: The term is for two (2) years from the date of approval, but may be extended by BLM. The term is intended to be commensurate with the state of Nevada NRS 534A.070.

Cultural Monitoring:
Ormat will hire a qualified cultural resource monitor(s) to be on site during the duration of all ground disturbing activities associated with well 11-32, including the associated access road and the excavation of sumps.

If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work that might further disturb such materials, and contact the authorized BLM officer. Within five working days the authorized BLM officer will inform the operator as to:

- whether the materials appear eligible for the National Register of Historic Places;

- the mitigation measures the operator will likely have to undertake before the site can be used (assuming in situ preservation is not necessary); and,

- a time frame for the authorized BLM officer to complete an expedited review under 36 CFR 800.11 or other applicable Programmatic Agreement, to confirm, through the State Historic Preservation Officer, that the findings of the authorized BLM officer are correct and that mitigation is appropriate.

Pre-Construction

1. All access roads will be constructed and maintained to BLM road standards (BLM Manual Section 9113).

2. Proposed surface disturbance and vehicular travel will be limited to the approved well location and access route.

3. Any changes in well location, facility location, and access or site expansion must be approved by the authorized BLM officer in advance.

4. No new surface disturbance in the Area of No Surface Occupancy will be authorized.

Well Pad and Facility Construction

1. A site diagram depicting the location of production facilities, recontoured slopes and stabilization measures shall be approved by an authorized BLM officer prior to installation of production facilities.

2. The design of all facilities, including well pads, roads, pumps, and pipelines, shall be approved by the authorized BLM officer prior to construction to avoid unnecessary conflicts with visual resources management objectives.

3. Drainage from disturbed areas will be confined or directed so that erosion of undisturbed areas is not increased. In addition, no runoff water (including that from roads) will be allowed to flow into intermittent or perennial waterways without first passing through a sediment-trapping mechanism. Erosion control structures may include: waterbars, berms, drainage ditches, sediment ponds, or other devices.

4. Access road construction for exploratory wells should be planned such that a permanent road can later be constructed in the event of field development.

5. Access roads requiring construction with cut and fill will be designed to minimize surface disturbance and take into account the character of the landform, natural contours, cut material, depth of cut, where the fill material will be deposited, resource concerns and visual contrast.

6. To maintain esthetics values, all semi-permanent and permanent facilities will be painted to blend with the natural surroundings. The Standard Environmental Colors will be used for color selection.

7. As required, fill slopes surrounding culverts will be rip-rapped with a well graded mixture of rock sizes containing no material

greater than two feet or smaller than three inches. The ratio of maximum to minimum dimension of any rock shall not exceed 6:1.

8. Water turnouts needed to provide additional drainage will be constructed not to exceed two percent slope to minimize soil erosion.

9. Well site layout should take into account the character of the topography and landform. Deep vertical cuts and steep long fill slopes should be avoided. All cut and fill slopes should be constructed to the least percent slope practical.

10. Trash will be retained in portable trash cages and hauled to an authorized disposal site for disposal. Burning will not be allowed on the well site.

11. No drilling or storage facilities will be allowed within 650 feet of any pond, reservoir, canal, spring or stream. Other protective areas near water may be required to protect riparian habitat and T&E species.

12. Springs and water developments on public lands may be used only with the prior written approval of the authorized BLM officer or the water rights holder.

13. To maintain esthetics values, all semi-permanent and permanent facilities will be painted to blend with the natural surroundings. The Standard Environmental Colors will be used for color selection.

14. Fences shall not be cut without prior approval of the authorized BLM officer. Before cutting through any fences, the operator shall firmly brace the fence on both sides of the cut; a temporary gate will be installed for use during the course of operations, unless the fence is immediately repaired. Upon completion of operations, fences shall be restored to at least their original condition.

15. As directed by the authorized BLM officer, cattle guards will be installed whenever access roads are through pasture gates or fences. These cattle guards shall be maintained. This includes cleaning out under cattle guard bases when needed.

16. The depth of surface soil material to be removed and stockpiled will be specified by the authorized BLM officer. If topsoil is stockpiled for more than one year, the stockpile shall be seeded or

otherwise protected from wind and water erosion. The stockpile shall be marked or segregated to avoid loss or mixing with other subsurface materials. Any trees removed will be separated from soils and stockpiled separately.

17. Mud, separation pits and other containments used during the exploration or operation of the lease for the storage of oil and other hazardous materials shall be adequately fenced, posted or covered.

18. Lessee/operator shall comply with all regulatory requirements for storage and handling of hazardous materials and wastes.

19. If the operator wishes, at any time, to relocate activities to avoid the expense of mitigation and/or the delays associated with the process described in item 20 above for inadvertent discovery of cultural resources, the authorized BLM officer will assume responsibility for whatever recordation and stabilization of the exposed materials may be required. Otherwise, the operator will be responsible for mitigation costs. The authorized BLM officer will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the authorized BLM officer that the required mitigation has been completed, the operator will then be allowed to resume construction.

20. No surface use will be permitted within 0.6 miles of occupied raptor aeries (nests) during the nesting and fledging period.

22. Fences shall be flagged with bright colored flagging at least every rod from visibility to wild horses. All fences should be constructed using green steel posts with white or silver tops to increase visibility. Fences should also avoid obvious horse migration routes (deep trails, stud piles) if at all possible.

Field Operation

1. Operations shall be done in a manner which prevents damage, interference, or disruption of water flows and improvements associated with all springs, wells, or impoundments. It is the operator's responsibility to enact the precautions necessary to prevent damage, interference, or disruptions.

2. Unauthorized use or failure to lock gates during specified time frames by the lessee or its subcontractors would be considered a violation of the terms of the GPD or associated grants.

3. The operator shall regularly maintain all roads used for access to the lease operation. A maintenance plan may be required. A regular maintenance program may include, but not be limited to, upgrading of existing roads, blading, ditching, culvert, drainage installation, and graveling or capping of the roadbed.

4. Management actions within riparian areas will be designed to maintain or, where possible, improve riparian habitat condition.

5. Noxious weeds which may be introduced due to soil disturbance and reclamation will be treated by methods to be approved by the authorized BLM officer. These methods may include biological, mechanical, or chemical. Should chemical methods be approved, the lessee must submit a Pesticide Use Proposal to the authorized BLM officer 60 days prior to the planned application date.

6. The lessee will institute and pay for a hydrologic evaluation program, which will be site specific and its intensity will be commensurate with the level of developmental drilling. The lessee will develop this evaluation program working with the BLM Carson City Stillwater Field Office Hydrogeologist and with BLM consent will implement. The number of aquifers encountered, their properties, their quality, and their saturated thickness may be documented. This type of information will be submitted to the BLM and would support future NEPA documentation as development progresses and may be useful to determine adverse impacts on surface water expressions of the geothermal reservoir (hot springs). The evaluation program may include the quality, quantity, and temperature of any hot springs or other water resource within the project area.

7. There will be no discharges into any Bureau of Reclamation water delivery or drainage facilities.

8. The operator shall not use Bureau of Reclamation operation and maintenance roads for lease related access without prior written approval from the Bureau of Reclamation.

9. Operations shall be done in a manner that prevents damage, interference, or disruption of water flows, and improvements associated with all springs, wells, impoundments, or Newlands Project facilities. It is the operator's responsibility to enact the precautions necessary to prevent damage, interference, or disruptions. Monitoring wells may be required al all sites where

exploration or development will occur to assess long-term impacts to quantity and quality in accordance with applicable State and federal requirements.

Reclamation and Abandonment

1. The operator or contractor will contact the authorized BLM officer 48 hours prior to reclamation work.

2. Restoration work may not begin on the well site until the reserve pits are completely dry.

3. Disturbed areas will be recontoured to blend as nearly as possible with the natural topography prior to revegetation. This includes removing all berms and refilling all cuts. Compacted portions of the pad will be ripped to a depth of 12 inches unless in solid rock.

4. Site preparation for reclamation may include contour furrowing, terracing, and reduction of steep cut and fill slopes, installation of water bars, etc.

5. All portions of the access roads not needed for other uses as determined by the authorized BLM officer will be reclaimed.

6. The stockpiled topsoil will be spread evenly over the disturbed area.

7. The operator will be required to construct waterbars and re-open drainages on abandoned access roads and pipeline routes to minimize erosion as required. Water bars will be spaced appropriately dependant upon topography and slope. Pipeline routes shall be water-barred perpendicular to the fall-line of the slope.

8. The area is considered to be satisfactorily reclaimed when all disturbed areas have been recontoured to blend with the natural topography, erosion stabilized and an acceptable vegetative cover has been established.

9. Rehabilitation shall be planned on the sites of both producing and abandoned wells. The entire site or portion thereof not required for the continued operation of the well should be restored as nearly as practical to its original condition. Final grading of back-filled and cut slopes will be done to prevent erosion and encourage establishment of vegetation.

10. Petroleum products such as gasoline, diesel fuel, helicopter fuel, crankcase oil, lubricants, and cleaning solvents used to fuel, lubricate, and clean vehicles and equipment will be containerized in approved containers.

11. Hazardous material shall be properly stored in separate containers to prevent mixing, drainage or accidents. Hazardous materials shall not be drained onto the ground or into streams or drainage areas.

12. Totally enclosed containment shall be provided for all solid construction waste including trash, garbage, petroleum products and related litter will be removed to an authorized sanitary landfill approved for the disposal of these classes of waste.

13. All construction, operation, and maintenance activities shall comply with all applicable federal, state, and local laws and regulations regarding the use of hazardous substances and the protection of air and water quality.

14. In construction areas where recontouring is not required, vegetation will be left in place wherever possible and the original contour will be maintained to avoid excessive root damage and allow for resprouting.

15. Watering facilities (e.g., tanks, developed springs, water lines, wells, etc.) will be repaired or replaced if they are damaged or destroyed by construction activities to its pre-disturbed condition as required by the authorized BLM officer.

16. When sites are abandoned, they will be inventoried for the presence of noxious weeds and treated if noxious weeds are present.

17. Seed and mulch used to reclaim disturbed areas must be weed free. Mulching of the seedbed following seeding may be required under certain conditions (i.e., expected severe erosion), as determined by the authorized BLM officer.

18. Seed will be broadcast between October 1 and March 15 using a site-specific seed mixture and depth of planting as determined by the authorized BLM officer. Seed may be applied with a rangeland drill at half the rate of broadcast seeding. All seeding application rates will be in pounds of pure live seed per acre. Seed should be adapted varieties.

The following **Conditions of Approval** apply to Vulcan lease numbers N-79665 and N-79668.

Carson Lake Basin Project, LLC
345 SW Cyber Drive, Suite 103
Bend, OR 97702
(541) 317-1984

REVISED
KETTLEMEN NUMBERS
06/25/07

Original Kettleman Numbers take from USGS quad sheets	Final Kettleman Numbers take by GPS reading
85-15	86-15
67-14	56-14
27-16	17-16
31-14	47-11
23-21	24-21
52-15	62-15
51-16	58-9
33-11	35-11
31-20	51-20
33-33	34-33

17-16

Form 3260-3
(February 2005)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB NO. 1004-0137
Expires: March 31, 2007

GEOTHERMAL SUNDRY NOTICE

The Bureau of Land Management (BLM) requires this form or other BLM approved forms to be prepared and filed in triplicate with requisite attachments. The BLM must approve this permit prior to any lease operations.

6. Lease Serial No.: N79665

7. Surface Manager: ☑ BLM ☐ FS ☐ Other

8. Unit Agreement Name: N/A

1a. Well Type: ☐ Production ☐ Injection ☐ Heat Exchange ☑ Observation ☐ Other

9. Well No.: CLB 27-16

10. Permit No.:

1b. Well Status: N/A

11. Field or Area: Salt Wells

2. Name of Lessee/Operator: Carson Lake Basin Project

12. Sec., T., R., B. & M.: Section 16, T17N, R30E

3. Address of Lessee/Operator: 345 SW Cyber Drive, Suite 103, Bend, OR 97702

13. County: Churchill

4. Location of Well or Facility: SW ¼ SW ¼, Section 16, T17N, R30E

14. State: NV

5. Type of Work

- ☑ Change Plans
- ☐ Site and Road Construction
- ☐ Construct New Production Facilities
- ☐ Alter Existing Production Facilities
- ☐ Convert to Injection
- ☐ Fracture Test
- ☐ Shoot or Acidize
- ☐ Repair Well
- ☐ Pull or Alter Casing
- ☐ Multiple Complete
- ☐ Abandon
- ☐ Other

15. Describe Proposed Operations *(Use this space for well activities only. See instructions for current well conditions on page 2.)*

Change to air / mud drilling. Change casing schematic. Total depth = 5,000. Location dimensions = 250' x 300'. See attached drilling program.

16. Describe Proposed Operations *(Use this space for activities other than well work.)*

NA

17. I hereby certify that the foregoing is true and correct.

Signed James Kiser Title V.P. Engineering Date 5/22/07

(This space for Federal use)

Approved by Gary Johnson Title Deputy State Director Date 06-13-07

Conditions of Approval, if any: See Attached Conditions of Approval

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212 make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

(Continued on page 2)

Conditions of Approval

Wells 52-15, 31-14, 27-16, 23-21, 85-15, 33-33
56-14, 51-16, 34-11, 31-20

1. These wells are permitted to be drilled to a total depth of 3500 feet only. You may not drill deeper than this depth without prior approval from BLM. Permission to drill deeper will be based on a joint review conducted by both BLM and NDOM of the drilling history and the lithology encountered in each well. The submittal of daily drilling reports and lithologic logs to both offices will be necessary to complete the review. Please plan your drilling activity accordingly.

2. The drilling program does not indicate water storage containers will be on site. At the time drilling activity is initiated, and at all times during drilling of the well, a sufficient volume of water to fill the entire completed well volume must be on site.

3. The drilling program does not indicate mud circulating equipment will be on site. This equipment shall be on site at all times during drilling of the well.

4. Fugitive dust generated on site, including air drilling operations, shall be controlled using best management practices such as misting, water spray, and/or dust abatement.

5. All test flow discharge shall be contained in the drill pad sump or container.

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CONDITIONS OF APPROVAL AND STANDARD OPERATING PROCEDURES
GEOTHERMAL DRILLING PERMIT

CARSON LAKE BASIN PROJECT, LLC
SALT WELLS, NEVADA

GEOTHERMAL LEASE NVN-79666
Production Well 47-11, MDBM T17N, R30E, Section 11 SESW
Production Well 58-9, MDBM T17N, R30E, Section 9 SWSE
Production Well 35-11, MDBM T17N, R30E, Section 11 NESW

GEOTHERMAL LEASE NVN-79665
Production Well 56-14, MDBM T17N, R30E, Section 14 NWSE

GEOTHERMAL LEASE NVN-79310
Production Well CLB 86-15 P, MDBM T17N, R30E, Section 15 NESE

SALT WELLS GEOTHERMAL DRILLING ENVIRONMENTAL ASSESSMENT, EA-NV-030-07-05, February 6, 2007

A COPY OF THESE CONDITIONS OF APPROVAL MUST BE FURNISHED TO YOUR FIELD REPRESENTATIVE TO INSURE COMPLIANCE

Agency Contacts

BUREAU OF LAND MANAGEMENT

Nevada State Office
PO Box 12000 (1340 Financial Blvd)
Reno NV. 89520-0006
(775) 861-6400

Petroleum Technician: Michael Tyler
24 Hr. Telephones: (775) 289-4722
m75tyler@blm.gov

Petroleum Engineer: John Menghini
Office Telephone: (775) 861-6573

Cell: (775) 223-1359
jmenghin@nv.blm.gov

Geothermal Lead: Rich Hoops
(775) 861-6568

NEVADA DIVISION OF MINERALS

Nevada Division of Minerals
400 W. King Street # 106
Carson City, NV 89703
(775) 684-7040

Oil, Gas and Geothermal Program Lead:
Christy Morris
Office Telephone: (775) 684-7045
Cell: (775) 721-1774
Fax: (775) 684-7052
clmorris@govmail.state.nv.us

CONDITIONS OF APPROVAL AND STANDARD OPERATION PROCEDURES (COAs)

Well Pad and Facility Construction

1. A site diagram depicting the location of production facilities, recontoured slopes and stabilization measures shall be approved by the authorized officer prior to installation of production facilities.

2. The design of all facilities, including well pads, roads, pumps, and pipelines, shall be approved by the authorized officer prior to construction to avoid unnecessary conflicts with visual resources management objectives.

3. Drainage from disturbed areas will be confined or directed so that erosion of undisturbed areas is not increased. In addition, no runoff water (including that from roads) will be allowed to flow into intermittent or perennial waterways without first passing through a sediment-trapping mechanism. Erosion control structures may include: waterbars, berms, drainage ditches, sediment ponds, or other devices.

4. Access road construction for exploratory wells should be planned such that a permanent road can later be constructed in the event of field development.

5. As required, fill slopes surrounding culverts will be rip-rappewith a well graded mixture of rock sizes containing no material greater than two feet or smaller than three inches. The ratio of maximum to minimum dimension of any rock shall not exceed 6:1.

6. Trash will be retained in portable trash cages and hauled to an authorized disposal site for disposal. Burning will not be allowed on the well site.

7. No drilling or storage facilities will be allowed within 650 feet of any pond, reservoir, canal, spring or stream. Other protective areas near water may be required to protect riparian habitat and T&E species.

8. As wells are drilled, the authorized officer will require that the drilling company monitor the temperature and outflow of water from local hot springs. If the temperature and outflow of water

from the hot spring is adversely impacted, the authorized officer will require the operator take corrective action, which may include amending or shutting down operations.

9. Springs and water developments on public lands may be used only with the prior written approval of the authorized officer or the water rights holder.

10. To maintain esthetics values, all semi-permanent and permanent facilities will be painted to blend with the natural surroundings. The Standard Environmental Colors will be used for color selection.

11. Mud, separation pits and other containments used during the exploration or operation of the lease for the storage of oil and other hazardous materials shall be adequately fenced, posted or covered.

12. Lessee/operator shall comply with all regulatory requirements for storage and handling of hazardous materials and wastes.

13. If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work that might further disturb such materials, and contact the authorized officer. Within five working days the authorized officer will inform the operator as to:

    - whether the materials appear eligible for the National Register of Historic Places;

    - the mitigation measures the operator will likely have to undertake before the site can be used (assuming in situ preservation is not necessary); and,

    - a time frame for the authorized officer to complete an expedited review under 36 CFR 800.11 or other applicable Programmatic Agreement, to confirm, through the State Historic Preservation Officer, that the findings of the authorized officer are correct and that mitigation is appropriate.

14. If the operator wishes, at any time, to relocate activities to avoid the expense of mitigation and/or the delays associated with the process described in item 13 above for inadvertent discovery of cultural resources, the authorized officer will assume responsibility for whatever recordation and stabilization of the exposed materials may be required. Otherwise, the operator will be responsible for

mitigation costs. The authorized officer will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the authorized officer that the required mitigation has been completed, the operator will then be allowed to resume construction.

15. Field development construction activities within 2 miles of a sage grouse lek will require all motorized equipment to have noise abatement devices to preclude excessive noise during the sage grouse strutting period.

16. Fences shall be flagged with bright colored flagging at least every rod from visibility to wild horses. All fences should be constructed using green steel posts with white or silver tops to increase visibility. Fences should also avoid obvious horse migration routes (deep trails, stud piles) if at all possible.

Field Operation

1. Operations shall be done in a manner which prevents damage, interference, or disruption of water flows and improvements associated with all springs, wells, or impoundments. It is the operator's responsibility to enact the precautions necessary to prevent damage, interference, or disruptions.

2. The operator shall regularly maintain all roads used for access to the lease operation. A maintenance plan may be required. A regular maintenance program may include, but not be limited to, upgrading of existing roads, blading, ditching, culvert, drainage installation, and graveling or capping of the roadbed.

3. Management actions within riparian areas will be designed to maintain or, where possible, improve riparian habitat condition.

4. Noxious weeds which may be introduced due to soil disturbance and reclamation will be treated by methods to be approved by the authorized officer. These methods may include biological, mechanical, or chemical. Should chemical methods be approved, the lessee must submit a Pesticide Use Proposal to the authorized officer 60 days prior to the planned application date.

Reclamation and Abandonment

1. A water well may be accepted by the Carson City Field Office upon completion of operations. Please submit the following information to the Carson City Field Office, Bureau of Land Management, 5665 Morgan Mill Road, Carson City, Nevada 89702.

A. Water Analysis;
B. Type of inside diameter of casing used in well;
C. Total depth of well;
D. Depth of concrete seal;
E. Depth of static water level;
F. Water bearing formation or description of aquifer.

2. The operator or contractor will contact the authorized officer 48 hours prior to reclamation work.

3. Restoration work may not begin on the well site until the reserve pits are completely dry.

4. Disturbed areas will be recontoured to blend as nearly as possible with the natural topography prior to revegetation. This includes removing all berms and refilling all cuts. Compacted portions of the pad will be ripped to a depth of 12 inches unless in solid rock.

5. Site preparation for reclamation may include contour furrowing, terracing, reduction of steep cut and fill slopes, installation of water bars, etc.

6. All portions of the access roads not needed for other uses as determined by the authorized officer will be reclaimed.

7. The stockpiled topsoil will be spread evenly over the disturbed area.

8. The operator will be required to construct waterbars and re-open drainages on abandoned access roads and pipeline routes to minimize erosion as required. Water bars will be spaced appropriately dependant upon topography and slope. Pipeline routes shall be water-barred perpendicular to the fall-line of the slope.

9. The area is considered to be satisfactorily reclaimed when all disturbed areas have been recontoured to blend with the natural topography, erosion stabilized and an acceptable vegetative cover has been established.

10. Rehabilitation shall be planned on the sites of both producing and abandoned wells. The entire site or portion thereof, not required for the continued operation of the well, should be restored as nearly as practical to its original condition. Final grading of back-filled and cut slopes will be done to prevent erosion and encourage establishment of vegetation.

11. Petroleum products such as gasoline, diesel fuel, helicopter fuel, crankcase oil, lubricants, and cleaning solvents used to fuel, lubricate, and clean vehicles and equipment will be containerized in approved containers.

12. Hazardous material shall be properly stored in separate containers to prevent mixing, drainage or accidents. Hazardous materials shall not be drained onto the ground or into streams or drainage areas.

13. Totally enclosed containment shall be provided for all solid construction waste including trash, garbage, petroleum products and related litter will be removed to an authorized sanitary landfill approved for the disposal of these classes of waste.

14. All construction, operation, and maintenance activities shall comply with all applicable federal, state, and local laws and regulations regarding the use of hazardous substances and the protection of air and water quality.

15. In construction areas where recontouring is not required, vegetation will be left in place wherever possible and the original contour will be maintained to avoid excessive root damage and allow for resprouting.

16. Watering facilities (e.g., tanks, developed springs, water lines, wells, etc.) will be repaired or replaced if they are damaged or destroyed by construction activities to its predisturbed condition as required by the authorized officer.

17. When sites are abandoned, they will be inventoried for the presence of noxious weeds and treated if noxious weeds are present.

18. Seed and mulch used to reclaim disturbed areas must be weed free. Mulching of the seedbed following seeding may be required under certain conditions (i.e., expected severe erosion), as determined by the authorized officer.

19. Seed will be broadcast between October 1 and March 15 using a site-specific seed mixture and depth of planting as determined by the authorized officer. Seed may be applied with a rangeland drill at half the rate of broadcast seeding. All seeding application rates will be in pounds of pure live seed per acre. Seed should be adapted varieties.

MITIGATION MEASURES FOR THE PROPOSED ACTION

Water Resources Evaluation Program

The lessee will institute and pay for a hydrologic evaluation program, which will be site specific and its intensity will be commensurate with the level of developmental drilling. The lessee will develop this evaluation program working with the BLM Carson City Field Office Hydrogeologist and with BLM consent will implement. The number of aquifers encountered, their properties, their quality, and their saturated thickness may be documented. This type of information will be submitted to the BLM and would support future NEPA documentation as development progresses and may be useful to determine adverse impacts on surface water expressions of the geothermal reservoir (hot springs). The evaluation program may include the quality, quantity, and temperature of any hot springs or other water resource within the project area.

Permittee Wildland Fire Mitigation Plan:

Scope of Work under permit:
Carson Lake Basin Project LLC is permitted to construct 5 geothermal production wells as described in their drilling programs and Geothermal Drilling Permits within Churchill County. This drilling work will be accomplished using several types of heavy equipment.

Contact Phone Numbers:

* Carson Lake Basin Project LLC
  Virgil Welch, Drilling Project Manager/Foreman 775-217-0813 (cell)

* Bureau of Land Management, Carson City Field Office

Ken Smihula, Fire Management Officer	775-885-6103
Steven Edgar, Fire Mitigation Specialist	775-885-6197
Kat Gonzales, Chief Dispatcher	775-883-5995
Carla James, Project Lead	775-885-6131

* Churchill County Fire Department-

Fred Rogne, Fire Chief	775-423-6521
Mitch Young, Fire Marshal	775-423-0665
Sgt. Traci Ricks, Dispatch Manager	775 423-3116

Fuels & Fire Weather Awareness Information:

Vegetation occurring on the Carson City District is highly flammable and consists of a diverse mix of pinyon, juniper, sagebrush, grasses and forbs. The risk of wildfire is year round. Be extra careful when working on or around the dry grasses. Check under vehicles when parking off road. Plan any activity that could cause a spark, in the morning, when the relative humidity is up and the temperatures are cooler (grinding or welding). Also, be especially vigilant when operating heavy equipment with pivoting metal tracks on rocky ground. When clearing land, work from the outside edge to the center of the project site. Under dry and windy weather conditions the potential for a fire start is high.

Emergency Reporting Requirements:

911 (initial call for all emergencies)
Sierra Front Interagency Dispatch Center: 775-883-5353 (wildland fire emergency line)

Information needed in reporting a wildland fire would include: Location: Geographical reference and if possible Latitude/longitude coordinates. Description on what the fire is doing size, spread, color of smoke, etc.

Mitigation Efforts:

* Fire extinguishers: 10 lb ABC extinguisher per vehicle.

* Recommended fire equipment: shovel, pulaski, 5 gallons of water.
* Clearing Requirements: Line perimeter of the borrow pit (fire break) prior to removing material from the pit area.
* Vehicle under carriages should be inspected often and cleaned of grass and brush debris.

Fire Prevention/Suppression:

The Contractor will, independently and in cooperation with the Government, take all reasonable action to prevent and suppress fires on the project. Independent initial action will be prompt and will include the use of all personnel and equipment available in the project area.

The Government may require emergency measures, including the necessary shutting down of equipment or portions of operations during periods of high fire danger.

The Contractor will report **ALL** wildland fires on or in the vicinity of the project to the Sierra Front Interagency Dispatch Center. When reporting a fire, provide the following information: name, call back telephone number, project name, location, and fire description. The emergency phone number for SFIDC dispatch is (775) 883-5353.

Wildfire Suppression Costs:

Under Title 43 CFR 9212.4 the holder of this permit may be liable for any and all costs should a wildland fire occur caused by the activities associated with the construction, maintenance, or operation of this project. Fire trespass action will be initiated and wildfire suppression costs will be collected from the holder of this permit.

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CONDITIONS OF APPROVAL AND STANDARD OPERATING PROCEDURES
GEOTHERMAL DRILLING PERMIT

CARSON LAKE BASIN, LLC SALT WELLS GEOTHERMAL EXPLORATORY DRILLING PROGRAM
CHURCHILL COUNTY, NEVADA

GEOTHERMAL LEASE NVN-79310
Production Well 71-15 (Pad 11), MDBM T17N, R30E, Section 15 N
GEOTHERMAL LEASE NVN-79663
Production Well 54-20 (Pad 17), MDBM T17N, R30E, Section 20 E
Production Well 51-29 (Pad 18), MDBM T17N, R30E, Section 29 E
Production Well 67-29 (Pad 19), MDBM T17N, R30E, Section 29 E
GEOTHERMAL LEASE NVN-79664
Production Well 65-32 (Pad 20), MDBM T17N, R30E, Section 32 E
GEOTHERMAL LEASE NVN-79665
Production Well 84-16 (Pad 12), MDBM T17N, R30E, Section 16 E
Production Well 55-17 (Pad 16), MDBM T17N, R30E, Section 17 E
GEOTHERMAL LEASE NVN-79666
Production Well 76-9 (Pad 10), MDBM T17N, R30E, Section 9 E
Production Well 11-12 (Pad 15), MDBM T17N, R30E, Section 12 W
GEOTHERMAL LEASE NVN-79668
Production Well 14-1 (Pad 14a), MDBM T17N, R30E, Section 1 W

SALT WELLS GEOTHERMAL EXPLORATORY DRILLING PROGRAM
ENVIRONMENTAL ASSESSMENT, DOI-BLM-NV-C010-2009-0006-EA

A COPY OF THESE CONDITIONS OF APPROVAL MUST BE FURNISHED TO YOUR FIELD REPRESENTATIVE TO INSURE COMPLIANCE

Agency Contacts

BUREAU OF LAND MANAGEMENT

Nevada State Office
PO Box 12000 (1340 Financial Blvd)
Reno NV. 89520-0006
(775) 861-6400

Petroleum Engineer: John Menghini
Office Telephone: (775) 861-6573

Cell: (775) 223-1359
jmenghin@nv.blm.gov

NEVADA DIVISION OF MINERALS

Nevada Division of Minerals
400 W. King Street # 106
Carson City, NV 89703
(775) 684-7040

Oil, Gas and Geothermal Program Lead:
Lowell Price
Office Telephone: (775) 684-7045
Cell: (775) 721-1774
Fax: (775) 684-7052
clmorris@govmail.state.nv.us

April 23, 2009
Cason Lake Basin Project LLC

CONDITIONS OF APPROVAL (COAs)

Pre-Construction

1. All access roads will be constructed and maintained to BLM road standards (BLM Manual Section 9113).

2. Off road travel will be restricted to terrain with less than 30 percent slopes unless approved by the authorized BLM officer.

3. Proposed surface disturbance and vehicular travel will be limited to the approved well location and access route.

4. Any changes in well location, facility location, and access or site expansion must be approved by the authorized BLM officer in advance.

5. Any activity planned within a quarter-mile on either side of the Pony Express National Historic Trail must undergo a visual assessment. Appropriate mitigation of visual impacts will be implemented as necessary to keep the management corridor in as natural a condition as possible.

Well Pad and Facility Construction

1. A site diagram depicting the location of production facilities, recontoured slopes and stabilization measures shall be approved by an authorized BLM officer prior to installation of production facilities.

2. The design of all facilities, including well pads, roads, pumps, and pipelines, shall be approved by the authorized BLM officer prior to construction to avoid unnecessary conflicts with visual resources management objectives.

3. Drainage from disturbed areas will be confined or directed so that erosion of undisturbed areas is not increased. In addition, no runoff water (including that from roads) will be allowed to flow into intermittent or perennial waterways without first passing through a sediment-trapping mechanism. Erosion control structures may include: waterbars, berms, drainage ditches, sediment ponds, or other devices.

4. Access road construction for exploratory wells should be planned

such that a permanent road can later be constructed in the event of field development.

5. Construction of access roads on steep hillsides and near watercourses will be avoided where alternate routes provide adequate access.

6. Access roads requiring construction with cut and fill will be designed to minimize surface disturbance and take into account the character of the landform, natural contours, cut material, depth of cut, where the fill material will be deposited, resource concerns and visual contrast.

7. Fill material will not be cast over hilltops or into drainages. Cut slopes should normally be no steeper than 3:1 and fill slopes no steeper than 2:1.

8. As required, fill slopes surrounding culverts will be rip-rapped with a well graded mixture of rock sizes containing no material greater than two feet or smaller than three inches. The ratio of maximum to minimum dimension of any rock shall not exceed 6:1.

9. Water turnouts needed to provide additional drainage will be constructed not to exceed two percent slope to minimize soil erosion.

10. Well site layout should take into account the character of the topography and landform. Deep vertical cuts and steep long fill slopes should be avoided. All cut and fill slopes should be constructed to the least percent slope practical.

11. Trash will be retained in portable trash cages and hauled to an authorized disposal site for disposal. Burning will not be allowed on the well site.

12. No drilling or storage facilities will be allowed within 650 feet of any pond, reservoir, canal, spring or stream. Other protective areas near water may be required to protect riparian habitat and T&E species.

13. Springs and water developments on public lands may be used only with the prior written approval of the authorized BLM officer or the water rights holder.

14. To maintain esthetics values, all semi-permanent and permanent facilities will be painted to blend with the natural surroundings. The Standard Environmental Colors will be used for color

selection.

15. Fences shall not be cut without prior approval of the authorized BLM officer. Before cutting through any fences, the operator shall firmly brace the fence on both sides of the cut; a temporary gate will be installed for use during the course of operations, unless the fence is immediately repaired. Upon completion of operations, fences shall be restored to at least their original condition.

16. As directed by the authorized BLM officer, cattle guards will be installed whenever access roads are through pasture gates or fences. These cattle guards shall be maintained. This includes cleaning out under cattle guard bases when needed.

17. The depth of surface soil material to be removed and stockpiled will be specified by the authorized BLM officer. If topsoil is stockpiled for more than one year, the stockpile shall be seeded or otherwise protected from wind and water erosion. The stockpile shall be marked or segregated to avoid loss or mixing with other subsurface materials. Any trees removed will be separated from soils and stockpiled separately.

18. Mud, separation pits and other containments used during the exploration or operation of the lease for the storage of oil and other hazardous materials shall be adequately fenced, posted or covered.

19. Lessee/operator shall comply with all regulatory requirements for storage and handling of hazardous materials and wastes.

20. If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work that might further disturb such materials, and contact the authorized BLM officer. Within five working days the authorized BLM officer will inform the operator as to:

    - whether the materials appear eligible for the National Register of Historic Places;

    - the mitigation measures the operator will likely have to undertake before the site can be used (assuming in situ preservation is not necessary); and,

    - a time frame for the authorized BLM officer to complete an expedited review under 36 CFR 800.11 or other applicable Programmatic Agreement, to

confirm, through the State Historic Preservation Officer, that the findings of the authorized BLM officer are correct and that mitigation is appropriate.

21. If the operator wishes, at any time, to relocate activities to avoid the expense of mitigation and/or the delays associated with the process described in item 20 above for inadvertent discovery of cultural resources, the authorized BLM officer will assume responsibility for whatever recordation and stabilization of the exposed materials may be required. Otherwise, the operator will be responsible for mitigation costs. The authorized BLM officer will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the authorized BLM officer that the required mitigation has been completed, the operator will then be allowed to resume construction.

22. No surface use will be permitted within 0.6 miles of occupied raptor aeries (nests) during the nesting and fledging period.

23. Field development construction activities within 2 miles of a sage grouse lek will require all motorized equipment to have noise abatement devices to preclude excessive noise during the sage grouse strutting period.

24. Fences shall be flagged with bright colored flagging at least every rod from visibility to wild horses. All fences should be constructed using green steel posts with white or silver tops to increase visibility. Fences should also avoid obvious horse migration routes (deep trails, stud piles) if at all possible.

Field Operation

1. Operations shall be done in a manner which prevents damage, interference, or disruption of water flows and improvements associated with all springs, wells, or impoundments. It is the operator's responsibility to enact the precautions necessary to prevent damage, interference, or disruptions.

2. Unauthorized use or failure to lock gates during specified time frames by the lessee or its subcontractors would be considered a violation of the terms of the GPD or associated grants.

3. The operator shall regularly maintain all roads used for access to the lease operation. A maintenance plan may be required. A regular maintenance program may include, but not be limited to, upgrading of existing roads, blading, ditching, culvert, drainage installation, and graveling or capping of the roadbed.

4. Management actions within riparian areas will be designed to maintain or, where possible, improve riparian habitat condition.

5. Noxious weeds which may be introduced due to soil disturbance and reclamation will be treated by methods to be approved by the authorized BLM officer. These methods may include biological, mechanical, or chemical. Should chemical methods be approved, the lessee must submit a Pesticide Use Proposal to the authorized BLM officer 60 days prior to the planned application date.

6. The lessee will institute and pay for a hydrologic evaluation program, which will be site specific and its intensity will be commensurate with the level of developmental drilling. The lessee will develop this evaluation program working with the BLM Carson City Stillwater Field Office Hydrogeologist and with BLM consent will implement. The number of aquifers encountered, their properties, their quality, and their saturated thickness may be documented. This type of information will be submitted to the BLM and would support future NEPA documentation as development progresses and may be useful to determine adverse impacts on surface water expressions of the geothermal reservoir (hot springs). The evaluation program may include the quality, quantity, and temperature of any hot springs or other water resource within the project area.

7. There will be no discharges into any Bureau of Reclamation water delivery or drainage facilities.

8. The operator shall not use Bureau of Reclamation operation and maintenance roads for lease related access without prior written approval from the Bureau of Reclamation.

9. Operations shall be done in a manner that prevents damage, interference, or disruption of water flows, and improvements associated with all springs, wells, impoundments, or Newlands Project facilities. It is the operator's responsibility to enact the precautions necessary to prevent damage, interference, or disruptions. Monitoring wells may be required al all sites where exploration or development will occur to assess long-term impacts to quantity and quality in accordance with applicable State and federal requirements.

Reclamation and Abandonment

1. The operator or contractor will contact the authorized BLM officer

48 hours prior to reclamation work.

2. Restoration work may not begin on the well site until the reserve pits are completely dry.

3. Disturbed areas will be recontoured to blend as nearly as possible with the natural topography prior to revegetation. This includes removing all berms and refilling all cuts. Compacted portions of the pad will be ripped to a depth of 12 inches unless in solid rock.

4. Site preparation for reclamation may include contour furrowing, terracing, and reduction of steep cut and fill slopes, installation of water bars, etc.

5. All portions of the access roads not needed for other uses as determined by the authorized BLM officer will be reclaimed.

6. The stockpiled topsoil will be spread evenly over the disturbed area.

7. The operator will be required to construct waterbars and re-open drainages on abandoned access roads and pipeline routes to minimize erosion as required. Water bars will be spaced appropriately dependant upon topography and slope. Pipeline routes shall be water-barred perpendicular to the fall-line of the slope.

8. The area is considered to be satisfactorily reclaimed when all disturbed areas have been recontoured to blend with the natural topography, erosion stabilized and an acceptable vegetative cover has been established.

9. Rehabilitation shall be planned on the sites of both producing and abandoned wells. The entire site or portion thereof not required for the continued operation of the well should be restored as nearly as practical to its original condition. Final grading of back-filled and cut slopes will be done to prevent erosion and encourage establishment of vegetation.

10. Petroleum products such as gasoline, diesel fuel, helicopter fuel, crankcase oil, lubricants, and cleaning solvents used to fuel, lubricate, and clean vehicles and equipment will be containerized in approved containers.

11. Hazardous material shall be properly stored in separate containers to prevent mixing, drainage or accidents. Hazardous materials shall not be drained onto the ground or into streams or drainage areas.

12. Totally enclosed containment shall be provided for all solid construction waste including trash, garbage, petroleum products and related litter will be removed to an authorized sanitary landfill approved for the disposal of these classes of waste.

13. All construction, operation, and maintenance activities shall comply with all applicable federal, state, and local laws and regulations regarding the use of hazardous substances and the protection of air and water quality.

14. In construction areas where recontouring is not required, vegetation will be left in place wherever possible and the original contour will be maintained to avoid excessive root damage and allow for resprouting.

15. Watering facilities (e.g., tanks, developed springs, water lines, wells, etc.) will be repaired or replaced if they are damaged or destroyed by construction activities to its pre-disturbed condition as required by the authorized BLM officer.

16. When sites are abandoned, they will be inventoried for the presence of noxious weeds and treated if noxious weeds are present.

17. Seed and mulch used to reclaim disturbed areas must be weed free. Mulching of the seedbed following seeding may be required under certain conditions (i.e., expected severe erosion), as determined by the authorized BLM officer.

18. Seed will be broadcast between October 1 and March 15 using a site-specific seed mixture and depth of planting as determined by the authorized BLM officer. Seed may be applied with a rangeland drill at half the rate of broadcast seeding. All seeding application rates will be in pounds of pure live seed per acre. Seed should be adapted varieties.

APPENDIX C
INTERAGENCY AGREEMENT BETWEEN THE BUREAU OF RECLAMATION AND THE BUREAU OF LAND MANAGEMENT

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INTERAGENCY AGREEMENT

BETWEEN

THE BUREAU OF RECLAMATION

AND

THE BUREAU OF LAND MANAGEMENT

December 1982

TABLE OF CONTENTS

Section 1. Purpose

Section 2. Authority to Enter into an Agreement

Section 3. Exchange of Services

Section 4. Reimbursement for Services Rendered

Section 5. Management of Reclamation Withdrawn and Acquired Lands

Section 6. Specific Services Applicable to this Agreement

A. Withdrawals
B. Withdrawal Review
C. Land Sales
D. Exchanges
E. Reservation of Rights-of-way
F. Granting Rights-of-way
G. Making of Planning Studies and Engineering Investigation on Public Lands
H. Mineral and Geothermal Leases
I. Cadastral Survey
J. Fire Protection During Project Construction
K. Forestry
L. Grazing and Beekeeping
M. Mining Claims
N. Recreation
O. Fish and Wildlife Mitigation and Enhancement
P. Environmental Impact Analyses and Statements
Q. Planning Program
R. Engineering and Technical Services
S. Wild and Free-Roaming Horses and Burros
T. Salinity Control on Public Land
U. Computer Service
V. Discrepancies in Policy
W. Hydrometeorological Data
X. Road Maintenance
Y. Other Specific Services

Section 7. Supplemental Agreements

Section 8. Implementation

Section 9. Renegotiation

Section 10. Termination of Agreement

Section 1. Purpose: This agreement sets forth the basic principles of the Bureau of Reclamation (Reclamation) and the Bureau of Land Management (BLM) for coordinating land use planning, land resource management, land conveyance and exchange, and cooperative services. It brings coordinated efforts into compliance with recent laws and policies. Reclamation will, when requested, provide expertise in the area of water resources conservation, development and management, to be utilized by BLM in preparing its resource management plans. BLM will, when requested, provide expertise in the areas of land resource, forest, range, oil, gas, and mineral management, to be utilized by Reclamation when preparing its land management plans, and in managing Reclamation administered acquired or withdrawn public lands.

This agreement supersedes the March 8, 1972, agreement. All agreements made supplemental to the 1972 agreement will be reviewed within 5 years, and those that are inconsistent with this agreement will be revised to conform in accordance with section 6 of this agreement or will be cancelled.

Section 2. Authority to Enter into an Agreement: Through delegation of authority from the Secretary of the Interior to the Director of BLM and to the Commissioner of Reclamation, agreements may be executed between Reclamation and BLM to provide for mutually beneficial land and water use planning and management activities. Statutory authority for such agreements includes: section 307, Federal Land Policy and Management Act (FLPMA), 43 U.S.C. 1737; Economy Act, 31 U.S.C. 686; and the Reclamation Act of 1902, 43 U.S.C. Chapter 12, as amended and supplemented.

Section 3. Exchange of Services: Either Reclamation or BLM may request services of and perform services for the other, consistent with law, Executive Orders, the Code of Federal Regulations (CFR), each Bureau's instructions, and this agreement.

Section 4. Reimbursement for Services Rendered: The cost of work performed shall be reimbursable providing such work is not normally performed by the Bureau doing the work, or adequate funding for such work is not provided to that Bureau through the normal appropriation process. The requesting Bureau will transfer funds to the other Bureau to cover the estimated cost of work to be performed. The requesting Bureau will furnish a detailed estimate of the work to be performed. The transfer of funds from one Bureau to the other will be accomplished by the State Director, BLM, and the Regional Director, Reclamation, by means of a journal voucher and effected on the SF-224 by the billed agency in accordance with a specific executed agreement supplemental to this agreement. Except under emergency conditions, no work will be performed which cannot be reimbursed from funds available in the current fiscal year's appropriation. Prior to entering into any supplemental agreements that would require the transfer of funds from BLM to Reclamation, an Economy Act Determination must be prepared and approved by BLM.

Where either Reclamation or BLM has agreed to furnish reimbursable service to the other, the agency requesting the service will supply the other with estimates of the cost of such service, the work to be undertaken, work schedules, and budgetary information necessary for the agency receiving the service request to prepare and support its budget requests for the work involved. Either bureau will assist the other as requested in supporting budget presentations for reimbursable work. Such budgetary information will be provided, whenever possible, 18 months prior to the budget year plus one.

Section 5. Management of Reclamation Withdrawn and Acquired Lands:

A. Reclamation withdrawn and acquired lands on which there are authorized for construction or constructed Reclamation projects.

Reclamation has full management jurisdiction until the withdrawal is revoked or modified, and over acquired lands until the administration is transferred to another Federal or non-Federal agency by agreement or law.

At the request of Reclamation, the responsibility for management of Reclamation withdrawn and acquired lands actively in use for project purposes may be transferred to BLM through the execution of a supplemental agreement. In exercising its management responsibility, BLM will regularly coordinate with Reclamation and undertake only those management activities which would not preclude or adversely affect use of the land for Reclamation project purposes.

B. Reclamation withdrawn lands on which there are no authorized for construction or constructed Reclamation projects.

On Reclamation lands which are not within the boundaries of national forests or under another agency administration and there are no authorized for construction or constructed Reclamation projects, BLM has full administrative responsibility.

In exercising its statutory responsibilities on Reclamation land (such as those relating to the U.S. mining and mineral leasing laws, rights-of-way, and cadastral surveys other than farm-unit surveys, and the Recreation and Public Purposes Act, FLPMA, etc.), BLM, in consultation with Reclamation, shall develop special stipulations, consistent with statutory authority, and terms and conditions, as may be determined necessary by Reclamation, to protect the Reclamation withdrawn and acquired land for Reclamation purposes.

Rights-of-way grants issued for lands to be occupied by Reclamation for project purposes in lieu of a withdrawal will contain a provision for a future agreement specifying management responsibilities.

Section 6. Specific Services Applicable to this Agreement:

A. Withdrawals. All withdrawals will be made, modified, extended, or revoked in accordance with section 204 of FLPMA, and implementing rules and regulations, 43 CFR Part 2300, unless otherwise directed by specific statutes.

Reclamation will file a petition and application for a withdrawal as a method of reserving public lands for project uses when Reclamation: (1) requires administrative and/or management jurisdiction; (2) requires protection for its facilities and project uses against nondiscretionary entries; or (3) intends to transfer administrative and/or management jurisdiction to a third party. Reclamation will apply for a right-of-way for all other uses. In either case, the application will cover no more land than is needed to construct, operate, maintain, and protect Reclamation project uses and will restrict use and entry only to the minimum necessary to protect project interests. When possible, an application will be submitted well in advance of need for the land. Blocking out will be accomplished in accordance with sound real estate and land management practices whenever possible and practical.

A withdrawal to reserve an area for a particular public purpose and/or transfer jurisdiction over surface management and close the lands to nondiscretionary mineral entry and disposal will usually be required for: (1) lands necessary for permanent structures such as dams, reservoirs, large capacity or lined canals, laterals or drains, and powerplants; (2) critical watershed lands on which nondiscretionary mineral entry would likely result in the degradation of water quality; and (3) lands needed for project operation, maintenance and dam safety.

A withdrawal only granting the transfer of surface management jurisdiction and/or reserving the land for a particular public purpose will usually be required for: (1) lands needed to meet present and future fish and wildlife requirements pursuant to the Fish and Wildlife Coordination Act and/or for outdoor recreation as may be authorized by Congress; (2) lands on which sedimentation and/or wave action may occur; and (3) lands necessary for the relocation of roads, railroads, highways and utilities required as a result of project construction or operations.

Rights-of-way will be used where the jurisdiction and protection afforded by a withdrawal is not necessary. Possible examples could include: (1) lands necessary for project works and facilities such as smaller, unlined laterals, drains, pipelines; (2) transmission lines, telephone lines, and roads; (3) lands necessary for operation and maintenance buffers; (4) lands required for scenic areas, open space, greenbelts, etc.; and (5) lands needed for floodplain management.

Within 2 years, or when possible, less, from receipt of a perfected petition or application for a withdrawal or 1 year or less from the

receipt of a perfected right-of-way request, BLM will complete the withdrawal or right-of-way grant process. If the occupancy and use of the land are mandated by law prior to these time limits, or a substantial financial savings will result, BLM and Reclamation will facilitate an accelerated schedule, including an emergency withdrawal or other methods of authorizing Reclamation's entry onto such land.

B. Withdrawal Review. Under the provisions of sections 204(f) and 204(1) of FLPMA, BLM is required to review, near the date of expiration, all withdrawals having a definite expiration date, or in the case of withdrawals made prior to October 1976 having no definite expiration date, the mandated review will be completed prior to October 1991. Reclamation and BLM have established schedules for the review of all Reclamation withdrawn lands by 1991.

Reclamation will propose to convert withdrawals, where appropriate, to rights-of-way in accordance with Section 6.A. herein. The withdrawal will be retained where a right-of-way does not provide Reclamation with: (1) the necessary administrative and/or management jurisdiction to perform all current, planned, and known future project uses; (2) sufficient protection for its facilities and project uses against nondiscretionary entries; or (3) the ability to readily transfer administrative or management jurisdiction to a third party, or to maintain such third party jurisdiction. In any event, the reservation of public land by either a withdrawal or right-of-way shall cover no more land than is needed to permit Reclamation the freedom of use and discretionary action necessary to meet all of its stated and implied statutory requirements to construct, operate, maintain, and protect all Reclamation project uses, and will restrict use and entry only to the minimum degree necessary to protect project interests.

Rejustification of withdrawals will be made according to the guidelines contained in the BLM Manual Part 2355.3.

In addition to the scheduled review of Reclamation's withdrawals, Reclamation will review, according to schedules mutually agreed to at the field level, all of its pending withdrawal applications to determine if Reclamation's purposes could be served as well by a right-of-way. If a right-of-way will serve as well, Reclamation will request the withdrawal application be terminated and replaced with a right-of-way application, or if the withdrawal of lands is still needed, Reclamation will act to perfect the withdrawal application. Reclamation will provide BLM a yearly inventory update of its withdrawn and acquired lands. This updated report will be provided to BLM by November 15 of each year to coincide with Public Land Statistics requirements.

C. Land Sales. When Reclamation requests relinquishment of withdrawn lands, it may recommend sale of those lands to a specific entity or sale on the open market. If BLM determines that the lands are appropriate

for sale under provisions of section 203 of FLPMA or any other authority, BLM will, within legal constraints, honor Reclamation's recommendation.

In accordance with Departmental Manual delegation, at the request of Reclamation, Reclamation and BLM may enter into a supplemental agreement at the field level providing that Reclamation perform a specific land sale under provisions of section 203 of FLPMA. Such a supplemental agreement may additionally provide that Reclamation perform requisite land use planning prior to land sale, subject to BLM approval of Reclamation prepared plans.

D. Exchanges. When Reclamation determines that an exchange of Federal land, either withdrawn or acquired by Reclamation for private land, would be in the best interest of the Federal Government, and Reclamation does not have authority under section 14 of the Act of August 4, 1939 (43 U.S.C. 389), or other direct authority to make such exchange, BLM will, when requested, effect the exchange through its authorities. A supplemental agreement under section 7 of this agreement will be entered into at the field level for each exchange. When Reclamation land to be exchanged is acquired land, Reclamation will prepare a public notice for signature of the Secretary of the Interior and for publication in the Federal Register, which transfers the jurisdiction of the acquired land to BLM, specifically to effect the exchange. Simultaneously with the transfer of jurisdiction over the land to BLM, BLM will publish a notice of realty action as prescribed in 43 CFR 2200.1 and 2200.2 for the proposed exchange segregating the lands involved from operation of the public land laws including the mineral laws. The exchange will be consummated by BLM within 2 years. Reclamation will be responsible for all land appraisals and preparation of legal description and transfer documents. Lands received by BLM in any such exchange will be transferred to Reclamation's jurisdiction in a mutually agreed to form utilizing a right-of-way or withdrawal.

E. Reservation of Rights-of-way. When Reclamation proposes to relinquish a withdrawal, or to otherwise dispose of withdrawn land under Reclamation's direct jurisdiction and management on which Reclamation needs or anticipates a need for a right-of-way, Reclamation will, when available, provide to BLM field reports, drawings, and descriptions of any rights-of-way reserved across this land under subsection 4-P of the Factfinders Act of 1924 (43 U.S.C. 417). When mineral entry is requested on Reclamation's withdrawn land, an opening may be granted under the Act of April 23, 1932 (43 U.S.C. 154), and necessary rights-of-way may be reserved, with any conditions or terms of use necessary to protect Reclamation's interests in the land or which have resulted from interagency consultation. Rights-of-way not meeting the criteria of the above laws will be reserved under section 507 of FLPMA.

F. Granting Rights-of-way. Reclamation will, within its discretion, authority, and rules (section 10 of the Act of August 4, 1939, 43 U.S.C. 387 and section 28 of the Mineral Leasing Act of 1920, as amended), be

responsible for reviewing requests and granting rights-of-way across its withdrawn and acquired land and facilities (see section 5.A.). Reclamation will furnish BLM's respective State Director with a copy of all grants on withdrawn lands, including maps, which it issues, to be recorded on BLM's Master Title Plats.

When land under this or any other agreement is managed by a third party, Reclamation will coordinate with that party before issuing rights-of-way that would interfere with the activities of the managing party. On all rights-of-way for which Reclamation lacks authority to make a grant, BLM will issue the grant on all withdrawn or acquired lands, after consultation with Reclamation. Such consultation shall include: (1) questions of whether grant should or should not be granted; (2) modification of location of grant from the location applied for; and (3) terms and conditions and stipulations of the grant.

G. Making of Planning Studies and Engineering Investigation on Public Lands. Under the provisions of section 307(a) or other legal authority, Reclamation may enter onto the public lands to make studies and investigations necessary for project purposes, as required or authorized by Congress. Such studies and investigations will be fully coordinated with the BLM to ensure minimum disruption of ongoing programs.

H. Mineral and Geothermal Leases. Except for those minerals and conditions meeting the provisions of section 10 of the Reclamation Projects Act of 1939 (43 U.S.C. 387), leases for mineral, and geothermal resources on all land acquired or withdrawn by Reclamation will be issued by BLM. Applicants for mineral and geothermal leases on such land should be directed to file their applications with BLM's State offices. BLM will, in all issues involving mineral, and geothermal leases on or under Reclamation lands, request that Reclamation determine whether leasing is permissible and if so to provide any stipulations required to protect the interest of the United States. Reclamation will respond to this request for mineral leasing clearance within 60 days when adequate records are readily available. When adequate records are not available, Reclamation will provide an interim progress report within 30 days. BLM will not issue permits, leases, or licenses on acquired or withdrawn lands under Reclamation's management without Reclamation's consent and concurrence on all conditions and stipulations. Reclamation's recommendations on withdrawn lands under BLM management responsibility are advisory only insofar as Reclamation planned or current project uses are not adversely affected.

I. Cadastral Survey. BLM will conduct, on a reimbursable basis, cadastral surveys, resurveys, and investigations on existing and future projects in accordance with: (1) jointly agreed to schedule, provided that Reclamation will notify BLM of needs in sufficient time for it to incorporate the work into its authorized work programs; and (2) Reclamation provides the funds. If BLM is unable to accomplish a cadastral survey within Reclamation's time limits, BLM will perform the work on a

reimbursable basis by contract, or in lieu of private sector contractors, may contract with Reclamation to conduct the surveys with qualified Reclamation surveyors, according to BLM standards and procedures. The assigned Reclamation surveyors must conduct the field work and the survey plats and field notes are to be certified by a Reclamation GS-1373 Surveyor on the Surveyor's Certificate. The survey plat and field notes will be reviewed and, if adequate, be officially accepted by the appropriate BLM State office. The Reclamation cadastral surveyors will be in accordance with 43 CFR 9185.3-1(c).

BLM public land survey corner monuments, which may be destroyed or rendered useless by reason of Reclamation project construction activities, will be referenced and removed and then replaced, if possible, by Reclamation. The monuments will be at least equivalent to those existing prior to project construction.

J. Fire Protection During Project Construction. On lands described in section 5.A., Reclamation is responsible for fire protection. This responsibility may, at Reclamation discretion, be contracted out to other agencies. If Reclamation elects to contract with BLM, then prior to BLM accepting fire protection responsibility over Reclamation lands, Reclamation and BLM will cooperatively develop a mutually acceptable fire plan. Prior to commencing project construction, Reclamation will coordinate with BLM and will formulate fire prevention and control plans and programs, and will provide for fire protection. During project construction, Reclamation will take reasonable precautions and ensure all contractors take precautions to prevent and suppress forest and range fires. When a fire starts on land of either party and spreads to the lands of the other party, the administrator of the land at the point of ignition is responsible for rehabilitating the land of the other party to the degree necessary that previous management objectives can be carried out. This includes, but is not limited to, construction of temporary erosion structures, seeding, reforestation, restoration of improvements, and fencing.

K. Forestry. Forest/woodland resources present on Reclamation acquired or withdrawn lands, as described in section 5.A., are the responsibility of Reclamation, and when such lands are not located within or adjacent to National Forest lands, they may be managed by BLM in accordance with supplemental agreements entered into between BLM State Directors and Reclamation Regional Directors.

Prudent forest management actions will be conducted on these lands to the maximum extent consistent with future use of the land for Reclamation project purposes. When BLM is managing the forest or woodland resources, BLM foresters will coordinate with Reclamation personnel in developing and executing needed management actions.

Sales will be the preferred method of disposing of wood products. All revenues shall be deposited into a treasury account as directed by Reclamation in accordance with applicable statutes.

L. Grazing and/or Beekeeping. On lands under the jurisdiction of Reclamation not located within or adjacent to a National Forest on which grazing and/or beekeeping is compatible with Reclamation's current or planned use of any land area, BLM may, at Reclamation's request, manage grazing and/or beekeeping on those lands, subject to a supplemental agreement made in accordance with this general agreement and under such provisions as Reclamation may deem necessary. On Reclamation withdrawn or acquired land where the management under supplemental agreement is with BLM, all grazing and/or beekeeping leases or permits issued by BLM shall be issued for BLM's normal permit or lease period, but shall include such special stipulations as determined necessary for Reclamation to protect the land or facilities for Reclamation project purposes. When Reclamation determines that within 2 years its needs and uses will no longer be compatible with grazing and/or beekeeping, Reclamation will so notify BLM enabling it to notify the lessees and permittees and terminate the leases and/or permits in accordance with section 402 of FLPMA. Under emergency conditions leases and permits may be terminated with shorter notice.

Grazing and/or beekeeping fees collected by BLM from Reclamation land managed by BLM shall be deposited into a treasury account as directed by Reclamation in accordance with applicable statutes. BLM will furnish, concurrent with the deposit by BLM, a copy of the certificate of deposit showing the date of deposit, fund symbol, amount, and Reclamation project number. When authorized by Reclamation, revenues or fees collected may remain with BLM to serve as Reclamation's reimbursement for work performed.

M. Mining Claims. Where the construction of a Reclamation water resource project requires the clearance of title to public land encumbered by unpatented mining claims, BLM will conduct, on a reimbursable basis, the examination of all unpatented mining claims. If construction is imminent, the agencies will work together to expedite clearance. The validity investigations of mining claims will, whenever possible, be in accordance with jointly agreed to schedules, wherever construction contractual schedules are not the driving force, and time will permit. Whenever possible, Reclamation will notify BLM of its needs in sufficient time for BLM to incorporate the work into its work program. Reclamation will notify BLM at least 30 months before the beginning of the fiscal year in which the work is needed; except when Reclamation finds it cannot give this lengthy notice with respect to clearance of a small area, such as a damsite, pumping plant, substation or radio communication site, then Reclamation and BLM will negotiate a suitable schedule sufficient to protect Reclamation's facilities.

As soon as Reclamation identifies a need for clearance of title work, Reclamation will supply BLM with a statement of the work it needs done, including necessary maps and other pertinent information. BLM will supply Reclamation with estimates of cost, manpower, time required, and other information. The State Director and the Regional Director will make necessary arrangements for incorporating the work into BLM's program.

Upon completion of the validity examination, BLM will notify Reclamation of the findings and recommendations. Where BLM believes mining claims are not supported by discovery, BLM will initiate a contest action and will report to Reclamation on the results of such actions.

N. Recreation. When the management of Reclamation withdrawn or acquired land not located within or adjacent to a National Forest is with Reclamation in accordance with section 5 of this agreement, unless otherwise authorized by Congress, Reclamation's recreation planning, development, and management will be in accordance with Public Law 89-72 (79 Stat. 213). Reclamation will encourage non-Federal public bodies to manage recreation associated with Reclamation's land and water areas. When a non-Federal recreation manager cannot be found, Reclamation will discuss with BLM the option of BLM managing recreation on Reclamation project lands. Supplemental agreements will, if necessary, be utilized to determine the management responsibility and funding reimbursement. The two agencies will assure coordination and cooperation to promote compatibility of recreation development and operation (including compatible recreation fee structure) on adjacent Reclamation/BLM lands. When Reclamation plans recreation development on project lands, it will consider recreation use and recreation potential of BLM administered lands that are adjacent to Reclamation project lands. When BLM plans recreation development on lands adjacent to Reclamation project lands, it will consider recreation use, recreation potential, and previously developed Reclamation recreation plans for authorized or constructed Reclamation projects. If BLM prepares plans or management actions that could alter recreation potential of a Reclamation project that is not yet constructed, BLM will consult with Reclamation.

O. Fish and Wildlife Mitigation and Enhancement. Each agency will coordinate with the other when its plans and activities involve fish and wildlife resources and values related to lands administered by the other. Where water-related projects of either agency involve meeting the requirement of the Fish and Wildlife Coordination Act (FWCA), the agency initiating the action will ensure that the coordination and other requirements of the FWCA are met. Plans for the management of wildlife resources on lands of interest/concern to both agencies shall be developed jointly with the State under authority of the Sikes Act (16 U.S.C. 670 a-f). Management of the lands will be specified in a habitat management plan (HMP) developed for the area. The HMP will become part of Reclamation's land resources management plan for the area. Where a supplemental agreement executed for the specific Reclamation project provides for BLM's implementation of the approved mitigation plans, Reclamation will transfer the funds necessary to enable BLM to carry out its agreed to efforts. State funding and participation will be as specified in supplemental agreements between the agencies cooperating on the specific project, and in accordance with BLM's existing memorandum of understanding with the concerned State wildlife agency. Cooperative programs of both agencies shall be implemented by the State Director and the Regional Director in accordance with the management plan for the project. BLM will be

responsible for funding such projects on its lands or on Reclamation lands where no Reclamation project is planned, and on which withdrawals have not been revoked. Reclamation will provide funding for wildlife management related plans/activities/projects on the withdrawn public lands whenever such plans/activities/projects are for the purpose of mitigating the impacts of Reclamation projects.

P. Environmental Impact Analyses and Statements. All actions taken pursuant to this agreement concerning environmental matters will conform to the requirements of the Council on Environmental Quality regulations, 40 CFR Parts 1500-1508, 516 DM-1-7, the Bureau of Reclamation National Environmental Policy Act (NEPA) Handbook, and BLM Guidebooks 1791 and 1792. The agency (BLM or Reclamation) initiating the action which requires NEPA compliance will be the lead agency.

Where BLM or Reclamation proposes an action in an area where both Bureaus have responsibility or interest, the two Bureaus will cooperate in the preparation of the appropriate environmental analysis and, where necessary, the lead agency as defined above will prepare the categorical exclusion checklist, environmental assessment, FONSI, or EIS.

Cultural resource protection and management matters will conform to applicable sections of 36 CFR 60, 63, and 800; Reclamation Instructions Part 376.11 and BLM Manuals 8100, 8110, and 8111.

Q. Planning Program. If either agency proposes to prepare a plan or undertake a study involving lands administered by or affecting the interests of the other agency, the agency proposing to conduct the study will provide notice to the affected agency at the time when it is proposed. The agencies shall fully coordinate their plans and studies allowing ample time for budget considerations. When appropriate, the planning agency's plans may be adopted by the other agency as an amendment to its own land use or resource management planning document. Provisions of 43 CFR 1600 and other appropriate authority will be utilized in revising, amending, or preparing planning or study documents.

Inconsistencies between the plans of the two agencies will be addressed as prescribed by the planning authority of each agency. Differences unresolved through negotiation will be referred to the Assistant Secretary - Land and Water Resources for action as deemed appropriate.

In the preparation of all planning documents, BLM will serve where practicable and legal as the primary supplemental source of expertise for various areas of multiple use land management when so requested by Reclamation. Reclamation will serve where practicable and as requested by BLM as the primary source of expertise in the planning, management, and development of water resources. This does not replace or supplement earlier agreements which either agency has with third parties.

R. Engineering and Technical Services. BLM State Directors may, at any time, request Reclamation Regional Directors for service in connection with the planning, investigation, design, inspection, construction, repair, or rehabilitation of engineering works, including activities under emergency conditions. There is one exception to this procedure. In accordance with DM 753 1.3c, requests for services related to dam safety will be initiated by BLM's Dam Safety Officer, Denver Services Center, or Chief, Division of Engineering, Washington, and submitted to the Reclamation Dam Safety Officer, Engineering and Research Center, Denver, or to the Commissioner, Washington. Requests may be for inspection, site investigations, and other exploratory work necessary to provide projects of a reconnaissance grade, or feasibility grade, with sufficient technical details and costs estimates to support BLM's budget requests.

Requests for engineering services will be made by letter from the State Director to that Regional Director responsible for the area in which BLM's works needing services are located. To the extent practical, such requests shall be made 18 months prior to the budget year plus one, or as early as possible to permit coordination with Reclamation work programs. The requests shall specify the following:

a. Job requirements;
b. Nature of the work to be done;
c. Extent of engineering and other services to be performed;
d. Schedules to be met; and
e. Budgetary information.

Where construction work which will cost over $1,000,000 and will extend over more than one fiscal year includes the issuance of invitations to bids and specifications for construction is to be undertaken by Reclamation for BLM, a separate supplemental agreement covering such work, and the record of its financing, shall be executed between the State Director of BLM and the Regional Director of Reclamation. Reimbursement shall be made promptly upon receipt of information or a detailed statement of cost. Such budgetary information will be supplied, whenever possible, 18 months prior to the budget year plus one. The indirect costs charged for work performed by Reclamation or BLM shall include supportable overhead costs associated with work performed under this agreement and based on the guidelines established in part 346, DM 3.4 of the Departmental Manual. These costs shall not be calculated by using arbitrary factors.

S. Wild and Free-Roaming Horses and Burros. When wild and free-roaming horses or burros inhabit areas crossing administrative boundaries between BLM and Reclamation, their management and protection will be the responsibility of BLM, under its regulations. Upon request from Reclamation, BLM will cooperate in the removal, and relocation or disposal, of such animals from Reclamation lands (see section 5.A.).

T. Salinity Control on Public Land. Each agency will coordinate with the other when its plans and activities involve salinity control efforts in the Colorado River Basin which relate to or affect the other's management responsibilities or the lands administered by the other. Coordination at the field administrative/technical level will be accomplished through Federal interagency Salinity Control Coordinating Committee, and supplemental agreements as needed, by the appropriate State Directors and Regional Directors.

U. Computer Service. Whenever either agency has computer programming, time, or other service, which would be of use to the other agency, and such service is requested, the agency having the desirable program, time, or other service, will, within its time and personnel constraints, provide, on a reimbursable basis, the program, time, or service to the requesting agency. Whenever computer stored information of either agency is compatible with the other agency's computer, and would be of use to the other agency, arrangements will be made for automatic, compatible transfer of such information.

V. Discrepancies in Policy. Where agency differences in policy exist, as described in policy documents and papers of the BLM or Reclamation, the policy of the agency having primary jurisdiction over the lands will prevail.

W. Hydrometeorological Data Collection. Requirements for the collection of hydrometeorological data on BLM lands, including wilderness areas, or wilderness study areas, will be determined mutually in order to establish correlation networks with gages outside such areas to enhance scientific study, or weather modification, to improve water supply forecasting, and for public safety in flood forecasting and flood control operations. Agreement for installation of hydrometeorological data collection devices will be accomplished through the BLM consultation and permit process. Hydromet stations may be placed and maintained within primitive areas, wilderness areas, or wilderness study areas administered by BLM only where approved by BLM, and will be placed and maintained in a manner prescribed by BLM.

X. Road Maintenance. When administratively controlled roads extend across boundary lines between BLM and Reclamation lands, then the agency offices are encouraged to develop local supplemental agreements for exchange of maintenance activities. The purpose of this is to improve efficiency by combining similar or like work across administrative boundaries. All maintenance activities should be accomplished in such a manner so as to protect the environment and performed to a standard that places user safety at the forefront.

Y. Other Specific Services. This agreement may be amended or modified at any time, upon mutual concurrence, to cover any service or requirement overlooked, or developing in the post-signing period. Amendments must be initialed by both agency heads or their designees to become effective.

Section 7. Supplemental Agreements: Supplemental agreements may be entered into by a BLM State Director and a Reclamation Regional Director to implement this master agreement. Those supplemental agreement needs identified within this master agreement that directly affect project authorization will be completed during the planning stage for the project.

Section 8. Implementation: This agreement is effective upon signature of the heads of both agencies. A copy of this agreement will be distributed by each agency to each State and Regional Director.

Section 9. Renegotiation: This agreement is renegotiable at the option of either party.

Section 10. Termination of Agreement: This agreement may be terminated upon mutual agreement or upon 90 days written notice of either party.

Robert N. Broadbent
Commissioner, Bureau of Reclamation

3/25/83
Date

Robert J. Burford
Director, Bureau of Land Management

3/25/83
Date

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APPENDIX D
PROGRAMMATIC AGREEMENT FOR THE SALT WELLS ENERGY PROJECTS

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PROGRAMMATIC AGREEMENT
AMONG
THE BUREAU OF LAND MANAGEMENT, BUREAU OF RECLAMATION, AND THE NEVADA STATE HISTORIC PRESERVATION OFFICER REGARDING THE SALT WELLS ENERGY PROJECTS

WHEREAS, the Bureau of Land Management Stillwater Field Office (BLM) has determined that the Salt Wells Energy Projects (SWEP) proposed by Sierra Pacific Power Company (SPPC), Ormat Technologies, Inc. (ORMAT), and Vulcan Power Company (VULCAN), referred to as Proponent(s), in Churchill County, Nevada, may have an effect upon properties eligible for inclusion in the National Register of Historic Places (NRHP), and have consulted with the Nevada State Historic Preservation Officer (SHPO) pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA); and

WHEREAS, BLM may issue permits, licenses, and right-of-way grants for geothermal operations proposed by ORMAT and VULCAN (Authorizations); and

WHEREAS, BLM and RECLAMATION may issue a right-of-way grant for SPPC proposed transmission line and facilities which crosses public lands (Authorizations); and

WHEREAS, the BLM, SHPO, and RECLAMATION shall be considered signatories; SPPC, ORMAT, and VULCAN shall be considered consulting parties to this Programmatic Agreement (PA), pursuant to 36 CFR 800.6(c) and 36 CFR 800.14(b), and these parties must concur on the execution this PA; and

WHEREAS, the Fallon Paiute-Shoshone Tribe (Tribe) that may have an interest in the area have been contacted and been offered an opportunity to participate in the Section 106 process; and

WHEREAS, the BLM has invited the Advisory Council on Historic Preservation (ACHP) to participate in consultation, and they elected on not to participate in the PA;

WHEREAS, the BLM has a Nationwide Programmatic Agreement and a State Protocol Agreement between BLM and SHPO dated October 26, 2009 (Protocol) that govern all other undertakings and historic properties that may occur within the Area of Potential Effect (APE) and those agreements are hereby incorporated by reference into this PA; and

WHEREAS, the definitions given in the Protocol between the Nevada Bureau of Land Management State Director and the SHPO apply throughout this PA, unless specifically modified below; and

WHEREAS, this PA covers all aspects of the planning, construction, and installation of the SWEP, including but not limited to, geothermal plants (binary air/water-cooled and/or flash), production, water, monitoring and injection wells, pipelines, substation(s), switching station(s), power lines, staging areas, access roads, other constructed facilities as identified; and

NOW, THEREFORE, the signators BLM, RECLAMATION, and SHPO, and the consulting parties SPPC, ORMAT, and VULCAN, agree that construction of the SWEP shall be administered in accordance with the following stipulations to ensure that historic properties will be treated to avoid or mitigate effects to the extent practicable, regardless of surface ownership and to satisfy BLM Section 106 responsibilities for all aspects of the undertaking.

I. ROLES AND RESPONSIBILITIES

A. The signatories agree that BLM will be the Lead Federal Agency for implementing this PA in accordance with the Protocol. The Protocol for implementing Section 106 of the NHPA is incorporated by reference and the document can be found here: http://www.blm.gov/style/medialib/blm/nv/cultural/permits.Par.99806.File.dat/state_protocol_agreement_oct2009.pdf

B. The BLM is responsible for administering this PA. This includes but is not limited to: ensuring that all signatories carry out their responsibilities; overseeing all cultural resource work, including reports, determinations of eligibility and effect, and treatment/data recovery plans; and assembling all submissions to the SHPO, other signatories, and interested parties during the implementation of this PA.

C. Proponent(s) signatory(s), or their designees, will be the responsible point of contact for the SWEP and provide the BLM with any and all information needed to implement this PA. The Stillwater Field Manager is the BLM Authorized Officer for the SWEP. The Authorized Officer, or their designee, is the SWEP point of contact for the BLM.

D. Proponent(s) will be responsible for costs of rehabilitation or mitigation, and may be subject to criminal penalties, should damage to cultural resources inside or outside the APE occur during the period of construction, operation or reclamation due to the unauthorized, inadvertent or negligent actions of the Proponents, their employees, contractors or any other project personnel.

II. AREA OF POTENTIAL EFFECT

The APE shall be defined to include all potential direct effects, including visual effects, and indirect effects to cultural resources from any Development activities associated with the undertaking. The APE is described in Appendix A and illustrated in Figure 1.

III. STIPULATIONS

The BLM, in cooperation with the other signatories, shall ensure that the following stipulations are carried out:

A. Identification of Historic Properties

1. The BLM shall involve interested parties and the Tribe identified through the Section 106 process, as appropriate, in all activities carried out under this PA associated with the undertaking.

2. The BLM shall have the consulting archaeologists conduct records searches of General Land Office (GLO) plat maps, the BLM's Master Title Plats/Historic Index, the GLO Land Records website (http://www.glorecords.BLM SWFO.gov/), the Nevada State Lands Patent Database Query (http://www.lands.nv.gov/patents/patents.htm), the Nevada Cultural Resources Information System (NVCRIS), the National and State Register of Historic Places, National Trail System, historic maps, BLM and SHPO cultural resources records, and pertinent historic records/publications and maps to identify historic resources within the APE which could be directly and indirectly affected by the project.

3. Prior to Authorization, or as a Condition of Approval/Special Stipulation to the Authorization, BLM shall ensure that the Proponent(s) fund and complete the appropriate cultural resource Class I and Class III inventories identifying all historic properties, including reports, ethnographic studies/interviews, and visual impact assessments/simulations within the APE for all activity areas, or portions thereof, in a manner consistent with the Protocol. Class III inventory of all proposed project facilities shall be completed prior to construction.

4. The required inventory/identification activities shall be completed regardless of the ownership (Federal or private) of the lands involved. SPPC shall be responsible for pursuing commercially reasonable efforts for gaining access to privately held lands through applying all reasonable means available including obtaining right of entry through courts with legal jurisdiction. After reasonable efforts are made, if access cannot be obtained to private land and after consulting with the BLM, the SPPC shall use existing data to determine the types of resources that might be present and anticipated effects. Upon BLM determination that the intention of this section has been satisfied, the BLM Authorized Officer may issue a Notice to Proceed (NTP) for any construction segment as prescribed in Stipulation G.

B. Eligibility

1. The BLM, in consultation with the SHPO, shall evaluate all cultural resources located within the APE for eligibility to the NRHP. Eligibility will be determined prior to the initiation of activities that may affect cultural resources. Eligibility will be determined in a manner consistent with the Protocol.

2. The BLM shall consult with the appropriate Tribe to evaluate the eligibility of properties of traditional religious and cultural importance.

3. To the extent practicable, eligibility determinations shall be based on documented inventory information. If the information gathered in the inventory is inadequate to determine eligibility, the Proponent(s), through its contractor, may be required to conduct limited subsurface testing or other evaluative techniques to determine eligibility.

4. The BLM will review and comment on any report submitted by the Proponent(s), through its contractor, within thirty (30) calendar days of receipt. Comments from Reclamation, Tribe and interested parties will be considered and incorporated, as appropriate, into the revised report.

5. If any of the signatories, Tribe, or interested parties disagree regarding eligibility of a cultural property, the BLM, SHPO, and the signatories, Tribe, or interested parties shall work together to seek a resolution on the determination of eligibility. If the dispute cannot be resolved, the BLM shall seek a formal determination of eligibility from the Keeper of the National Register in accordance with 36 CFR 63.2. The Keeper's determination will be considered final.

C. Treatment

1. BLM shall submit the results of all identification, evaluation, effects assessment, and treatment efforts, including discovery situations, and Treatment or Data Recovery Plans to the SHPO. The SHPO will have fifteen (15) calendar days from their receipt to review and comment on any submission.

2. When avoidance is not feasible and data recovery is proposed to lessen or mitigate project-related adverse effects to historic properties, the BLM, in consultation with the SHPO, shall ensure that the Proponent(s), through its contractor, develop a Data Recovery/Treatment Plan (Plan) that is consistent with the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716-37), *Treatment of Historic Properties: A Handbook* (Advisory Council on Historic Preservation 1980) and ACHP's Recommended Approach for Consultation on the Recovery of Significant Information from Archaeological Sites dated June 17, 1999. BLM shall submit the Plan to SHPO with a fifteen (15) day review and comment period. At the same time, the BLM shall provide the Tribe and interested parties, as appropriate, with a copy of the Plan with the same fifteen (15) day review opportunity as afforded the SHPO.

3. For properties eligible under Criteria A through C as defined in National Park Service Bulletin #36, mitigation other than data recovery may be considered in the Treatment Plan (e.g., oral history, historic markers, exhibits, interpretive brochures or publications, etc.). Where appropriate, Treatment Plan shall include provisions (content and number of copies) for a publication for the general public.

4. To the extent practicable, BLM shall ensure that the Proponent(s) avoid adverse effects to historic properties through project design, or redesign, relocation of facilities, or by other means in a manner consistent with the Protocol.

5. Pursuant to Section H, the BLM shall ensure as a condition of approval/special stipulation on any license, permit or grant that the Proponent(s), through its contractor, implements and completes the fieldwork portions of any final Treatment or Data Recovery Plan prior to initiating any activities that may affect historic properties.

6. Pursuant to Section H, the BLM shall ensure that all records and materials resulting from identification and treatment efforts are curated in accordance with 36 CFR 79 in an approved curation facility in Nevada. As defined in the Native American Graves Protection and Repatriation Act (NAGPRA) materials will be handled in accordance with 43 CFR 10. All materials collected will be maintained in accordance with 36 CFR 79 or 43 CFR 10, until the final treatment report is complete and collections are curated and/or returned to their owners. The Proponent(s) or their contractor shall provide proof of curation to the BLM from the curatorial facility within two (2) weeks of BLM acceptance of the final reports.

7. Pursuant to Section H, the BLM shall ensure that all final archaeological reports resulting from actions pursuant to this PA will be provided to the signatories, Tribe, and other interested persons as identified. All such reports shall be consistent with contemporary professional standards and the Department of Interior's Formal Standards for Final Reports of Data Recovery Programs (48 FR 44716-44740). A draft final report of all identification, evaluation, treatment activities will be due to the BLM from the Proponent(s) within nine (9) months after the completion of the fieldwork associated with the activity, unless otherwise negotiated. Final reports will be due sixty (60) days after receiving BLM comments.

D. Discovery Situations

1. Prior to initiating any activities within the APE, the Proponent(s) will provide the BLM with a list of, and schedule for, the SWEP employees, contractors, and subcontractors empowered to halt all activities in a discovery situation and who will be responsible for notifying BLM of any discoveries. At least one of these employees will be present during all SWEP activities.

2. When previously unidentified cultural resources are discovered or an unanticipated impact situation occurs, all SWEP related activities within 100 meters/300 feet of the discovery/impact will cease immediately. The Proponent(s) through its contractor or its authorized representative shall secure the location to prevent vandalism or other damage. The Proponent(s) or its authorized representative shall immediately notify the BLM Authorized Officer of the discovery followed by written confirmation. Activity at the location shall be suspended until the discovery has been evaluated and any necessary mitigation measures completed.

3. The BLM shall notify the SHPO, RECLAMATION, Tribe, and interested parties as appropriate, within one (1) working day of being notified of the discovery or unanticipated impact, and consider their initial comments on the situation. Within two (2) working days after initial discovery, the BLM shall notify all signatories or other parties, of the decision to either allow SWEP activities to proceed or to require further evaluation and/or mitigation.

4. If, in consultation with the signatories, the BLM determines that mitigation for discoveries or unanticipated impacts is required, the BLM shall solicit comments from the signatories, Tribe, and interested persons, as appropriate, to develop mitigating measures. The signatories, Tribe, and interested persons, as appropriate, will be allowed two (2) working days to provide BLM with comments to be considered when BLM decides on the nature and extent of mitigative

efforts. Within seven (7) working days of initial SHPO notification, the BLM will inform all signatories of the nature of the mitigation required, and ensure that such mitigative actions are implemented before allowing SWEP activities to resume.

5. Pursuant to Section H, the BLM shall ensure that reports of mitigation efforts for discoveries or unanticipated impacts are completed in a timely manner and conform to the Department of Interior's Formal Standards for Final Reports of Data Recovery Program (42 FR 5377-79). Drafts of such reports shall be submitted to the SHPO for a fifteen (15) day review and comment period. Final reports shall be submitted to the SHPO, other signatories, Tribe, and interested persons, as appropriate for informational purposes.

6. Any disputes or objections arising during a discovery or unanticipated impact situation regarding the treatment of historic properties that cannot be resolved by BLM and SHPO shall be referred to the Nevada BLM State Office for resolution. The Nevada BLM State Office decision will be considered final.

7. SWEP related activities in the area of the discovery or unanticipated impact will be halted until the Proponent(s) are notified by the BLM Authorized Officer in writing that mitigation is complete and activities can resume.

E. Other Considerations

1. The BLM shall ensure that ethnographic, historic, architectural, and archaeological work conducted pursuant to this PA is carried out by or under the direct supervision of persons meeting qualifications set forth in the Draft Secretary of the Interior's Professional Qualification Standards dated June 20, 1997 (62 FR 33707-33723).

2. Prior to construction, the Proponent(s), in cooperation with BLM and SHPO, shall provide in house training by the Cultural Contractor to ensure that all its personnel and all the personnel of its contractors and subcontractors are directed not to engage in the illegal collection of historic and prehistoric materials. Subsequent hires for field work will also be required to be subject to similar training prior to operating in the field. Training can be in association with the Proponent(s) safety and or related job training and project orientation. The Proponent(s) shall cooperate with the BLM to ensure compliance with the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470) on Federal lands and with Nevada Revised Statutes (NRS) 381 for private lands.

3. Pursuant to Section H, the Proponent(s) shall bear the expense of identification, evaluation, and treatment of all cultural properties directly or indirectly affected by SWEP related activity. Such costs shall include, but not be limited to, pre-field planning, fieldwork, post-fieldwork analysis, research and report preparation, interim and summary report preparation, publications for the general public, and the cost of curating project documentation and artifact collections. If the Proponent(s) withdraw project applications, then the Proponent(s) shall incur no further expense except for completing fieldwork and post-fieldwork activities (production of final

inventory, testing and data recovery reports covering the description and analysis of data, and the curation of materials) that has occurred as of the date of withdrawal.

4. In general, the identification, evaluation, and treatment of historic properties directly affected by the SWEP shall be limited to the project-related construction. However, identification, evaluation, and treatment efforts may extend beyond the geographic limits of the construction when the resources being considered extend beyond the boundary of the construction activities.

5. Properties of traditional religious and cultural importance will be identified, evaluated, and treated through consultation with appropriate interested persons and shall be consistent with the Protocol. The Proponent(s) may contract for data gathering to assist the BLM in identifying, evaluating, and treating these properties. However, formal consultation, as needed, will be completed and documented by the BLM.

6. Information on the location and nature of all cultural resources and information considered proprietary by Tribe will be held confidential to the extent provided by Federal and state law.

7. The BLM shall ensure that any human remains, grave goods, items of cultural patrimony, and sacred objects encountered during the undertaking are treated with the respect due such materials. In coordination with this PA, human remains and associated grave goods found on Federal land will be handled according to the provisions of the NAGPRA and its implementing regulations (43 CFR 10). Human remains and associated grave goods on private land will be handled according to the provisions of NRS 383.

F. Monitoring

1. Any signatory may monitor actions carried out pursuant to this PA. To the extent practicable, all monitoring activities will be done so as to minimize the number of monitors involved in the undertaking.

2. Any areas that the BLM, in consultation with the SHPO, RECLAMATION, Tribe, or interested party identifies as sensitive will be monitored by an appropriate professional (Monitor) during related construction activities. The Proponent(s) may also provide for a tribal representative during construction activities that may impact the area. Monitors shall be empowered to stop work to protect resources if that work is inconsistent with the terms of this PA or any corresponding treatment/monitoring plan.

G. Notices to Proceed

The BLM, in consultation with the other signatories, may issue NTP to each of the Proponent(s) for individual construction segments as defined by the Proponent(s) in their Construction Plan, under any of the following conditions:

1. The BLM and SHPO have determined that there are no cultural resources within the APE for that construction segment/location; or

2. The BLM and SHPO have determined that there are no historic properties within the APE for the construction segment/locations; or

3. The BLM, after consultation with the SHPO and interested persons, has implemented an adequate Treatment Plan for the construction segment/location, and

(a) The fieldwork phase of the treatment option has been completed; and

(b) The BLM has accepted a summary description of the fieldwork performed and a reporting schedule for that work; and

(c) The SHPO has received, reviewed and accepted the description of the fieldwork prior to the Notice to Proceed; and

(d) RECLAMATION has received, reviewed and accepted the description of the fieldwork prior to the Notice to Proceed.

4. The Proponent(s) have posted a surety as set forth in Section H.1.

H. Surety Bonds

1. Based on a written detailed cost estimate submitted by the Cultural Contractor and agreed to by the responsible Proponent(s) and BLM, the Proponent(s) will post a surety bond with the BLM in an amount sufficient to cover all post-fieldwork costs associated with the inventory; implementing a Treatment Plan, Data Recovery Plan, or other cultural resource management activities. Such costs may include, but are not limited to post-fieldwork analyses, research and report preparation, interim and summary reports preparation, and the curation of project documentation and artifact collections in an approved curation facility. The surety shall be posted prior to BLM issuing any NTP. Additional surety bonds may be required by BLM to cover any of the issues associated with Sections C, D, and E of the PA.

2. The surety bond posted shall be subject to forfeiture if the post-fieldwork tasks are not completed within the time period established by the treatment option selected; provided, however, the BLM and the Proponent(s) may agree to extend any such time periods. The BLM shall notify the Proponent(s) that the surety is subject to forfeiture and shall allow the Proponent(s) thirty (30) calendar days to respond before action is taken to forfeit the surety.

3. The surety bond shall be released, in whole or in part, as specific post-fieldwork tasks, including final disposition of all collections, are completed and accepted by the BLM.

IV. Dispute Resolution

1. If there is an objection by any signatory to the manner in which the terms of this PA are implemented, the objecting signatory will notify the Stillwater Field Manager in writing of the objection. The Stillwater Field Manager will notify all other signatories of the objection. All signatories will consult to resolve the objection. If the BLM determines that the objection cannot be resolved, it shall request assistance of the BLM Nevada State Office to help resolve the objection. The final decision for resolution of the objection by any signatory shall be made by the BLM State Director.

2. The signatories may continue all actions under this PA that are not the subject of the dispute.

V. Amendment

Any signatory to this PA may request that this PA be amended, whereupon the signatories will consult to consider such amendment.

VI. Termination

Any signatory may initiate consultation for termination by providing written notice to the other parties of their intent. After notification by the initiating consulting party, the remaining signatories shall have thirty (30) calendar days to consult to seek agreement on amendments or any other actions that would address the issues and avoid termination. If such consultation fails, the termination will go into effect at the end of this thirty (30) calendar-day period, unless all parties agree to a longer period. The party or parties to the termination shall be required to meet any and all current or outstanding obligations the party or parties assumed under the terms of the PA.

VII. Execution

1. Execution and implementation of this PA evidences that the signatories have satisfied their Section 106 responsibilities for all actions associated with the construction of the SWEP.

2. In the event that the signatories do not carry out the requirements of this PA or it is terminated, the BLM will comply with the provisions of the Protocol.

3. This PA shall become effective on the date of the last signature below, and shall remain in effect until terminated as provided in Section VI. or until undertaking is completed.

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Signatories:

Bureau of Land Management, Stillwater Field Office

Teresa Knutson, Field Manager — Date: 10/05/2010

Nevada State Historic Preservation Officer

Ronald M. James, State Historic Preservation Officer and Historian — Date: 10-5-10

Bureau of Reclamation, Lahontan Basin Area Office

Kenneth Parr, Area Manager Lahontan Basin Area Office — Date: 09/27/10

Consulting Parties:

Sierra Pacific Power Company

Lee R. Simpkins, Team Leader Environmental Services Dept. — Date: 09/28/10

Vulcan Power Company

Ken Bonin, Sr., Director of Permitting — Date: 09/30/10

Ormat Technologies, Inc.

Scott Kessler, Project Manager — Date: 9-27-2010

APPENDIX A: AREA OF POTENTIAL EFFECT

SALT WELLS ENERGY PROJECT GENERAL LEGAL DESCRIPTION

Sierra Pacific Power Company—(815 acres)

Proposed Greenwave Substation(approx. 12 acres): NW/NW of Sec. 1, T.18N, R. 28E.

Proposed 60kV folds (approx. 200 x 100 ft): SW/SW of Sec. 36, T.19N, R.28E.

Proposed Action and Alternatives for 230kV lines (approx. 45 miles x 300 ft): Begins in the NW/NW/NW of Sec. 1, T.18N, R.28E and crosses Secs. 1, 12, 13, 24, 25, and 36 in that township and range; Sec. 1 of T.17N, R.28E; Secs. 19, 20, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36 of T.18N, R.29E; Secs. 1, 2, 3, 4, 6, 7, 8, 9, and 10, T.17N, R.29E; Sec. 31, T.18N, R.30E; Secs. 5, 8, 9, 15, 22, 23, 26, and ending in the NW/SW of Sec. 36, T.17N, R.30E.

Proposed Bass Flat 230kV Switching Station (approx. 12 acres): SE/SE Sec. 22, T.16N, R.30E.

Ormat Technologies, Inc.---(325 acres)

Ormat legal descriptions include block areas surrounding proposed wells, pipelines, and powerplants within the Ormat Lease Boundary.

Proposed blocks include: the W1/2/SE/SW and the SW/NE/SW of Sec. 19; the SW1/4, the SW/SW/SE, the SE/NW, and part of the SW/NE/NW of Sec. 30; most of the N1/2, and the eastern edge of the SE1/4 of Sec. 31; and part of the W1/2 of the SW1/4 of Sec. 32, T.18N, R.30E; part of the W1/2 of Sec. 5, the SE/SE of Sec. 6, part of the E1/2 of Sec. 7, and part of the W1/2 of Sec. 8, T.17N, R.30E; and S1/2 N 1/4 of Sec. 31, T.18N, R.31E .

Proposed Macari 230kV Switching Station (approx. 12 acres): SE/NW of Sec. 31, T.18N, R.30E.

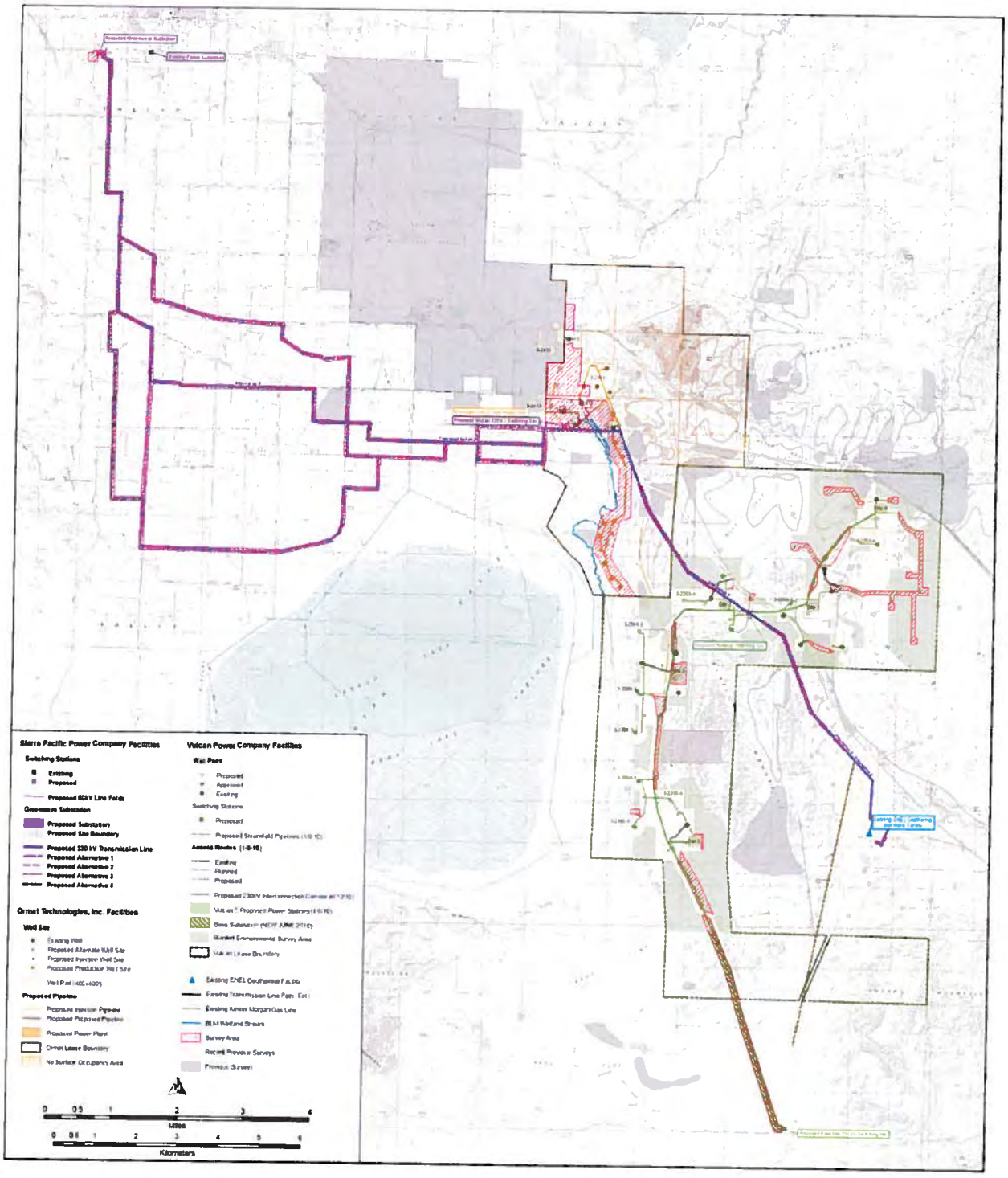
Vulcan Power Company—(approx. 826 acres)

Proposed power plants, well pads, pipelines, and access road corridors would cross parts of the following: Secs. 1, 2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 29, 32, and 33, T.17N, R.30E, and part of Sec. 4, T.16N, R.30E. A new 500-foot-wide transmission corridor extends through parts of Secs. 9, 10, 15, and 22 ending at the proposed Bass Flat 230kV Switching Station in the SE1/4 of Sec. 22, T.16N, R.30E.

Vulcan Power Company—(approx. 4,016 acres)

Blanket environmental surveys cover parts of Secs. 1, 2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 28, 29, 32, and 33, T.17N, R.30E, and all of Sec. 4, T.16N, R.30E. A new 500-foot-wide transmission corridor extends through parts of Secs. 9, 10, 15, and 22 ending at the proposed Bass Flat 230kV Switching Station in the SE1/4 of Sec. 22, T.16N, R.30E.

FIGURE 1: MAP OF THE PROJECT AREA



APPENDIX E
ENVIRONMENTAL PROTECTION MEASURES AND BEST MANAGEMENT PRACTICES

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APPENDIX E
ENVIRONMENTAL PROTECTION MEASURES AND BEST MANAGEMENT PRACTICES

In addition to the requirements and conditions stated in the project permits, geothermal lease stipulations, and conditions of approval, the project proponents are committed to implementing the best management practices (BMPs) discussed below, as appropriate for each of the proposed actions. These measures have been divided into the following categories: General Measures, Air Quality, Soil/Erosion Control, Blasting, Water Resources, Noxious Weeds, Vegetation, Wildlife and Sensitive Species, Cultural and Paleontological Resources, Noise and Public Health and Safety.

General Measures

1. Prior to construction, the limits of the temporary construction ROW would be recorded using a global positioning system unit.

2. Prior to construction, all construction personnel would be instructed on the protection of sensitive biological, cultural, and paleontological resources that have the potential to occur on site.

3. Construction in residential areas would be limited to between daylight and dusk seven days a week.

4. All construction vehicle movement would be restricted to the ROW, pre-designated access roads, and public roads.

5. Fences and gates, if damaged or destroyed by construction activities, would be repaired or replaced to their original preconstruction condition as required by the landowner or land-management agency.

6. Temporary gates would be installed only with prior permission of the landowner or land management agency.

7. All existing roads would be left in a condition equal to or better than their preconstruction condition.

8. All vehicle traffic associated with the projects would be restricted to designated access roads.

9. Non-specular conductors would be installed on transmission lines to reduce visual impacts.

10. All buildings, insulation jacketing, and visible structures would be painted according to the BLM "Standard Environmental Colors Chart" designations for facilities on BLM lands in order to minimize the visual impacts in the area.

11. Speed limits of 25 miles per hour would be observed on all unpaved roads in each project area in order to minimize dust and avoid collision with and incidental death of local wildlife.

Air Quality

1. Construction and operation of the proposed developments would comply with all applicable federal and state air quality standards.

2. BMPs for dust control would be implemented during construction of the access roads, well pads, power plant sites, pipelines, and electrical interconnection lines.

3. Vulcan Power Company has obtained a Surface Area Disturbance (SAD) permit from the Nevada Division of Environmental Protection Bureau of Air Pollution Control and would use the following dust-control measures from the BMP section of that permit within the Vulcan Project Area:

    - Two water trucks would pre-water areas to be disturbed and apply water on disturbed areas and material storage piles on a regular basis.
    - Roads would be graveled and vehicle speeds limited to 25 miles per hour.
    - Subcontractors would be informed of their responsibilities to control fugitive dust.
    - Construction equipment operators would be trained to recognize excessive fugitive dust generation and call for a water truck to spray water on the disturbed areas.
    - Construction contractors would use equipment that is maintained per manufacturer's specifications and meets all applicable US Environmental Protection Agency standards for criteria pollutants from diesel engines, including particulates.

4. The drilling contractor would use state-of-the-art drill rigs certified to meet current EPA standards for non-methane hydrocarbons, nitrogen oxides, and particulates.

5. Fugitive emissions from any hydrocarbon working fluids (isopentane/pentane) would be minimized by utilizing the latest industry technology flanges, seals, vapor-recovery units, leak-detection system, and routine maintenance procedures.

6. Sensors located around major equipment would continuously provide information regarding hydrocarbon levels to the control room and the annunciators. The annunciators would alert the plant operators when a certain level of hydrocarbon is detected by the sensors. This would enable quick response time to alleviate potential problems and would keep plant personnel safe while minimizing hydrocarbon emissions.

7. Whenever maintenance needs to be performed on the turbine-generator equipment or the hydrocarbon system, the hydrocarbon would be recovered to prevent a release into the atmosphere by installing a system that would evacuate the hydrocarbon from the network of piping and equipment, sub-cool the vapor back into a liquid, and pump it back into the hydrocarbon storage tank.

8. As part of the COM plan, SPPC or its contractor would prepare and implement a Dust Control Plan to minimize fugitive dust emissions generated from project construction activities. The Dust Control Plan would be submitted to the Churchill County Planning Department and would be prepared in accordance with the Nevada Division of Environmental Protection, Bureau of Air Pollution Control's SAD Permit. At a minimum, the Dust Control Plan would discuss:

    - Enforcement of dust control requirements;
    - Environmental training; and
    - Dust-control measures to be implemented during construction.

Soil Disturbance

1. In areas where significant grading would be required, topsoil, where present, would be segregated, stockpiled, and stabilized until later reapplication.

2. Construction would be prohibited when the soil is too wet to adequately support construction equipment or would result in ruts of 4 inches or greater.

3. An approved Storm Water Pollution Prevention Plan (SWPPP) would be prepared as part of the COM plan and implemented to minimize erosion from the project construction worksites and contain sediment. The SWPPP would be prepared in accordance with the National Pollutant Disposal Elimination System General Construction Stormwater Permit. At a minimum, it would identify the existing drainage patterns of the construction work sites and ROW, nearby drainages and washes, potential

pollutant sources other than sediment, and the BMPs that that would be implemented to minimize off-site erosion and sedimentation. The SWPPP would include maps of the project area with potential locations for appropriate BMPs. The SWPPP would be kept on site throughout the duration of construction. Measures identified in the SWPPP would be inspected on the ground at least once per week, as well as before and after rain events of 0.5-inch or more in a 24-hour period.

4. Compaction of the soils would be in accordance with the recommendations in the geotechnical report and the detailed civil design.

5. All disturbed lands not required for plant operations would be revegetated upon completion of construction.

Blasting (if required and approved)

1. At a minimum, all explosive storage facilities would be weather resistant, fire resistant, bullet resistant, and theft resistant.

2. Potential rockslide/landslide areas would be identified and avoided to the maximum extent possible, and a blasting geologist would be consulted prior to blasting in these areas.

3. Blasts would be designed to minimize ground vibrations that can cause slope instability and impacts to wells and/or springs.

4. Blasting within 500 feet of wells and/or springs would be avoided to the maximum extent possible.

5. Precautions would be taken to minimize or avoid damaging structures or utilities located within 150 feet of blasting operations. Precautions may include rippling the charge detonations further apart or reducing the amount of charge material that detonates simultaneously.

6. To prevent or minimize the amount of rock particles cast into the air following detonation, blasting mats would be used.

7. A signaling system would be used to alert individuals of an impending blast. The signaling system would include the following components:

    - A warning signal: five minutes prior to the blasting signal, a one-minute series of long audible signals would be sounded at the blast site.
    - A blasting signal: one minute prior to the blast, a series of short, audible signals would be sounded at the blast site.
    - An all-clear signal: a prolonged, audible signal would be sounded at the blast site following the post-blast inspection of the blast area.

8. To inform construction personnel of the signaling protocol, signs explaining the protocol would be posted at the staging areas and at other appropriate areas along the construction ROW.

9. The proponent and/or its contractor would perform pre- and post-blast inspections of existing structures that may sustain damage due to blasting operations.

10. If any damage to structures occurs due to blasting operations, the proponent and/or its contractor would repair the damage as quickly as possible after becoming aware of the damage. In the event of damage to any water supply systems, the proponent and/or its contractor would provide an alternative water source until the original water supply system is restored.

Water Resources

1. All construction vehicle and equipment staging or storage would be located at least 100 feet away from any streams, wetlands, and other water features.

2. All production wells would be cased to a depth below the lowest groundwater aquifer to prevent commingling of fluids.

3. Site drainage, including the plant finish grade, ditches, swales, and other drainage features, would be designed to meet local weather conditions and the mean average rainfall. The drainage would be designed to ensure that there would be no stormwater runoff that would adversely affect nearby surface waters (e.g., wetlands, canals). The design would also incorporate containment for oil-filled equipment where required. This would allow runoff from the oil-filled equipment to be inspected to avoid contaminated discharge to a pond or local drainage.

4. Appropriate oil separation and disposal measures would be taken as required prior to release of runoff to the surface drainage.

5. Stormwater from the well pad would be directed to the reserve pit and contained on site.

6. The geothermal wells would be drilled using non-toxic drilling mud to prevent the loss of drilling fluids into the rock and the risk of contamination to any aquifers from the drilling fluid.

7. Reserve pits would be constructed at each Ormat well site for the containment and temporary storage of drilling mud, drill cuttings, geothermal fluid and storm water runoff from each constructed well pad. Because non-toxic drilling mud would be used, the reserve pits would not be lined. Additionally, the bentonite drilling muds discharged into the reserve pits would act as a liner, in the same way they prevent the loss of

drilling fluids in the well bore into the rock. Therefore, contamination of the local ground water aquifers as a result of the temporary discharges into the reserve pits would be unlikely.

8. Culverts would be strategically placed to allow for the natural drainage in any disturbed areas in the project area to be maintained.

9. The well pads would be set back at least 100 feet from the boundary of the Carson Lake and Pasture and would have berms that would prevent spills from draining west to the wildlife refuge.

Noxious Weeds

1. Prior to preconstruction activities, project personnel would identify all noxious weeds present on the land to be included in the ROW grant and provide this information to the BLM. BLM would then determine any noxious weeds that require flagging for treatment. The proponent would treat the noxious weeds as identified under the Weed Plan component of the COM plan, as required by the BLM.

2. All gravel and/or fill material would be certified as weed-free.

3. All off-road equipment would be cleaned (power or high-pressure cleaning) of all mud, dirt, and plant parts prior to initially moving equipment onto public land. Equipment would be cleaned again prior to reentry if it leaves the project site.

Vegetation

1. Wherever possible, vegetation would be left in place. Where vegetation must be removed, it would be cut at ground level to preserve the root structure and allow for potential resprouting.

2. All temporary construction areas that have been disturbed, including stringing sites and transmission structure work areas, would be recontoured and restored as required by the landowner or land-management agency. The method of restoration typically would consist of seeding or revegetating with native plants (if required), installing cross drains for erosion control, and placing water bars in the road or centerline travel route. Seed used for revegetation would be certified as weed-free.

Wildlife and Sensitive Species

1. If land-clearing activities are conducted during the avian breeding season (May 15 to July 15), nesting bird surveys would be conducted to identify nests and evidence of breeding birds.

2. Excavations left open overnight would be covered or fenced securely to prevent wildlife from falling into open excavations.

3. Structures would be constructed to conform to those practices described in the Suggested Practices for Avian Protection on Power Lines (APLIC 2006).

4. Any toxic or hazardous material or any other items that present a risk to wildlife would be fenced, netted or include some other measure to exclude wildlife.

Cultural and Paleontological Resources

1. A Class III cultural resource inventory would be conducted prior to construction. Unevaluated cultural sites would be tested to determine their eligibility status. Wherever possible, the proponent would avoid cultural sites identified as eligible for inclusion on the National Register of Historic Places. Where avoidance is not possible, a treatment plan would be developed through consultation between the BLM, State Historic Preservation Office (SHPO), and applicable tribes.

2. Prior to construction, the proponent and/or its contractors would train workers and individuals involved with the project regarding the potential to encounter historic or prehistoric sites and objects, proper procedures in the event that cultural items or human remains are encountered, prohibitions on artifact collection, and respect for Native American religious concerns. As part of this training, all construction personnel would be instructed to inspect for paleontological and cultural objects when excavating or conducting other ground-disturbing activities.

3. If potential resources are found, work would be halted immediately within a minimum distance of 300 feet from the discovery, and a professional archaeologist (holding a valid Cultural Resources Permit from Nevada BLM) would be mobilized to the site to evaluate the find. Any potential resources would not be handled or moved. The professional archaeologist would then determine whether the find needs to be evaluated by a paleontologist or Native American representative. The appropriate specialist(s) would then make a recommendation of the significance of the find and the steps to be followed before proceeding with the activity. Any cultural and/or paleontological resource discovered during construction on public or federal land would be reported immediately to the BLM. Work would not continue until the BLM issues a notice to proceed. The BLM would notify and consult with SHPO and appropriate tribes on eligibility and suitable treatment options. If significant resources are discovered, they would be recovered, transported, and stored at an approved curation facility that meets the standards specified in Title 36 of the Code of Federal Regulations (CFR) Part 79.

4. If human remains are encountered during project construction, all work within 300 feet of the remains would cease, and the remains would be protected. If the remains are on land managed by the BLM, BLM representatives would be immediately notified. If the remains are Native

American, the BLM would follow the procedures set forth in 43 CFR Part 10, Native American Graves Protection and Repatriation Regulations. If the remains are located on state or private lands, the Nevada SHPO and the BLM would be notified immediately. Native American human remains discovered on state or private lands would be treated under the provisions of the Protection of Indian Burial Sites section of the Nevada Revised Statutes Chapter 383. The Nevada SHPO would consult with the Nevada Indian Commission and notify the appropriate Native American tribe. Procedures for inadvertent discovery are listed under Nevada Revised Statutes 383.170.

Noise

1. Noise mufflers would be used on all drill rig and air compressor engines. Each well pad may have one rock muffler. Rock mufflers are approximately 30 feet tall with a diameter of about 10 feet and are used to separate and attenuate steam venting noise during well testing.

2. Ormat employs proprietary turbine designs having rotation speeds matching generator output rotations per minute. This process eliminates the need for gear reduction units and the resulting associated noise. As a result the facilities operate at approximately 65dbA at 200 feet. Ormat will also employ the best available noise control technology on cooling tower fans.

Health and Safety

1. All potential spark-emitting equipment would be fitted with spark arresters.

2. Trash and other non-hazardous solid waste would be collected and stored on site and periodically disposed of at an off-site disposal facility authorized to accept waste.

3. Blowout prevention equipment would be utilized while drilling below the surface casing to ensure that any geothermal fluids encountered do not flow uncontrolled to the surface. The blowout prevention equipment would be installed on the well head, which is welded to the casing, and kept in operating condition and tested in compliance with federal regulations and industry standards.

4. A spill and disposal contingency plan would be developed within the COM plan, which would describe the methods for cleanup and abatement of any petroleum hydrocarbon or other hazardous material spill.

5. Access to the drill pads and reserve pit would be limited to authorized personnel, and appropriate safety and warning signs would be posted at each pad site and entrance road.

6. Drill cuttings may be used at the discretion of the surface manager, in this case BLM, as fill material for projects such as road repair and pad

construction. Before use of the cuttings for construction, the cuttings from test wells would be tested by a certified lab for hazardous wastes. Using the federally mandated toxicity characteristics and leaching profile testing methods, each sample would be tested for heavy metals and volatile and semi-volatile organic properties. These results would be provided to the BLM upon the request for authorization of use of cuttings in construction.

7. All machinery, drilling platforms, and oil and fuel storage areas on the drill pads would have secondary containment up to 110 percent of volume and, as a secondary precaution, would drain to the reserve pit.

8. Over the operational life of the project, accidental discharges of geothermal fluids, which could contaminate surface or ground waters, are unlikely because of frequent inspections and ultrasonic testing of the geothermal pipelines, pipeline flow and pressure monitoring, and well pump and pipeline valve shutdown features.

9. Portable sanitary facilities and potable water would be provided at the drill sites and maintained in accordance with applicable health standards.

10. Emergency showers and eyewash stations would be located in areas where chemical irritants would be used as required by code.

11. Outside emergency showers/eyewash stations would be provided with freeze/summer high temperature protection, as appropriate.

12. Well pad sites would be surrounded by a berm to contain accidental spills and runoff on-site and would be sloped to drain into collection ditches, which in turn would drain into the on-site reserve pit.

13. Power plant sites would be sloped and graded with a drainage system to collect all runoff.

14. Liquids would be stored in the reserve pit until the liquid evaporates, is pumped out and injected back into the wells, or is disposed of in accordance with BLM and Nevada regulations. Should drainage swales be encountered, they would be diverted around the site or otherwise handled in accordance with BLM and other applicable regulations.

15. Each power plant site would be fenced.

16. Perimeter and switchyard fencing would be properly grounded to provide personnel protection. All fence fabric, posts, barbed wire, hardware, and gates would be galvanized.

17. Permanent sensors for detecting hydrocarbon leakage would be located in areas of potential leakage, such as near the hydrocarbon storage tanks,

turbines, and hydrocarbon pumps. They can be responded to manually or interlocked with the fire protection system to provide automatic response.

18. All construction vehicles would be maintained in accordance with the manufacturers' recommendations. All vehicles would be inspected for leaks prior to entering the job site. All discovered leaks would be contained with a bucket or absorbent materials until repairs can be made.

19. All hazardous waste materials would be properly labeled in accordance with 40 CFR Part 262. A list of hazardous materials expected to be used during project construction is presented in **Table E-1**, Hazardous Materials Proposed for Project Use.

Table E-1
Hazardous Materials Proposed for Project Use

Hazardous Materials	
2-Cycle Oil	Lubricating Grease
ABC dry Chemical Fire Extinguisher	Mastic Coating
Acetylene Gas	Methyl Alcohol
Air Tool Oil	North Wasp and Hornet Spray (1,1,1-Trichloroethane)
Ammonium Hydroxide	Oxygen
Antifreeze	Paint
Automatic Transmission Fluid	Paint Thinner
Battery Acid	Petroleum Products
Bee Bop Insect Killer	Prestone II Antifreeze
Canned Spray Paint	Puncture Seal Tire Inflator
Chain Lubricant (Methylene Chloride)	Safety Fuses
Connector Grease	Safety Solvent
Contact Cleaner 2000	Starter Fluid
Eye Glass Cleaner (Methylene Chloride)	Trichloroethane
Gas Treatment	Wagner Brake Fluid
Gasoline	WD-40
Insulating Oil	

20. Hazardous material storage, equipment refueling, and equipment repair would be conducted at least 100 feet from streams or other water features

to the maximum extent feasible. If these activities must be conducted within 100 feet of streams or other water features, secondary containment would be used to protect these water features.

21. Spilled material of any type would be cleaned up immediately. A shovel and spill kit would be maintained on site at all times to respond to spills.

22. All sanitary wastes would be collected in portable, self-contained toilets at all construction staging areas and other construction operation areas and managed in accordance with local requirements.

23. The proponent would designate a Fire Marshall (Project Fire Marshall) who would coordinate with a Fire Marshall to be designated by the prime contractor (Contractor Fire Marshall) and the BLM's fire-management representative, as necessary.

24. The Contractor Fire Marshall would be responsible for the following tasks:

    - Conducting regular inspections of tools, equipment, and first aid kits for completeness.
    - Conducting regular inspections of storage areas and practices for handling flammable fuels to confirm compliance with applicable laws and regulations.
    - Posting smoking and fire rules at centrally visible locations on site.
    - Coordinating initial response to contractor-caused fires within the project area.
    - Conducting fire inspections along the ROW and access roads.
    - Ensuring that all construction workers and subcontractors are aware of all fire protection measures.
    - Remaining on duty and on site when construction activities are in progress and during any additional periods when fire safety is an issue, or designating another individual to serve in this capacity when absent.
    - Reporting all wildfires in accordance with the notification procedures described below.
    - Initiating and implementing fire-suppression activities until relieved by agency or local firefighting services in the event of a project-related fire. Project fire suppression personnel and equipment, including water tenders, would be dispatched within 15 minutes from when a fire is reported.
    - Coordinating with the Project Manager regarding current fire conditions potential and fire safety warnings from the BLM and communicating these to the contractor's crews.

25. The Construction Foreman or Contractor Fire Marshal would immediately notify firefighting services of any fires on site.

26. Contractors would be notified to stop or reduce construction activities that pose a significant fire hazard until appropriate safeguards are taken.

27. If an accidental fire occurs during construction, immediate steps to extinguish the fire, if it is manageable and safe to do so, would be taken using available fire suppression equipment and techniques. Fire-suppression activities would be initiated by the proponent and/or its contractor until relieved by agency or local firefighting services.

28. Smoking would only be permitted in designated cleared areas and would be prohibited while walking or working in areas with vegetation or while operating equipment. In areas where smoking is permitted, all burning tobacco and matches would be completely extinguished and discarded in ash trays, not on the ground.

29. "No smoking" signs and fire rules would be posted at construction staging areas, helicopter fly yards, and key construction sites during the fire season.

30. Fire-suppression equipment would be present in areas where construction tools or equipment have the potential to spark a fire.

31. Extra precautions would be taken when fire danger is considered to be high.

32. All field personnel would be instructed regarding emergency fire response. The contractors would receive training on the following:

    - Initial fire-suppression techniques;
    - Fire event reporting requirements;
    - Methods to determine if a fire is manageable;
    - Fire-control measures to be implemented by field crews on site;
    - When the worksite should be evacuated;
    - How to respond to wildfires in the vicinity; and
    - How to maintain knowledge of and plans for evacuation routes.

33. All flammable material, including dead vegetation, dry grasses, and snags (fallen or standing dead trees) would be cleared for a minimum of 10 feet from areas of equipment operation that may generate sparks or flames.

34. No open burning, campfires, or barbeques would be allowed along the ROW, at construction staging areas, at substations, on access roads, or in any other project-related construction areas.

35. All welding or cutting of power line structures or their component parts would be approved by the Construction Foreman. Approved welding or cutting activities would only be performed in areas cleared of vegetation a minimum of 10 feet around the area. Welding or cutting activities would cease one hour before all fire-response personnel leave a construction area to reduce the possibility of welding activities smoldering and starting a fire. Welder vehicles would be equipped with fire-suppression equipment.

36. All internal combustion engines, both stationary and mobile, would be equipped with approved spark arresters that have been maintained in good working condition. Light trucks and cars with factory-installed mufflers in good condition may be used on roads cleared of all vegetation with no additional equipment required. Vehicles equipped with catalytic converters are potential fire hazards and would be parked on cleared areas only.

37. The use of torches, fuses, highway flares, or other warning devices with open flames would be prohibited. The proponent and its contractors would only use electric or battery-operated warning devices on site.

38. Equipment parking areas, small stationary engine sites, and gas and oil storage areas would be cleared of all extraneous flammable materials. "No smoking" signs would be posted in these areas at all times.

39. All fuel tanks would be grounded.

40. The proponent and the contractors would provide continuous access to roads for emergency vehicles during construction.

41. All motorized vehicles and equipment would be equipped with the following fire-protection items:
    - One long-handled round point shovel;
    - One ax or Pulaski fire tool;
    - One five-pound ABC Dry Chemical Fire Extinguisher;
    - One five-gallon water backpack (or other approved container) full of water or other extinguishing solution; and
    - Hard hat, work gloves, and eye protection.

42. Project construction worksites would include the following equipment:
    - Power saws, if required for construction, equipped with an approved spark arrester and accompanied by one five-pound ABC Dry Chemical Fire Extinguisher and a long-handled, round-point shovel when used away from a vehicle.

- Fuel service trucks with one 35-pound capacity fire extinguisher charged with the necessary chemicals to control electrical and fuel fires. At least two long-handled, round-point shovels and two five-pound ABC Dry Chemical Fire Extinguishers at wood-cutting, welding, or other construction work sites that have a high risk of starting fires.
- At least one radio and/or cellular telephone to contact fire-suppression agencies or the project management team.
- Back pumps filled with water (two at each wood-cutting site, one at each welding site, and two at each tower installation or construction site, or any activity site at risk of igniting fires).

43. During periods of increased fire danger, a fire-suppression vehicle would be available in the construction area or stationed near high-risk construction work sites and would be equipped with the following items:

    - One water tank with a minimum capacity of 500 gallons;
    - 250 feet of 0.75-inch heavy-duty rubber hosing;
    - One pump with a discharge capacity of at least 20 gallons per minute (the pump would have fuel capacity to operate for at least a 2-hour period); and
    - One tool cache (for fire use only) containing at a minimum: two long-handled round point shovels; two axes or Pulaski fire tools; and one chainsaw of 3.5 (or more) horsepower with a cutting bar of at least 20 inches in length.

44. The government may require emergency measures, including the necessary shutting down of equipment or portions of operations during periods of high fire danger.

45. If a fire is unmanageable, field crews would evacuate and call "911" or the Sierra Front Interagency Dispatch Center: 775-883-5353 (wildland fire emergency line).

46. The Contractor will report ALL wildland fires on or in the vicinity of the project to the Sierra Front Interagency Dispatch Center (SFIDC). When reporting a fire, provide the following information: name, callback telephone number, project name, location, and fire description. The emergency phone number for SFIDC dispatch is 775-883-5353.

47. The fire protection system at each constructed plant site would consist of a 300,000-gallon water storage tank, two 100-percent diesel pumps, a water-distribution piping system, control panel, automatic valves, instrumentation, and hydrants. In addition, handheld fire extinguishers would be located in key areas throughout the plant.

48. Infrared flame detection sensors would be strategically located adjacent to major equipment and hydrocarbon storage tanks. When a flame is detected, a signal is transmitted to the fire protection control panel, which opens a valve, and the zone where the flame was detected is deluged until the valve is manually shut off. In the outdoor area, the fire water system would be tied into the leak detection and annunciator systems.

49. A separate waterless fire suppression system would be installed in the control building. This product would not damage motor control center and electrical equipment, yet is safe to use in the control room where personnel would be located.

50. Current wildland fire information can be found on line at the Sierra Front Interagency Dispatch Center's (SFIDC) websites, http://www.sierrafront.net/ under the Intelligence link. This site will provide current and expected weather conditions, posting of Red Flan watches and warnings as well as areas of current fire activity.

51. Under Title 43 CFR 9212, the holder of this permit may be held liable for any and all costs, should a wildland fire occur caused by the activities associated with the construction, maintenance, or operation of this project. Fire trespass action might be initiated and wildfires suppression costs may be collected from the holder of this permit.

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APPENDIX F
LAND USE AUTHORIZATIONS IN THE SALT WELLS ENERGY PROJECTS AREA

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APPENDIX F
LAND USE AUTHORIZATIONS IN THE SALT WELLS ENERGY PROJECTS AREA

AUTHORIZED USES IN THE SALT WELLS ENERGY PROJECTS AREA

Methodology

Research regarding authorized uses in the Salt Wells Energy Projects Area was conducted by tracing the proposed projects on current Master Title Plats, and running LR2000 Case Recordation Geographic Reports with Customer based on the Township, Range, and Section that would be encumbered by the proposed action. All authorized holders of federal cases in the sections were listed.

The proposed power transmission line runs through many private parcels within the City of Fallon. For this research, the Plats were reviewed to determine if any current federal actions were within the private holdings. None were identified. Further, the Plats were reviewed to find any small, landlocked federal holdings. Any section with such a holding was also run through the same reporting mechanism, identified above, in LR2000.

The Administrative Record shows the reports run and parameters used to generate the reports, which were the data used in constructing **Table F-1**, Authorized Uses in the Salt Wells Energy Projects Area, below.

On Township T 18 N, R 28 E, a report and banner page was not generated; the proposed action with alternatives would be entirely on non-federal holdings.

Table F-1

Authorized Uses in the Salt Wells Energy Projects Area

Serial Number	Holder	Use Type	Authority
NVN 0 029370	Nevada Department of Transportation	Federal Aid Highway (Sec. 17)	The Act of November 9, 1921 (Federal Aid Highway Act)
NVN 0 052045	Nevada Department of Transportation	Materials Site (Sec. 317)	The Act of August 27, 1958 (Forest Highways Act)
NVN 0 063440	Paiute Pipeline Company	Oil and Gas Pipeline	The Act of February 25, 1920 (Mineral Leasing Act)
NVN 005253	Sierra Pacific Power Company	Power Transmission Line	The Act of March 4, 1911 (General Authorities Act)
NVN 016376	United States Department of the Navy	Power Transmission Line	The Act of October 21, 1976 (Federal Land Policy and Management Act)
NVN 044613	Bureau of Land Management	Community Pit	The Act of July 31, 1947 (Mineral Materials Act)
NVN 044613 01	Bureau of Land Management	Mineral Material Negotiated Sale	The Act of July 31, 1947 (Mineral Materials Act)
NVN 044613 02	Bureau of Land Management	Free Use Permit	The Act of July 31, 1947 (Mineral Materials Act)
NVN 054780	United States Department of the Navy	Federal Facility Communication Line	The Act of October 21, 1976 (Federal Land Policy and Management Act)
NVN 066394	AT&T Nevada	Fiber Optic Line	The Act of October 21, 1976 (Federal Land Policy and Management Act)
NVN 066753	Hodges Transportation	Land Use Permit	The Act of October 21, 1976 (Federal Land Policy and Management Act)
NVN 076179	Sierra Pacific Power Company	Fiber Optic Line	The Act of October 21, 1976 (Federal Land Policy and Management Act)

Table F-1
Authorized Uses in the Salt Wells Energy Projects Area

Serial Number	Holder	Use Type	Authority
NVN 079310	Gradient Resources, Inc.	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 079662	Gradient Resources, Inc.	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 079663	Gradient Resources, Inc.	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 079664	Gradient Resources, Inc.	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 079665	Gradient Resources, Inc.	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 079666	Gradient Resources, Inc.	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 079667	Gradient Resources, Inc.	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 079668	Gradient Resources, Inc.	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 079669	Sierra Pacific Power Company	Power Transmission Line	The Act of October 21, 1976 (Federal Land Policy and Management Act)
NVN 079707	Amp Resources, LLC	Mineral Material Negotiated Sale	The Act of July 31, 1947 (Mineral Materials Act)
NVN 083072	Carson Lake Basin Project, LLC	Mineral Material Negotiated Sale	The Act of July 31, 1947 (Mineral Materials Act)
NVN 084012	A&K Earth Movers	Mineral Material Negotiated Sale	The Act of July 31, 1947 (Mineral Materials Act)

Table F-1
Authorized Uses in the Salt Wells Energy Projects Area

Serial Number	Holder	Use Type	Authority
NVN 084525	A&K Earth Movers	Mineral Material Negotiated Sale	The Act of July 31, 1947 (Mineral Materials Act)
NVN 084672	A&K Earth Movers	Mineral Material Negotiated Sale	The Act of July 31, 1947 (Mineral Materials Act)
NVN 085018	A&K Earth Movers	Mineral Material Negotiated Sale	The Act of July 31, 1947 (Mineral Materials Act)
NVN 087400	Carson Lake Basin Project, LLC	Geothermal Geophysical Exploration	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 087402	Carson Lake Basin Project, LLC	Geothermal Geophysical Exploration	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 087747	Carson Lake Basin Project, LLC	Geothermal Geophysical Exploration	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 087749	Carson Lake Basin Project, LLC	Geothermal Geophysical Exploration	The Act of December 24, 1970 (Geothermal Steam Act)
NVN 088293	Nevada Department of Wildlife	Free Use Permit	The Act of July 31, 1947 (Mineral Materials Act)
NVN 088476	HOV Energy	Geothermal Lease	The Act of December 24, 1970 (Geothermal Steam Act)

APPENDIX G
SOILS

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APPENDIX G
SOILS

Appendix G contains the following tables referenced in **Section 3.5**, Soils.

Table G-1, Soil Map Units in Proposed Areas of Disturbance – SPPC Project Area

Table G-2, Volume of Growth Medium - SPPC Project Area - Proposed Action

Table G-3, Volume of Growth Medium - SPPC Project Area – Alternatives

Table G-4, Soil Map Units in Proposed Areas of Disturbance – Ormat Project Area

Table G-5, Volume of Growth Medium - Ormat Project Area - Proposed Action

Table G-6, Volume of Growth Medium - Ormat Project Area – Alternatives

Table G-7, Soil Map Units in Proposed Areas of Disturbance – Vulcan Project Area

Table G-8, Volume of Growth Medium - Vulcan Project Area - Proposed Action

Table G-9, Volume of Growth Medium - Vulcan Project Area – Alternatives

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Table G-1

Soil Map Units in Proposed Areas of Disturbance - SPPC Project Area - Proposed Action

Map unit symbol	Map unit name	Landform	Parent Material	Surface Texture	Saline and/or Sodic?	Groundwater Depth	Whole Soil Erodibility Factor (Kw)	Wind Erodibility Group (WEG)
102	Appian, clay substratum complex, 0 to 2 percent slopes	Lake terraces	Mixed alluvium over lacustrine deposits	Fine sand over clay loam, or clay loam at surface	Saline	>80 inches	0.24	1
119	Bunejug sandy loam, slightly saline, 0 to 1 percent slopes	Flood plains	Lacustrine deposits	Sandy loam	Saline	36 to 60 inches	0.28	3
120	Bunejug sandy loam, strongly saline, 0 to 1 percent slopes	Flood plains	Lacustrine deposits	Sandy loam	Saline	36 to 60 inches	0.28	3
121	Bunejug-Erber complex, 0 to 1 percent slopes	Flood plains	Lacustrine deposits	Clay loam	Saline	36 to 60 inches	0.32	4L
122	Carcity clay, 0 to 1 percent slopes	Flood plains	Clayey alluvium over sandy alluvium	Clay	Slightly saline	36 to 60 inches	0.17	4
123	Carcity clay, slightly saline, 0 to 1 percent slopes	Flood plains	Clayey alluvium over sandy alluvium	Clay	Slightly saline	36 to 60 inches	0.17	4
124	Carcity clay, strongly saline, 0 to 1 percent slopes	Flood plains	Clayey alluvium over sandy alluvium	Clay	Saline	36 to 60 inches	0.17	4
125	Carson clay, 0 to 1 percent slopes	Flood plains	Clayey alluvium	Clay	Saline-sodic	36 to 60 inches	0.24	4
126	Carson clay loam, strongly saline, 0 to 1 percent slopes	Flood plains	Clayey alluvium	Clay loam	Saline-sodic	36 to 60 inches	0.32	4
129	Carson-Stillwater complex, 0 to 2 percent slopes	Flood plains	Clayey alluvium from mixed rocks	Clay	Saline-sodic	20 to 36 inches	0.28	4
132	Dia loam, 0 to 1 percent slopes	Stream terraces	Mixed alluvium	Loam	No.	36 to 60 inches	0.37	5
133	Dia loam, strongly saline, 0 to 1 percent slopes	Stream terraces	Mixed alluvium	Loam	Saline-sodic	36 to 60 inches	0.37	5
135	Dia loam, slightly saline, 0 to 1 percent slopes	Stream terraces	Mixed alluvium	Loam	Slightly saline	36 to 60 inches	0.37	5
137	Dithod loam, slightly saline, 0 to 1 percent slopes	Stream terraces	Mixed alluvium	Loam	Slightly saline	36 to 60 inches	0.37	5
140	East Fork clay loam, 0 to 1 percent slopes	Stream terraces	Mixed alluvium	Clay loam	No.	>80 inches	0.28	6
142	East Fork clay loam, strongly saline, 0 to 1 percent slopes	Stream terraces	Mixed alluvium	Clay loam	Saline-sodic	36 to 60 inches	0.28	6
144	Erber clay, strongly saline, 0 to 1 percent slopes	Flood plains	Mixed alluvium	Clay	Saline-sodic	36 to 60 inches	0.17	4
147	Erber sand, 0 to 1 percent slopes	Flood plains	Mixed alluvium	Sand	Saline	36 to 60 inches	0.15	2
149	Fallon fine sandy loam, slightly saline, 0 to 1 percent slopes	Stream terraces	Mixed alluvium	Fine sandy loam	Slightly saline	36 to 60 inches	0.32	3
154	Fernley sand, 0 to 1 percent slopes	Stream terraces	Mixed alluvium	Sand	No.	36 to 60 inches	0.15	1
186	Pelic sand, clay substratum, 0 to 2 percent slopes	Flood plains	Mixed alluvium	Sand	Saline	Frequently at or above ground surface	0.17	1
192	Playas	Playas	--	Silty clay.	Saline-sodic	Frequently at or above ground surface	0.28	8
193	Ragtown clay loam, slightly saline, 0 to 1 percent slopes	Lake plains	Lacustrine deposits	Clay loam	Slightly saline	36 to 60 inches	0.32	4L
206	Stillwater clay loam, slightly saline, 0 to 1 percent slopes	Flood plains	Clayey alluvium from mixed rocks	Clay loam	Slightly saline	36 to 60 inches	0.28	4L
207	Stillwater clay loam, strongly saline, 0 to 1 percent slopes	Flood plains	Clayey alluvium from mixed rocks	Clay loam	Saline-sodic	36 to 60 inches	0.28	4L
208	Stillwater clay loam, wet, 0 to 1 percent slopes	Flood plains	Clayey alluvium from mixed rocks	Clay loam	Saline-sodic	18 to 36 inches	0.28	4L
215	Swope clay loam, slightly saline, 0 to 1 percent slopes	Flood plains	Mixed alluvium	Clay loam	Slightly saline	36 to 60 inches	0.28	4L
216	Swope clay loam, strongly saline, 0 to 1 percent slopes	Flood plains	Mixed alluvium	Clay loam	Saline-sodic	36 to 60 inches	0.28	4L
217	Swope sandy loam, 0 to 1 percent slopes	Flood plains	Mixed alluvium	Sandy loam	Saline	36 to 60 inches	0.37	3
7017	Biddleman-Mazuma-Weena association	Beach terraces	Mixed alluvium	Very cobbly fine sandy loam	Saline-sodic	>80 inches	0.05	4
7026	Isolde-Parran-Appian association	Dunes	Eolian deposits	Fine sand	No.	>80 inches	0.17	1
7099	Tuffman-Bluewing-Labou association	Beach terraces	Alluvium derived from tufa and/or alluvium derived from volcanic rock	Very gravelly sandy loam (10 to 20 inches to lithic bedrock)	No.	>80 inches	0.1	Not Rated

Color Codes:	Low	Medium	High	Very High

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Table G-2
Volume of Growth Medium - SPPC Project Area - Proposed Action

Project Component	Temporary Disturbance Area (acres)	Volume of Growth Medium in Temporary Disturbance Area (yd^3)*
Proposed Bass Flat Switching Station	5.75	4,630
Proposed Pony Express Switching Station	5.75	4,630
Proposed Greenwave Substation	11.5	9,277
Proposed 230 kV Transmission Line	789	636,460
Proposed 60 kV Electric Folds	0.6	484
TOTAL:	**812.6**	**655,480**

* Assumes a growth medium thickness of 6 inches.

Table G-3
Volume of Growth Medium - SPPC Project Area - Alternatives

	Temporary Disturbance Area (acres)	Volume of Growth Medium in Temporary Disturbance Area (yd^3)*
Alternative 1	814.55	657,070
Alternative 2	789.09	636,533
Macari Fiber Optic Alternative	345.56	278,752

* Assumes a growth medium thickness of 6 inches.

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Table G-4

Soil Map Units in Proposed Areas of Disturbance - Ormat Project Area

Map unit symbol	Map unit name	Whole Soil Erodibility Factor (Kw)	Wind Erodibility Group (WEG)	Average Thickness of Surface Horizon in Map Unit (in.)	Surface Horizon Thickness for Each Component (in.)	Percentage of Map Unit in Each Component	Notes Regarding Quality of Surface Horizon	Is Shallow Bedrock or Shallow Groundwater Table Present in Component?
119	Bunejug sandy loam	0.28	3	2	2	85%	Sandy loam. Saline.	Yes. 36 to 60 inches to groundwater.
121	Bunejug-	0.32	4L	3	2	45%	Sandy loam. Saline.	Yes. 36 to 60 inches to groundwater.
	Erber complex				5	40%	Clay loam. Saline-sodic.	Yes. 36 to 60 inches to groundwater.
126	Carson clay loam	0.32	4	10	10	85%	Clay loam. Saline-sodic.	Yes. 36 to 60 inches to groundwater.
129	Carson-	0.28	4	7	10	40%	Clay. Saline-sodic.	Yes. 20 to 36 inches to groundwater.
	Stillwater complex				5	40%	Clay loam. Saline-sodic.	Yes. 18 to 36 inches to groundwater.
143	Erber clay, slightly saline	0.17	4	5	5	85%	Clay. Slightly saline.	Yes. 36 to 60 inches to groundwater.
144	Erber clay, strongly saline	0.17	4	5	5	85%	Clay. Saline-sodic.	Yes. 36 to 60 inches to groundwater.
145	Erber loam	0.37	4L	5	5	85%	Loam.	Yes. 36 to 60 inches to groundwater.
147	Erber sand	0.15	1	5	5	90%	Sand. Strongly saline.	Yes. 36 to 60 inches to groundwater.
163	Isolde fine sand	0.17	1	6	6	85%	Fine sand.	No.
208	Stillwater clay loam	0.28	4L	5	5	90%	Clay loam. Saline-sodic.	Yes. 18 to 36 inches to groundwater.
215	Swope clay loam, strongly saline	0.28	4L	7	7	85%	Clay loam. Saline.	Yes. 36 to 60 inches to groundwater.
240	Parran-	0.32	4	11	18	50%	Silty clay. Saline-sodic.	Yes. 36 to 60 inches to groundwater.
	Sondoa association				4	35%	Silt loam. Saline-sodic.	No.
7026	Isolde-	0.17	1	4	0	40%	Dune sand.	No.
	Parran-				18	15%	Silty clay. Saline-sodic.	Yes. 36 to 60 inches to groundwater.
	Appian association				3	30%	Sandy loam. Saline-sodic.	No.
7220	Badland-	0.37	5	6	6	55%	Variable surface horizon underlain by clay.	No.
	Mazuma complex				8	30%	Very cobbly fine sandy loam. Saline-sodic.	No.
		Average Growth Medium Thickness (in.):		**6**				

Color Codes:	Low	Medium	High	Very High

Notes:

Shallow groundwater means the water table is encountered less than 60 inches from ground surface.

Shallow bedrock means rock or paralithic material is encountered less than 80 inches from ground surface.

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Table G-5
Volume of Growth Medium - Ormat Project Area - Proposed Action

Project Component	Temporary Disturbance Area (acres)	Volume of Growth Medium in Temporary Disturbance Area (yd^3)*
Carson Lake Binary Power Plant Site	30	24,200
Carson Lake Power Plant Substation	Within the footprint of the Power Plant site.	---
Macari Switching Station	Within the footprint of the Power Plant site.	---
Interconnect Transmission Line	Within the footprint of the Power Plant site.	---
Pipelines	236.36	190,664
Well Pads	54.6	44,044
Access Roads	Included in the pipeline corridor area of disturbance.	---
TOTAL:	**320.96**	**258,908**

* Assumes a growth medium thickness of 6 inches.
--- = Not Applicable.

Table G-6
Volume of Growth Medium - Ormat Project Area - Alternatives

	Temporary Disturbance Area (acres)	Volume of Growth Medium in Temporary Disturbance Area (yd^3)*
Alternative 1	317.84	256,391

* Assumes a growth medium thickness of 6 inches.

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Table G-7

Soil Map Units in Proposed Areas of Disturbance -Vulcan Project Area - Proposed Action

Map unit symbol	Map unit name	Whole Soil Erodibility Factor (Kw)	Wind Erodibility Group (WEG)	Average Thickness of Surface Horizon in Map Unit (in.)	Surface Horizon Thickness for Each Component (in.)	Percentage of Map Unit in Each Component	Notes Regarding Quality of Surface Horizon	Is Shallow Bedrock or Shallow Groundwater Table Present in Component?
192	Playas	0.28	8	6	6	100%	Silty clay. Saline-sodic. Frequent ponding of water.	Yes. Water table frequently at ground surface or above.
240	Parran-	0.32	4	11	18	50%	Silty clay. Saline-sodic.	Yes. 36 to 60 inches to groundwater.
	Sondoa association				4	35%	Silt loam. Saline-sodic.	No.
7017	Biddleman-	0.05	4	4	3	50%	Very cobbly fine sandy loam. Saline-sodic.	No.
	Mazuma-				8	25%	Fine sandy loam. Saline-sodic.	No.
	Weena association				2	10%	Loam.	Yes. 4 to 14 inches to paralithic bedrock.
7022	Hawsley	0.1	1	7	8	65%	Sand sheets.	No.
	Isolde association				6	30%	Dune sand.	No.
7023	Bango-	0.15	3	5	4	40%	Sandy loam. Sodic.	No.
	Biddleman-				3	30%	Very cobbly fine sandy loam. Sodic.	No.
	Mazuma association				8	20%	Fine sandy loam. Saline-sodic.	No.
7024	Turupah-	0.28	6	7	2	55%	Clay loam. Saline.	Yes. 18 to 30 inches to groundwater.
	Parran association				18	30%	Silty clay. Saline-sodic.	Yes. 36 to 60 inches to groundwater.
7026	Isolde-	0.17	1	4	0	40%	Dune sand.	No.
	Parran-				18	15%	Silty clay. Saline-sodic.	Yes. 36 to 60 inches to groundwater.
	Appian association				3	30%	Sandy loam. Saline-sodic.	No.
7099	Tuffman-	0.1	Not Rated	5	0	35%	Very gravelly sandy loam at surface.	Yes. 10 to 20 inches to lithic bedrock.
	Bluewing-				1	30%	Very gravelly loamy sand.	No.
	Labou association				20	20%	Gravelly loamy fine sand. Saline-sodic.	Yes. 8 to 14 inches to lithic bedrock.
7220	Badland-	0.37	5	6	6	55%	Variable surface horizon underlain by clay.	No.
	Mazuma complex				8	30%	Very cobbly fine sandy loam. Saline-sodic.	No.
7221	Biddleman-	0.05	6	4	3	55%	Very cobbly fine sandy loam. Saline-sodic.	No.
	Mazuma association, sodic				8	30%	Silt loam. Saline-sodic.	No.
		Average Growth Medium Thickness (in.):		**5**				

Color Codes:	Low	Medium	High	Very High

Notes:

Shallow groundwater means the water table is encountered less than 60 inches from ground surface.

Shallow bedrock means rock or paralithic material is encountered less than 80 inches from ground surface.

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Table G-8
Volume of Growth Medium - Vulcan Project Area - Proposed Action

Project Component	Temporary Disturbance Area (acres)	Volume of Growth Medium in Temporary Disturbance Area (yd^3)*
Proposed Power Plants	94	63,189
Proposed Power Plant Substations	Within the footprint of the Power Plant site.	---
Proposed Bunejug Switching Station	5.75	3,865
Interconnect Transmission Lines	287	192,928
Pipelines	698	469,211
Well Pads	109	73,272
Geothermal Wells	Included in well pad disturbance footprint.	---
Water Wells	60	40,333
Well Pad Access Roads	Included in the pipeline corridor area of disturbance.	---
TOTAL:	**1253.75**	**842,799**

* Assumes a growth medium thickness of 6 inches.
--- = Not Applicable.

Table G-9
Volume of Growth Medium - Vulcan Project Area - Alternatives

	Temporary Disturbance Area (acres)	Volume of Growth Medium in Temporary Disturbance Area (yd^3)*
Alternative 1	1426.75	959,093

* Assumes a growth medium thickness of 6 inches.

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APPENDIX H
SUPPLEMENTAL BIOLOGICAL RESOURCES

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APPENDIX H
SUPPLEMENTAL BIOLOGICAL RESOURCES

Endangered, Threatened, Proposed, and Candidate Species in Churchill County

US Fish and Wildlife Service
Nevada Fish and Wildlife Office
Updated March 5, 2010, Printed from the USFWS web site on August 30, 2010

CHURCHILL COUNTY

Bird

C Greater sage-grouse	*Centrocercus urophasianus*

Fish

T Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*

E = Endangered T = Threatened C = Candidate

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At Risk Taxa Recorded Near the Salt Wells Project Area

Compiled by the Nevada Natural Heritage Program for Environmental Management and Planning Associates, Inc.
03 June 2010

Scientific name	Common name	Usfws	Blm	Usfs	State	Srank	Grank	UTM E	UTM N	Prec	Last observed
Plants											
Helianthus deserticola	dune sunflower					S3	G2G3Q	355333.91	4342565.02	S	2000-07-07
Helianthus deserticola	dune sunflower					S3	G2G3Q	349153.12	4334295.19	G	1976-06-19
Helianthus deserticola	dune sunflower					S3	G2G3Q	375845.05	4351773.39	G	1942-05-26
Oryctes nevadensis	oryctes		N			S2S3	G2G3	375821.08	4351773.77	G	1942-05-26
Invertebrates											
Limenitis archippus lahontani	Nevada viceroy					S1S2	G5T1T2	346574.14	4369134.10	M	1930-06-22
Pseudocopaeodes eunus flavus	Nevada alkali skipperling					S1	G3G4T3	356547.00	4366515.00	S	2004-06-01
Amphibians											
Rana pipiens	northern leopard frog		N	I;L	YES	S2S3	G5	340755.00	4370773.00	M	1939-11-11
Mammals											
Antrozous pallidus	pallid bat		N;C	I	YES	S3	G5	366150.87	4359242.45	S	1994-06-09
Brachylagus idahoensis	pygmy rabbit		N		YES	S3	G4	348234.94	4370921.09	G	1981-PRE
Corynorhinus townsendii	Townsend's big-eared bat		N;C	S;I;L	YES	S2	G4	360757.92	4360169.78	G	1953-08-26
Myotis ciliolabrum	western small-footed myotis		N;C			S3	G5	366150.87	4359242.45	S	1995-05-25
Myotis yumanensis	Yuma myotis		N;C			S3S4	G5	346959.36	4370483.51	G	1945-PRE
Myotis yumanensis	Yuma myotis		N;C			S3S4	G5	T18N R30E		S	1994-07-25
Pipistrellus hesperus	western pipistrelle		N			S4	G5	366150.87	4359242.45	S	1995-02-24
Birds											
Buteo swainsoni	Swainson's Hawk		N	I	YES	S2B	G5	T18N R28E		M	2000-06
Buteo swainsoni	Swainson's Hawk		N	I	YES	S2B	G5	T18N R28E		M	2000-06
Buteo swainsoni	Swainson's Hawk		N	I	YES	S2B	G5	T18N R28E		M	2000-06
Buteo swainsoni	Swainson's Hawk		N	I	YES	S2B	G5	T18N R29E		M	2000-06
Buteo swainsoni	Swainson's Hawk		N	I	YES	S2B	G5	T17N R29E		M	2000-06
Buteo swainsoni	Swainson's Hawk		N	I	YES	S2B	G5	T18N R28E		M	2000-06
Buteo swainsoni	Swainson's Hawk		N	I	YES	S2B	G5	T18N R29E		M	2000-06
Buteo swainsoni	Swainson's Hawk		N	I	YES	S2B	G5	T18N R29E		M	2000-06
Charadrius alexandrinus nivosus	Western Snowy Plover		N		YES	S3B	G4T3	352853.62	4354048.25	G	1993-06
Chlidonias niger	Black Tern		N		YES	S2S3B	G4	354492.69	4351495.07	G	1986-06-02
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	C	S	I	YES	S1B	G5T3Q	CARSON LAKE		G	1986-06-24
Pelecanus erythrorhynchos	American White Pelican		P		YES	S2B	G3	355101.66	4355893.79	S	1987-01-04
Plegadis chihi	White-faced Ibis		P		YES	S3B	G5	354702.28	4353742.49	G	1978

U. S. Fish and Wildlife Service (Usfws) Categories for Listing under the Endangered Species Act:

- C Candidate

Bureau of Land Management (Blm) Species Classification:

- S Nevada Special Status Species - USFWS listed, proposed or candidate for listing, or protected by Nevada state law
- N Nevada Special Status Species - designated Sensitive by State Office
- P Proposed Nevada Special Status Species

- C California Special Status Species (see definition S and N)

United States Forest Service (Usfs) Species Classification:

- S Region 4 (Humboldt-Toiyabe NF) sensitive species
- I Region 5 (Inyo NF) sensitive species
- L Region 5 (Lake Tahoe Basin Management Unit) sensitive species

Nevada State Protected (State) Species Classification:

Fauna:

- YES Species protected under NRS 501.

Precision (Prec) of Mapped Occurrence:

Precision, or radius of uncertainty around latitude/longitude coordinates:

- S Seconds: within a three-second radius
- M Minutes: within a one-minute radius, approximately 2 km or 1.5 miles
- G General: within about 8 km or 5 miles, or to map quadrangle or place name

Nevada Natural Heritage Program Global (**Grank**) and State (**Srank**) Ranks for Threats and/or Vulnerability:

- G Global rank indicator, based on worldwide distribution at the species level
- T Global trinomial rank indicator, based on worldwide distribution at the infraspecific level
- S State rank indicator, based on distribution within Nevada at the lowest taxonomic level
  - l Critically imperiled and especially vulnerable to extinction or extirpation due to extreme rarity, imminent threats, or other factors
  - 2 Imperiled due to rarity or other demonstrable factors
  - 3 Vulnerable to decline because rare and local throughout its range, or with very restricted range
  - 4 Long-term concern, though now apparently secure; usually rare in parts of its range, especially at its periphery
  - 5 Demonstrably secure, widespread, and abundant
    - A Accidental within Nevada
    - B Breeding status within Nevada (excludes resident taxa)
    - H Historical; could be rediscovered
    - N Non-breeding status within Nevada (excludes resident taxa)
    - Q Taxonomic status uncertain
    - U Unrankable
    - Z Enduring occurrences cannot be defined (usually given to migrant or accidental birds)
    - ? Assigned rank uncertain

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Nevada Fish and Wildlife Office
1340 Financial Blvd., Suite 234
Reno, Nevada 89502
Ph: (775) 861-6300 ~ Fax: (775) 861-6301

RECEIVED BUREAU OF LAND MGMT CARSON CITY DISTRICT OFFICE

August 17, 2009
File No. 2009-SL-0442

Memorandum

To: Wildlife Biologist, Stillwater Field Office, Bureau of Land Management, Carson City, Nevada

From: State Supervisor, Nevada Fish and Wildlife Office, Reno, Nevada

Subject: Species List Request for the Salt Wells Geothermal Energy Projects in Churchill County, Nevada

This responds to your letter received on July 23, 2009, requesting a species list for the Salt Wells Geothermal Energy Projects in Churchill County, Nevada. To the best of our knowledge, no listed, proposed, or candidate species occur in the subject project area. This response fulfills the requirements of the Fish and Wildlife Service (Service) to provide a list of species pursuant to section 7(c) of the Endangered Species Act of 1973 (Act), as amended, for projects that are authorized, funded, or carried out by a Federal agency.

The Nevada Fish and Wildlife Office no longer provides species of concern lists. Most of these species for which we have concern are also on the sensitive species list for Nevada maintained by the State of Nevada's Natural Heritage Program (Heritage). Instead of maintaining our own list, we are adopting Heritage's sensitive species list and partnering with them to provide distribution data and information on the conservation needs for sensitive species to agencies or project proponents. The mission of Heritage is to continually evaluate the conservation priorities of native plants, animals, and their habitats, particularly those most vulnerable to extinction or in serious decline. Consideration of these sensitive species and exploring management alternatives early in the planning process can provide long-term conservation benefits and avoid future conflicts.

For a list of sensitive species by county, visit Heritage's website at www.heritage.nv.gov. For a specific list of sensitive species that may occur in the project area, you can obtain a data request form from the website or by contacting Heritage at 901 South Stewart Street, Suite 5002,

TAKE PRIDE IN AMERICA

Carson City, Nevada 89701-5245, (775) 684-2900. Please indicate on the form that your request is being obtained as part of your coordination with the Service under the Act. During your project analysis, if you obtain new information or data for any Nevada sensitive species, we request that you provide the information to Heritage at the above address. Furthermore, certain species of fish and wildlife are classified as protected by the State of Nevada (see http://www.leg.state.nv.us/NAC/NAC-503.html). Before a person can hunt, take, or possess any parts of wildlife species classified as protected, they must first obtain the appropriate license, permit, or written authorization from the Nevada Department of Wildlife (visit http://www.ndow.org or call 775-688-1500).

We are concerned that the project may impact the greater sage-grouse (*Centrocercus urophasianus*), a species listed as sensitive under the Nevada Natural Heritage Program. On February 26, 2008, the Service published in the Federal Register an initiation of a status review for the species as threatened or endangered under the Act. The Western States Sage and Columbian Sharp-tailed Grouse Technical Committee, under direction of the Western Association of Fish and Wildlife Agencies, has developed and published guidelines to manage and protect sage-grouse and their habitats in the Wildlife Society Bulletin (Connelly *et al*. 2000). We ask that you consider incorporating these guidelines (http://ndow.org/wild/sg) into the proposed project. On a more local level, the Sage Grouse Conservation Plan for Nevada and Portions of Eastern California was completed in June 2004. The Plan is available online at: http://www.ndow/org/wild/sg/plan/index.shtm. We encourage you to adopt all appropriate management guidance from this Plan as you implement your proposed action.

We are concerned that the project may impact the pygmy rabbit (*Brachylagus idahoensis*). On January 8, 2008, the Service published a substantial 90-day finding on a petition to list the pygmy rabbit as threatened or endangered under the Act, thus initiating a status review of the species. Draft survey guidelines have been developed for this species and are available upon request from the Nevada Fish and Wildlife Office. We encourage you to survey the proposed project area for pygmy rabbits prior to any ground disturbing activities and to consider the needs of this species as you complete project planning and implementation.

Because wetlands, springs, or streams occur in the vicinity of the project area, we ask that you be aware of potential impacts project activities may have on these habitats. Discharge of fill material into wetlands or waters of the United States is regulated by the U.S. Army Corps of Engineers (COE) pursuant to section 404 of the Clean Water Act of 1972, as amended. We recommend you contact the COE's Regulatory Section, 300 Booth Street, Room 2103, Reno, Nevada 89509, (775) 784-5304, regarding the possible need for a permit.

Based on the Service's conservation responsibilities and management authority for migratory birds under the Migratory Bird Treaty Act of 1918 (MBTA), as amended (16 U.S.C. 703 *et seq.*), we are concerned about potential impacts the proposed project may have on migratory birds in the area. Given these concerns, we recommend that any land clearing or other surface disturbance associated with proposed actions within the project area be timed to avoid potential destruction of bird nests or young, or birds that breed in the area. Such destruction may be in violation of the MBTA. Under the MBTA, nests with eggs or young of migratory birds may not be harmed, nor may migratory birds be killed. Therefore, we recommend land clearing be

conducted outside the avian breeding season. If this is not feasible, we recommend a qualified biologist survey the area prior to land clearing. If nests are located, or if other evidence of nesting (*i.e.*, mated pairs, territorial defense, carrying nesting material, transporting food) is observed, a protective buffer (the size depending on the habitat requirements of the species) should be delineated and the entire area avoided to prevent destruction or disturbance to nests until they are no longer active.

Please reference File No. 2009-SL-0442 in future correspondence concerning this species list. If you have any questions regarding this correspondence or require additional information, please contact me or Chad Mellison at (775) 861-6300.

Marcy Hawkins

Robert D. Williams

STATE OF NEVADA

DEPARTMENT OF WILDLIFE

1100 Valley Road
Reno, Nevada 89512
(775) 688-1500 • Fax (775) 688-1595

JIM GIBBONS
Governor

KENNETH E. MAYER
Director

RICHARD L. HASKINS II
Deputy Director

April 1, 2010

Jennifer Thies
Environmental Management and Planning Solutions, Inc.
325 Airmotive Way, Suite 175A
Reno, Nevada 89502

Re: Salt Wells Geothermal Project – Vulcan Project Area

Dear Ms. Thies:

I am responding to your letter requesting information from the Nevada Department of Wildlife (NDOW) on the known or potential occurrence of wildlife species within the Vulcan project area associated with the Salt Wells Geothermal Project. To perform this analysis we developed a three mile buffer around the project area provided by you via email (March 18, 2010) and searched our data records for species occurrences within this area of interest.

A review of our data sources has produced the following information:

Big Game –The three species of big game occurring in the area are bighorn sheep, mule deer, and pronghorn antelope. The attached maps depict the distribution areas for these species in relation to the project area.

Raptors - Various species of raptors, which use diverse habitat types, are known to reside within the area of interest. Within the specified project area and designated buffer area are species such as great horned owl, red-tailed hawk, Cooper's hawk, golden eagle, and northern goshawk, all of which are protected by State and Federal laws. In addition, the northern goshawk is a NDOW species of special concern and is a target species for conservation as outlined by the Nevada Wildlife Action Plan.

There are 7 raptor nests within the three-mile buffer zone and two raptor nests within one mile or less of the project area. These two nests are located in T17N R30E Section 28, and T18N R31E Section 31.

Here is a complete list of raptor species that are known by NDOW to have habitat range in the area of interest:

American kestrel; barn owl; burrowing owl; Cooper's hawk; ferruginous hawk; golden eagle; great horned owl; long-eared owl; northern goshawk; northern harrier; northern saw-whet owl; osprey; peregrine falcon; prairie falcon; red-tailed hawk; sharp-shinned hawk; short-eared owl; Swainson's hawk; turkey vulture and western screech owl.

Ferruginous hawk distribution occurs in the southwest of the project area and three-mile buffer area. A map depicting this distribution is included with this letter.

A list of all of the species occurrences recorded by the NDOW within the area of interest has also been included with this letter.

The above information is based on data stored at our headquarters office in Reno, and may or may not represent accurate current environmental conditions for your project area. I suggest and recommend that you contact the following biologists at our Western Region Winnemucca Field Office (775-623-6505) for more information:

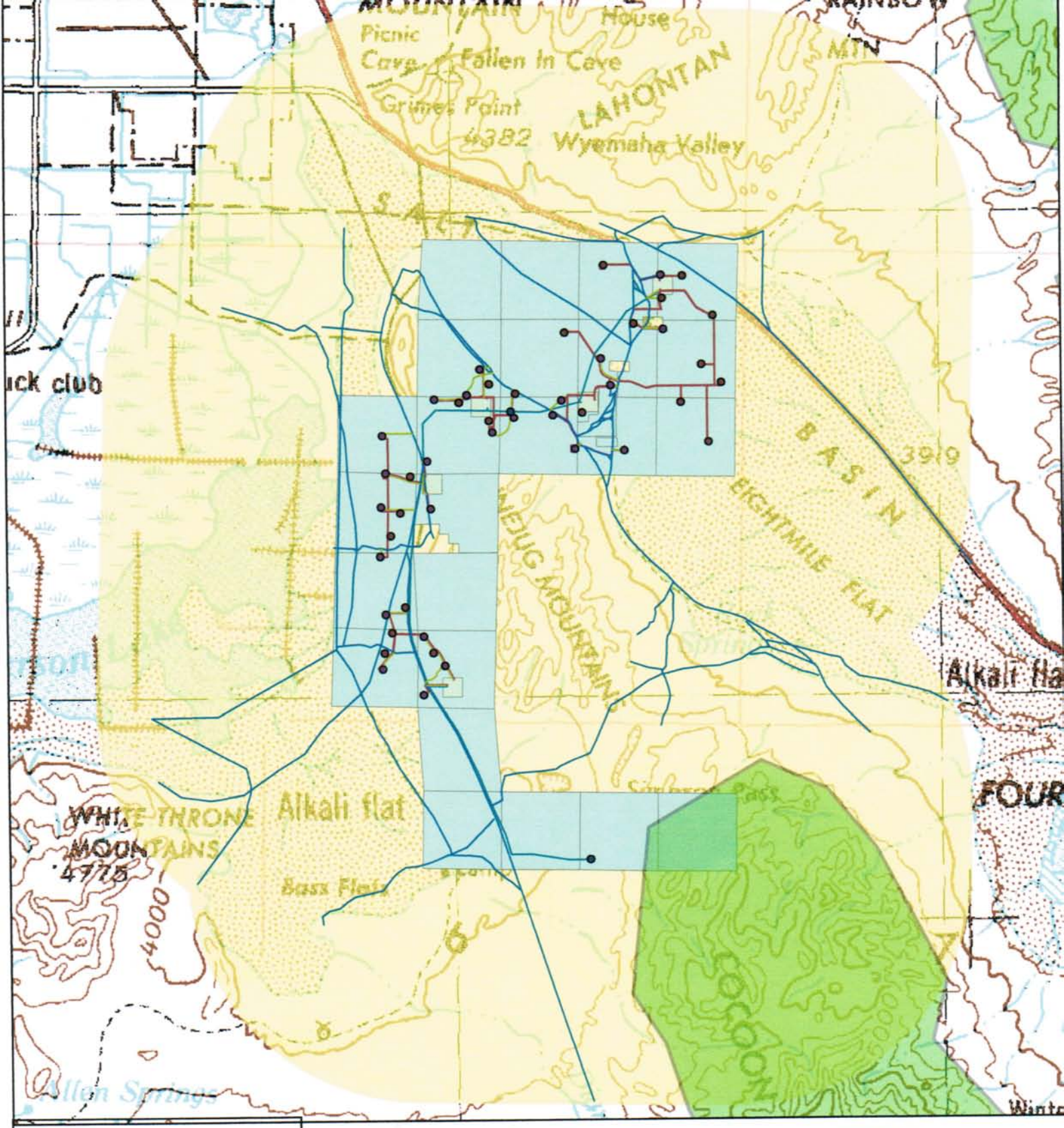
Clint Garrett, Habitat Biologist or
Kenny Pirkle, Habitat Mining Biologist.

If you have any questions or require more information, please do not hesitate to contact our office at 775-688-1565.

Sincerely,

Tim Herrick

Tim Herrick
Conservation Aide 3
Wildlife Diversity Division



Legend

- Vulcan Leases
- 3 Mile Buffer
- Existing Roads
- Bighorn Sheep Distribution

Z:\ActiveProjects\DataRequests\Consultants\EMPSi\SaltWells\Vulcan

Salt Wells, Vulcan Project Area and Big Horn Sheep Distribution

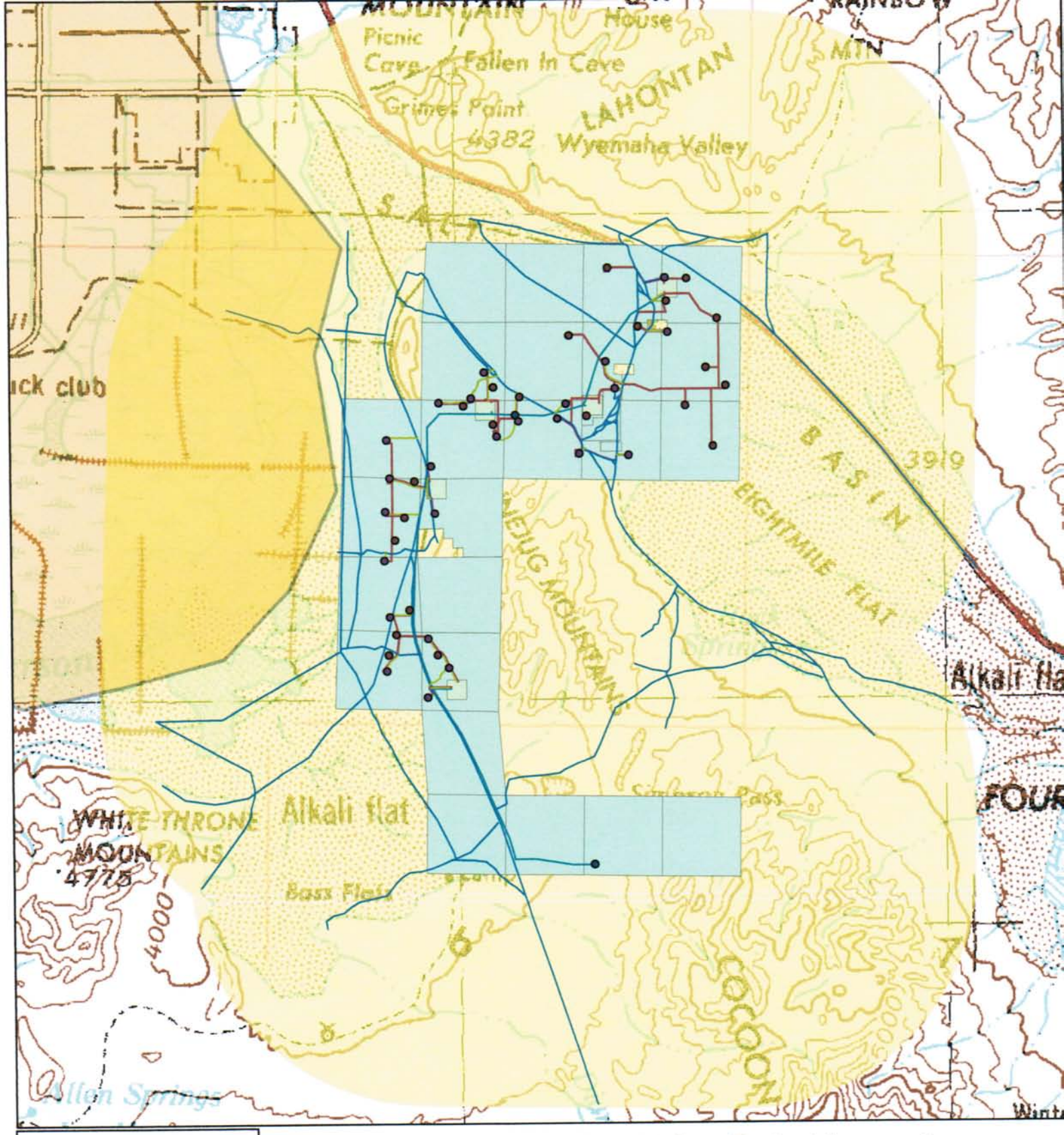
April 1, 2010

0 0.75 1.5 2.25 3 Miles

1 in = 2 miles

N

No warranty is made by the Nevada Department of Wildlife as to the accuracy, reliability, or completeness of the data for individual use or aggregate use with other data.



Legend

- Vulcan Leases
- 3 Mile Buffer
- Existing Roads
- Mule Deer Distribution

Salt Wells, Vulcan Project Area and Mule Deer Distribution

April 1, 2010

0 0.75 1.5 2.25 3 Miles

1 in = 2 miles

N

NEVADA DEPARTMENT OF WILDLIFE

No warranty is made by the Nevada Department of Wildlife as to the accuracy, reliability, or completeness of the data for individual use or aggregate use with other data.

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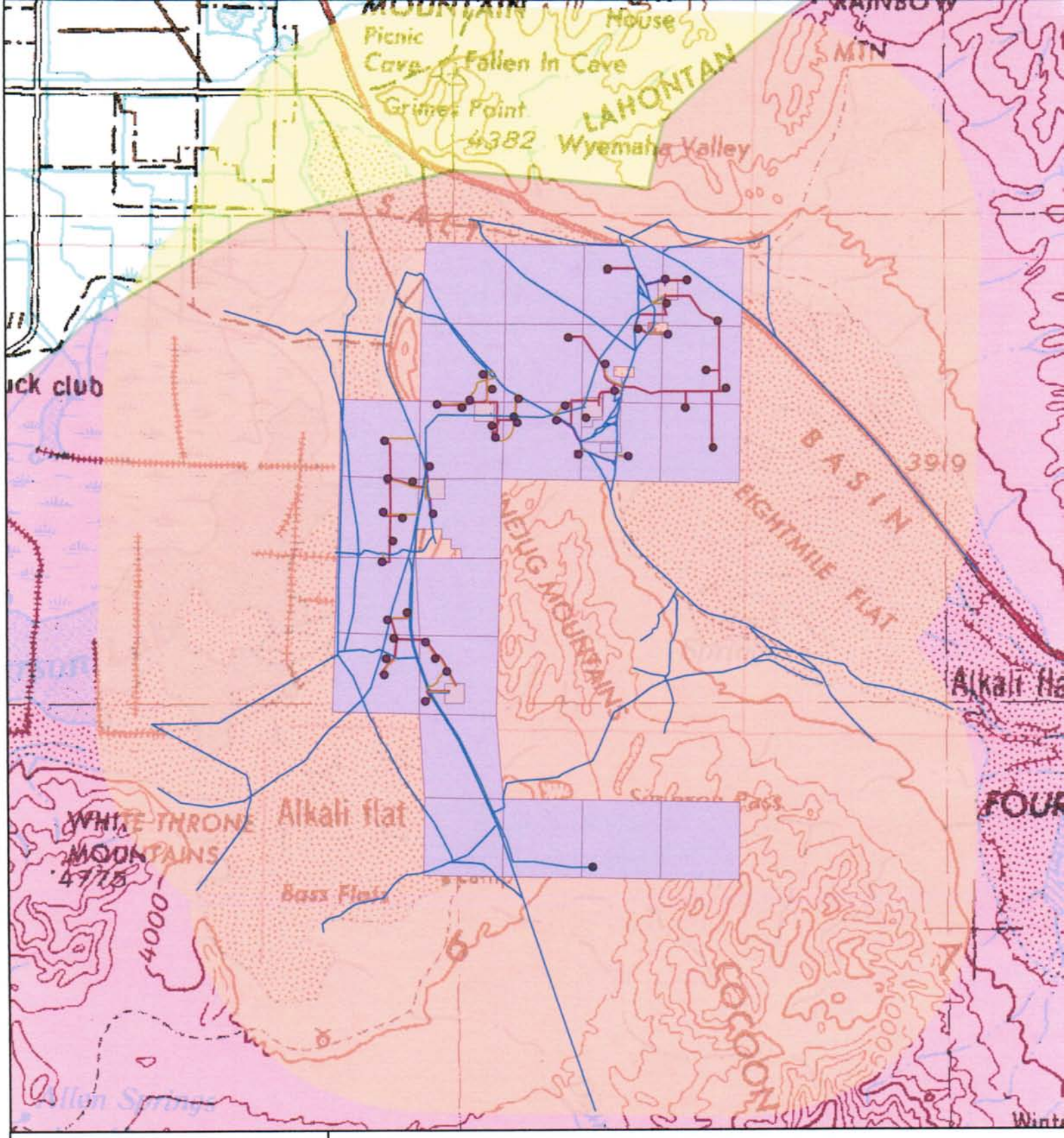

Legend

- Vulcan Leases
- 3 Mile Buffer
- Existing Roads
- Pronghorn Antelope Distribution

Salt Wells, Vulcan Project Area and Pronghorn Antelope Distribution

April 1, 2010

0 0.75 1.5 2.25 3 Miles

1 in = 2 miles

N

No warranty is made by the Nevada Department of Wildlife as to the accuracy, reliability, or completeness of the data for individual use or aggregate use with other data.

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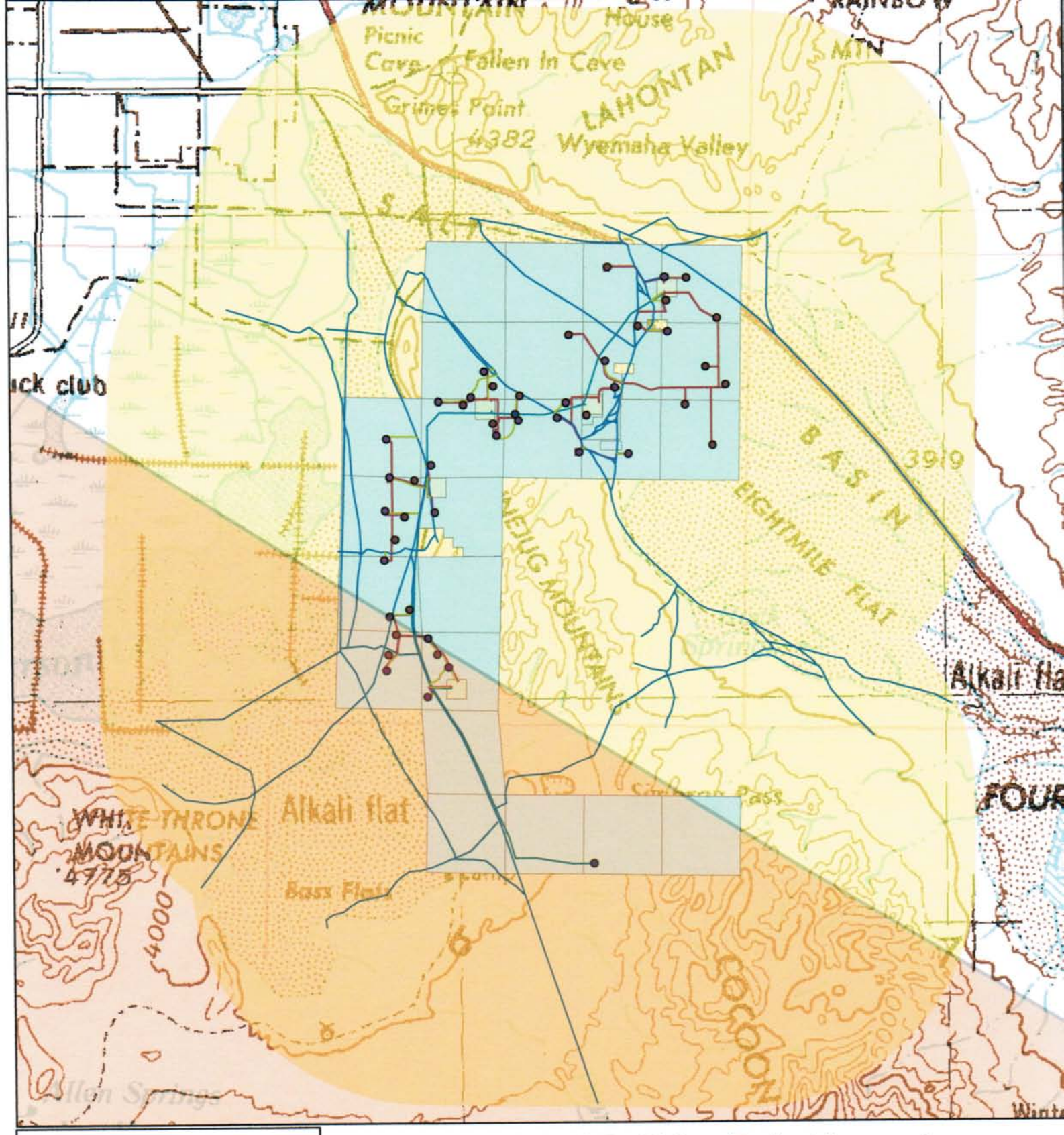

Legend

- Vulcan Leases
- 3 Mile Buffer
- Existing Roads
- Ferruginous Hawk Distribution

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Salt Wells, Vulcan Project Area and Ferruginous Hawk Distribution

April 1, 2010

0 0.75 1.5 2.25 3 Miles

1 in = 2 miles

N

No warranty is made by the Nevada Department of Wildlife as to the accuracy, reliability, or completeness of the data for individual use or aggregate use with other data.

NEVADA DEPARTMENT OF WILDLIFE

Salt Wells, Vulcan Project, species recored in the project area and surrounding buffer.

Within SW_Leases1_8_10

COMMON NAME	SPECIES
desert horned lizard	Phrynosoma platyrhinos
Great Basin collared lizard	Crotaphytus bicinctores
long-nosed leopard lizard	Gambelia wislizenii
yellow-backed spiny lizard	Sceloporus uniformis
zebra-tailed lizard	Callisaurus draconoides

Within 3 Mile Buffer

COMMON NAME	SPECIES
American avocet	Recurvirostra americana
American bittern	Botaurus lentiginosus
American coot	Fulica americana
American golden-plover	Pluvialis dominica
bald eagle	Haliaeetus leucocephalus
black-crowned night-heron	Nycticorax nycticorax
Brazilian free-tailed bat	Tadarida brasiliensis
bullfrog	Rana catesbeiana
common sagebrush lizard	Sceloporus graciosus
common side-blotched lizard	Uta stansburiana
desert horned lizard	Phrynosoma platyrhinos
Eurasian wigeon	Anas penelope
golden eagle	Aquila chrysaetos
gophersnake	Pituophis catenifer
Great Basin collared lizard	Crotaphytus bicinctores
Great Basin pocket mouse	Perognathus parvus
Great Basin whiptail	Aspidoscelis tigris tigris
green heron	Butorides virescens
kit fox	Vulpes macrotis
least bittern	Ixobrychus exilis
little pocket mouse	Perognathus longimembris
long-nosed leopard lizard	Gambelia wislizenii
long-tailed duck	Clangula hyemalis
long-tailed jaeger	Stercorarius longicaudus
Merriam's kangaroo rat	Dipodomys merriami
mountain plover	Charadrius montanus
northern grasshopper mouse	Onychomys leucogaster
osprey	Pandion haliaetus
pale kangaroo mouse	Microdipodops pallidus
pallid bat	Antrozous pallidus
peregrine falcon	Falco peregrinus
red phalarope	Phalaropus fulicaria
red-breasted merganser	Mergus serrator
ruddy turnstone	Arenaria interpres
ruff	Philomachus pugnax
sanderling	Calidris alba
sandhill Crane	Grus canadensis
short-eared owl	Asio flammeus
snowy egret	Egretta thula
tiger whiptail	Aspidoscelis tigris
western fence lizard	Sceloporus occidentalis
western mosquitofish	Gambusia affinis
western patch-nosed snake	Salvadora hexalepis
western pipistrelle	Pipistrellus hesperus
western small-footed myotis	Myotis ciliolabrum
whimbrel	Numenius phaeopus
white-faced ibis	Plegadis chihi
yellow-backed spiny lizard	Sceloporus uniformis
zebra-tailed lizard	Callisaurus draconoides

STATE OF NEVADA

DEPARTMENT OF WILDLIFE

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JIM GIBBONS
Governor

KENNETH E. MAYER
Director

RICHARD L. HASKINS II
Deputy Director

Jennifer Thies
Environmental Management and Planning Solutions, Inc.
325 Airmotive Way, Suite 175A
Reno, Nevada 89502

March 30, 2010

Re: Salt Wells Geothermal Project – Proposed Sierra Pacific Transmission Line

Dear Ms. Thies:

I am responding to your letter requesting information from the Nevada Department of Wildlife (NDOW) on the known or potential occurrence of wildlife species within the proposed transmission line associated with the Salt Wells Geothermal Project. To perform this analysis we developed a three-mile buffer around the project area provided by you via email (March 18, 2010) and searched our data records for species occurrences within this area of interest.

A review of our data sources has produced the following information:

Big Game –The three species of big game occurring in the area are bighorn sheep, mule deer, and pronghorn antelope. The attached maps depict the distribution areas for these species in relation to the proposed transmission line project area and area of interest.

Raptors - Various species of raptors, which use diverse habitat types, are known to reside within the area of interest. Within the specified project area and designated buffer area are species such as great horned owl, red-tailed hawk, Cooper's hawk, golden eagle, and northern goshawk, all of which are protected by State and Federal laws. In addition, the northern goshawk is a NDOW species of special concern and is a target species for conservation as outlined by the Nevada Wildlife Action Plan.

There are 14 raptor nests within the three-mile buffer zone and three raptor nests within one mile or less of the proposed transmission line. These three nests are located in T18N R28E Sections 11, 23, and 24.

Here is a complete list of raptor species that are known by NDOW to have habitat range in the area of interest:

American kestrel; barn owl; burrowing owl; Cooper's hawk; ferruginous hawk; golden eagle; great horned owl; long-eared owl; northern goshawk; northern harrier; northern saw-whet owl; osprey; peregrine falcon; prairie falcon; red-tailed hawk; sharp-shinned hawk; short-eared owl; Swainson's hawk; turkey vulture and western screech owl.

A list of all of the species occurrences recorded by the NDOW within the area of interest has been included with this letter.

The above information is based on data stored at our headquarters office in Reno, and may or may not represent accurate current environmental conditions for your project area. I suggest and recommend that you contact the following biologists at our Western Region Winnemucca Field Office (775-623-6505) for more information:

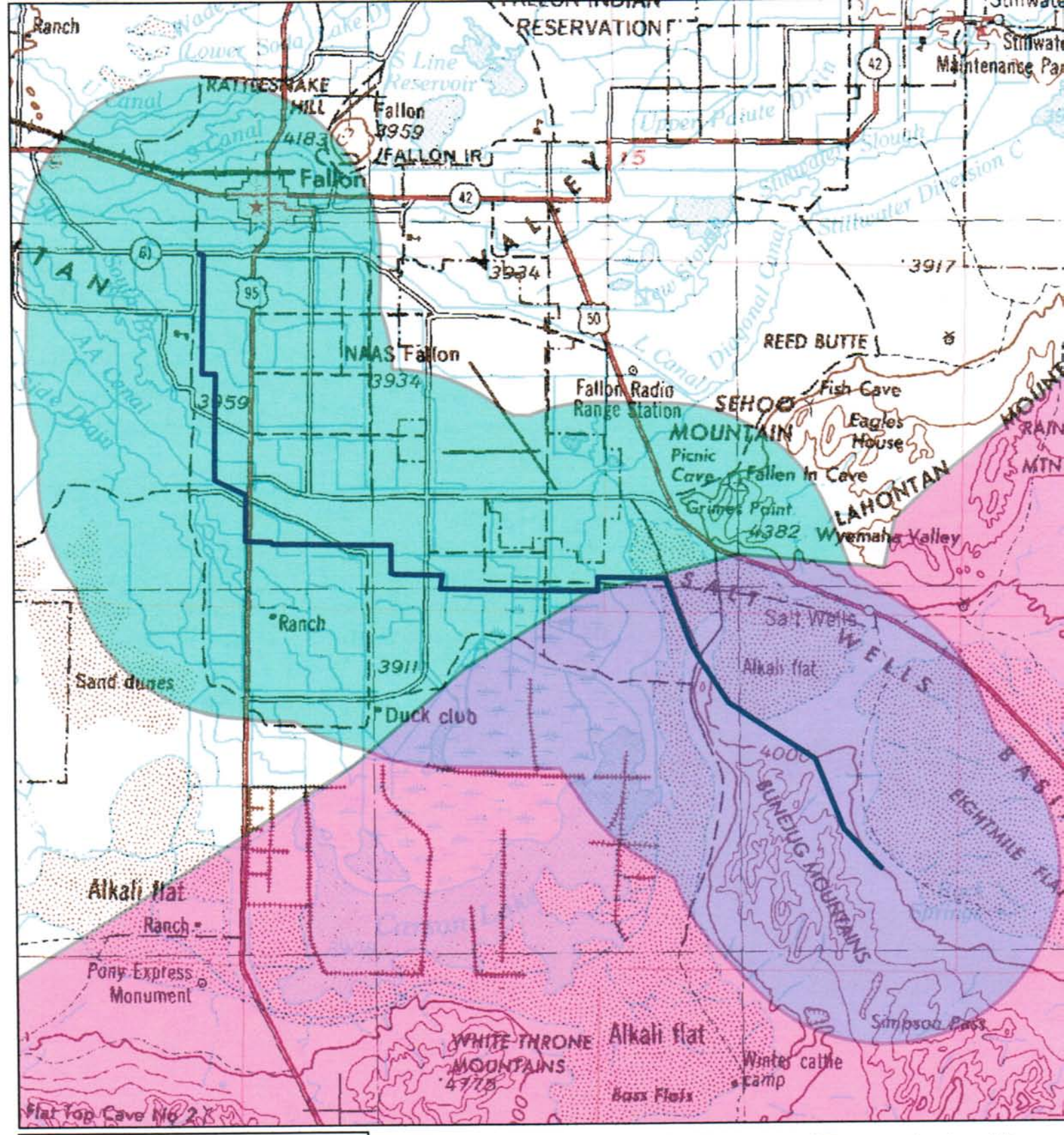
Clint Garrett, Habitat Biologist or
Kenny Pirkle, Habitat Mining Biologist.

If you have any questions or require more information, please do not hesitate to contact our office at 775-688-1565.

Sincerely,

Tim Herrick

Tim Herrick
Conservation Aide 3
Wildlife Diversity Division



Legend

- Proposed Transmission Line
- Pronghorn Antelope Distribution
- 3 Mile Buffer

Salt Wells, Sierra Pacific Proposed Transmission Line and Pronghorn Antelope Distribution

March 30, 2010

0 0.5 1 2 3 4 Miles

1 in = 2 miles

N

No warranty is made by the Nevada Department of Wildlife as to the accuracy, reliability, or completeness of the data for individual use or aggregate use with other data.

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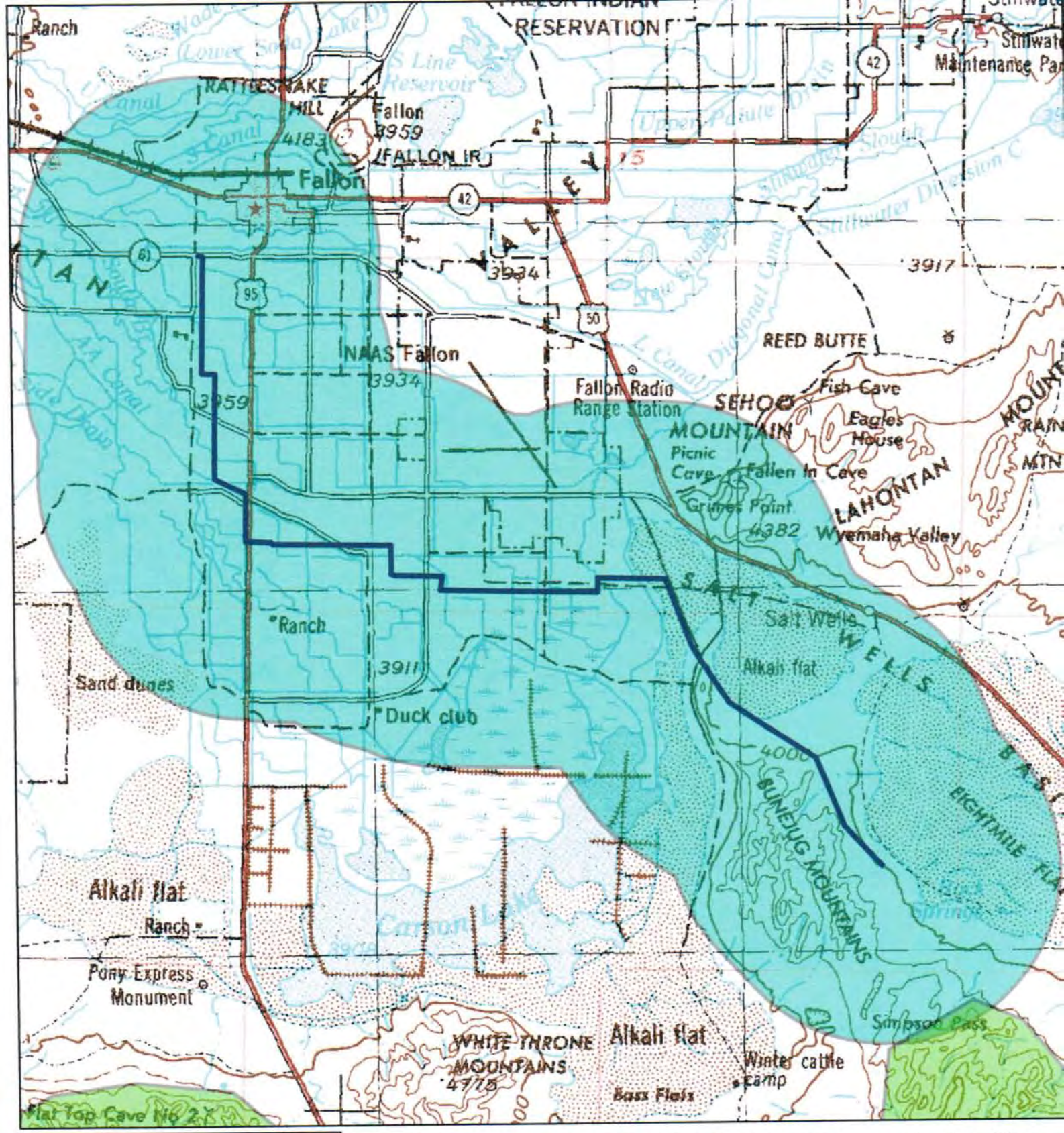

Legend

- Proposed Transmission Line
- Bighorn Sheep Distribution
- 3 Mile Buffer

Salt Wells, Sierra Pacific Proposed Transmission Line and Bighorn Sheep Distribution

March 30, 2010

0 0.5 1 2 3 4 Miles

1 in = 2 miles

N

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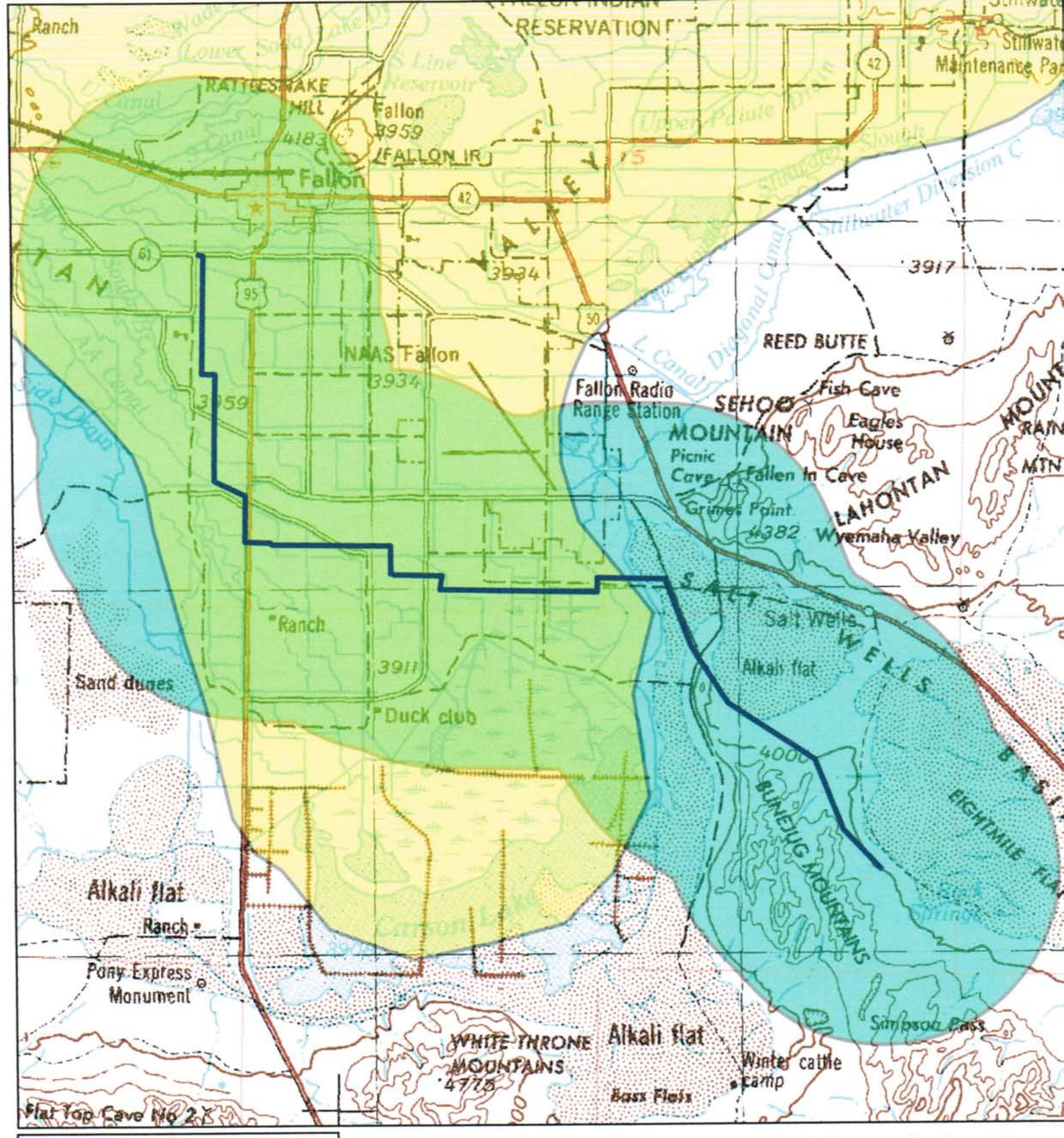

Legend

- Proposed Transmission Line
- Mule Deer Distribution
- 3 Mile Buffer

Salt Wells, Sierra Pacific Proposed Transmission Line and Mule Deer Distribution

March 30, 2010

0 0.5 1 2 3 4 Miles

1 in = 2 miles

N

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Salt Wells, Sierra Pacific transmission line Project, species recorded in project area and surrounding buffer.

COMMON NAME	SPECIES
acorn woodpecker	Melanerpes formicivorus
American avocet	Recurvirostra americana
American beaver	Castor canadensis
American bittern	Botaurus lentiginosus
American coot	Fulica americana
American kestrel	Falco sparverius
American white pelican	Pelecanus erythrorhynchos
bald eagle	Haliaeetus leucocephalus
band-tailed pigeon	Patagioenas fasciata
barn owl	Tyto alba
big brown bat	Eptesicus fuscus
black bullhead	Ameiurus melas
black-crowned night-heron	Nycticorax nycticorax
black-necked stilt	Himantopus mexicanus
Brazilian free-tailed bat	Tadarida brasiliensis
bullfrog	Rana catesbeiana
cinnamon teal	Anas cyanoptera
common carp	Cyprinus carpio
common raven	Corvus corax
common sagebrush lizard	Sceloporus graciosus
common side-blotched lizard	Uta stansburiana
cooper's hawk	Accipiter cooperii
cougar	Felis concolor
desert horned lizard	Phrynosoma platyrhinos
european starling	Sturnus vulgaris
ferruginous hawk	Buteo regalis
gadwall	Anas strepera
golden eagle	Aquila chrysaetos
Great Basin collared lizard	Crotaphytus bicinctores
Great Basin gophersnake	Pituophis catenifer deserticola
Great Basin whiptail	Aspidoscelis tigris tigris
great blue heron	Ardea herodias
great egret	Ardea alba
great horned owl	Bubo virginianus
greater sage-grouse	Centrocercus urophasianus
great-tailed grackle	Quiscalus mexicanus
green-winged teal	Anas crecca
Harlan's hawk	Buteo jamaicensis harlani
Harris's sparrow	Zonotrichia querula
hermit thrush	Catharus guttatus
killdeer	Charadrius vociferus
least bittern	Ixobrychus exilis
Lewis's woodpecker	Melanerpes lewis
long-nosed leopard lizard	Gambelia wislizenii
long-tailed weasel	Mustela frenata
mallard	Anas platyrhynchos

merlin	Falco columbarius
northern pintail	Anas acuta
northern shoveler	Anas clypeata
northern shrike	Lanius excubitor
osprey	Pandion haliaetus
pallid bat	Antrozous pallidus
peregrine falcon	Falco peregrinus
prairie falcon	Falco mexicanus
redhead	Aythya americana
red-shouldered hawk	Buteo lineatus
red-tailed hawk	Buteo jamaicensis
ring-billed gull	Larus delawarensis
roughleg hawk	Buteo lagopus
ruddy duck	Oxyura jamaicensis
Sacramento blackfish	Orthodon microlepidotus
Sacramento perch	Archoplites interruptus
sandhill crane	Grus canadensis
sharp-shinned hawk	Accipiter striatus
Swainson's hawk	Buteo swainsoni
tiger whiptail	Aspidoscelis tigris
tui chub	Gila bicolor
vermilion flycatcher	Pyrocephalus rubinus
western burrowing owl	Athene cunicularia
western fence lizard	Sceloporus occidentalis
western mosquitofish	Gambusia affinis
western red bat	Lasiurus blossevillii
western screech-owl	Otus kennicottii
western small-footed myotis	Myotis ciliolabrum
whimbrel	Numenius phaeopus
white bass	Morone chrysops
white crappie	Pomoxis annularis
white-crowned sparrow	Zonotrichia leucophrys
white-faced ibis	Plegadis chihi
yellow-backed spiny lizard	Sceloporus uniformis
yellow-billed cuckoo	Coccyzus americanus
zebra-tailed lizard	Callisaurus draconoides

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JIM GIBBONS
Governor

KENNETH E. MAYER
Director

RICHARD L. HASKINS II
Deputy Director

April 12, 2010

Jennifer Thies
Environmental Management and Planning Solutions, Inc.
325 Airmotive Way, Suite 175A
Reno, Nevada 89502

Re: Salt Wells Geothermal Project – Carson Lake/Ormat Area

Dear Ms. Thies:

I am responding to your letter requesting information from the Nevada Department of Wildlife (NDOW) on the known or potential occurrence of wildlife species within the proposed transmission line associated with the Salt Wells Geothermal Project. To perform this analysis we developed a three-mile buffer around the project area provided by you via email (April 7, 2010) and searched our data records for species occurrences within this area of interest.

A review of our data sources has produced the following information:

Big Game –The two species of big game occurring in the area are mule deer and pronghorn antelope. The attached maps depict the distribution areas for these species in relation to the proposed Carson Lake/Ormat project area and area of interest.

Raptors - Various species of raptors, which use diverse habitat types, are known to reside within the area of interest. Within the specified project area and designated buffer area are species such as great horned owl, red-tailed hawk, Cooper's hawk, golden eagle, and northern goshawk, all of which are protected by State and Federal laws. In addition, the northern goshawk is a NDOW species of special concern and is a target species for conservation as outlined by the Nevada Wildlife Action Plan.

There are 14 raptor nests within the three-mile buffer zone and two raptor nests within Carson Lake/Ormat project area. These two nests are located in T18N R28E Sections 20 and 29.

Here is a complete list of raptor species that are known by NDOW to have habitat range covering the entire area of interest:

American kestrel; barn owl; burrowing owl; Cooper's hawk; golden eagle; great horned owl; long-eared owl; northern goshawk; northern harrier; northern saw-whet owl; osprey; peregrine falcon; prairie falcon; red-tailed hawk; sharp-shinned hawk; short-eared owl; Swainson's hawk; turkey vulture and western screech owl.

Ferruginous hawk range occurs in the southwest portion of the Carson Lake/Ormat area of interest (see attached map).

A list of all of the species occurrences recorded by the NDOW within the area of interest has been included with this letter.

The above information is based on data stored at our headquarters office in Reno, and may or may not represent accurate current environmental conditions for your project area. I suggest and recommend that you contact the following biologists at our Western Region Winnemucca Field Office (775-623-6505) for more information:

Clint Garrett, Habitat Biologist or
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If you have any questions or require more information, please do not hesitate to contact our office at 775-688-1565.

Sincerely,

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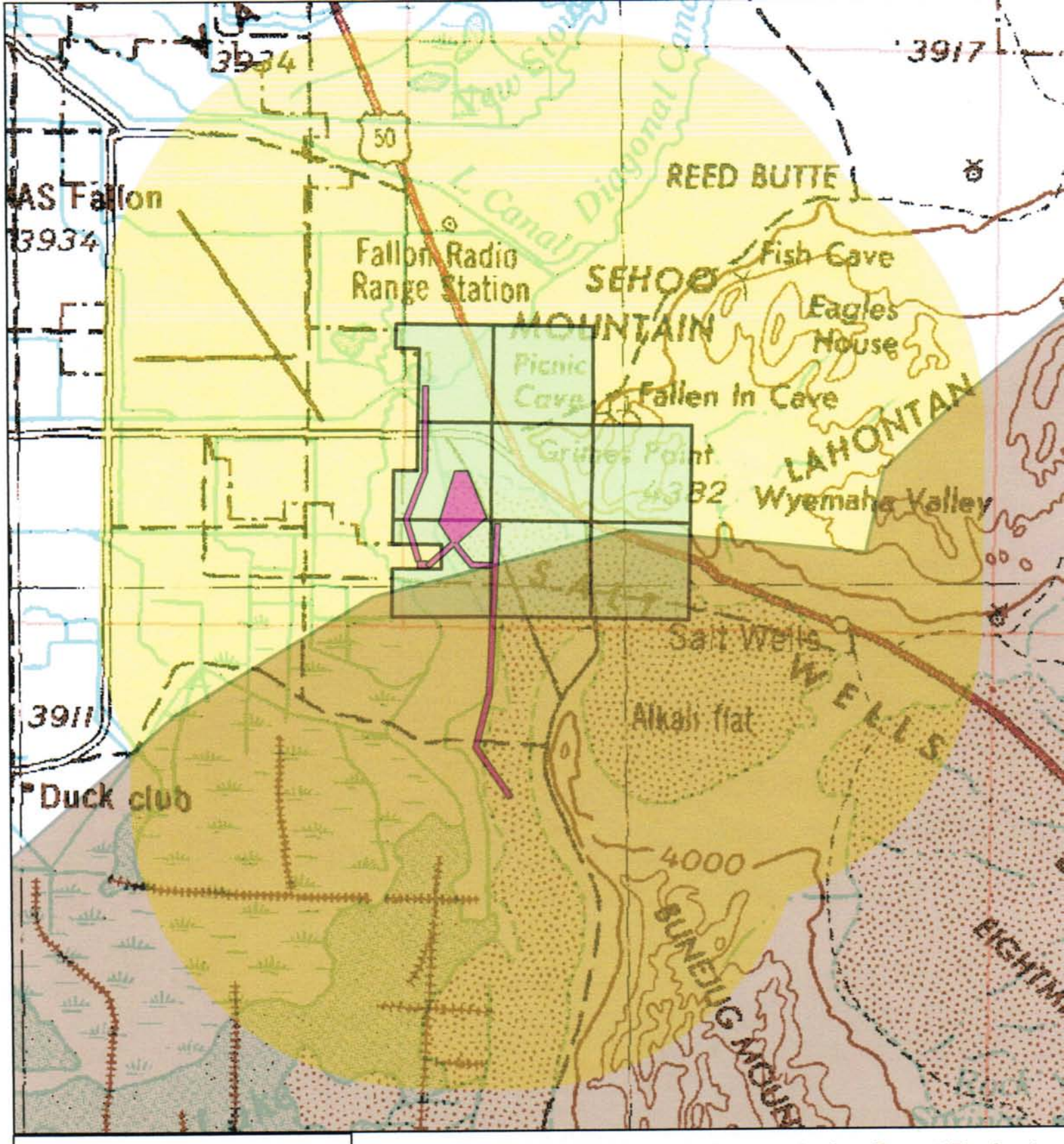
Conservation Aide 3
Wildlife Diversity Division



Legend

- NSO Ormat
- Ormat Lease Area
- 3 Mile Buffer
- Pronghorn Antelope Distribution

Salt Wells, Sierra Pacific Carson Lake, Ormat Project and Pronghorn Antelope Distribution

April 12, 2010

0 0.3 0.6 1.2 1.8 2.4 Miles

1 in = 1 miles

N

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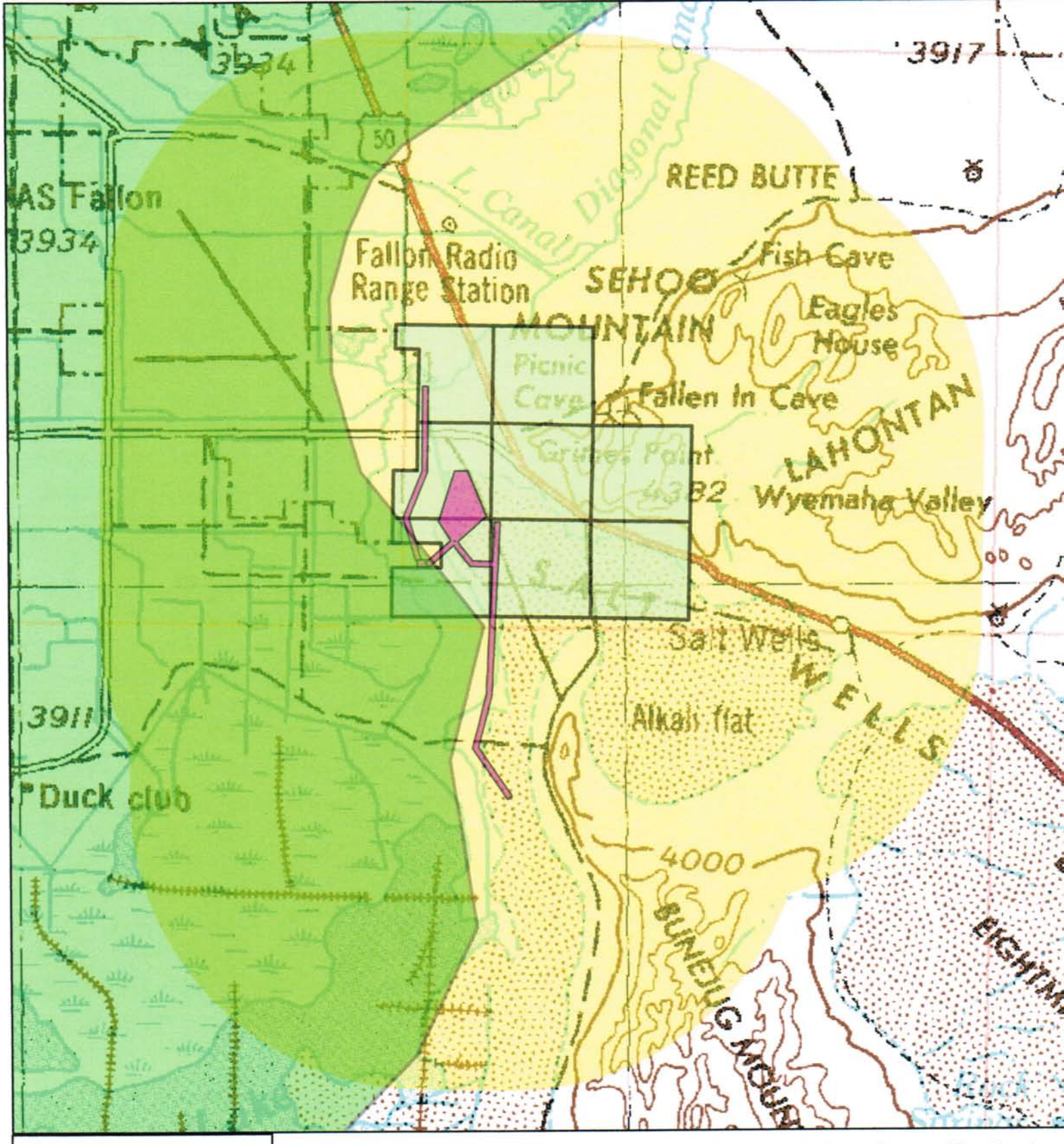

Legend

- NSO Ormat
- Ormat Lease Area
- 3 Mile Buffer
- Mule Deer Distribution

Salt Wells, Sierra Pacific Carson Lake, Ormat Project and Mule Deer Distribution

April 12, 2010

0 0.3 0.6 1.2 1.8 2.4 Miles

1 in = 1 miles

N

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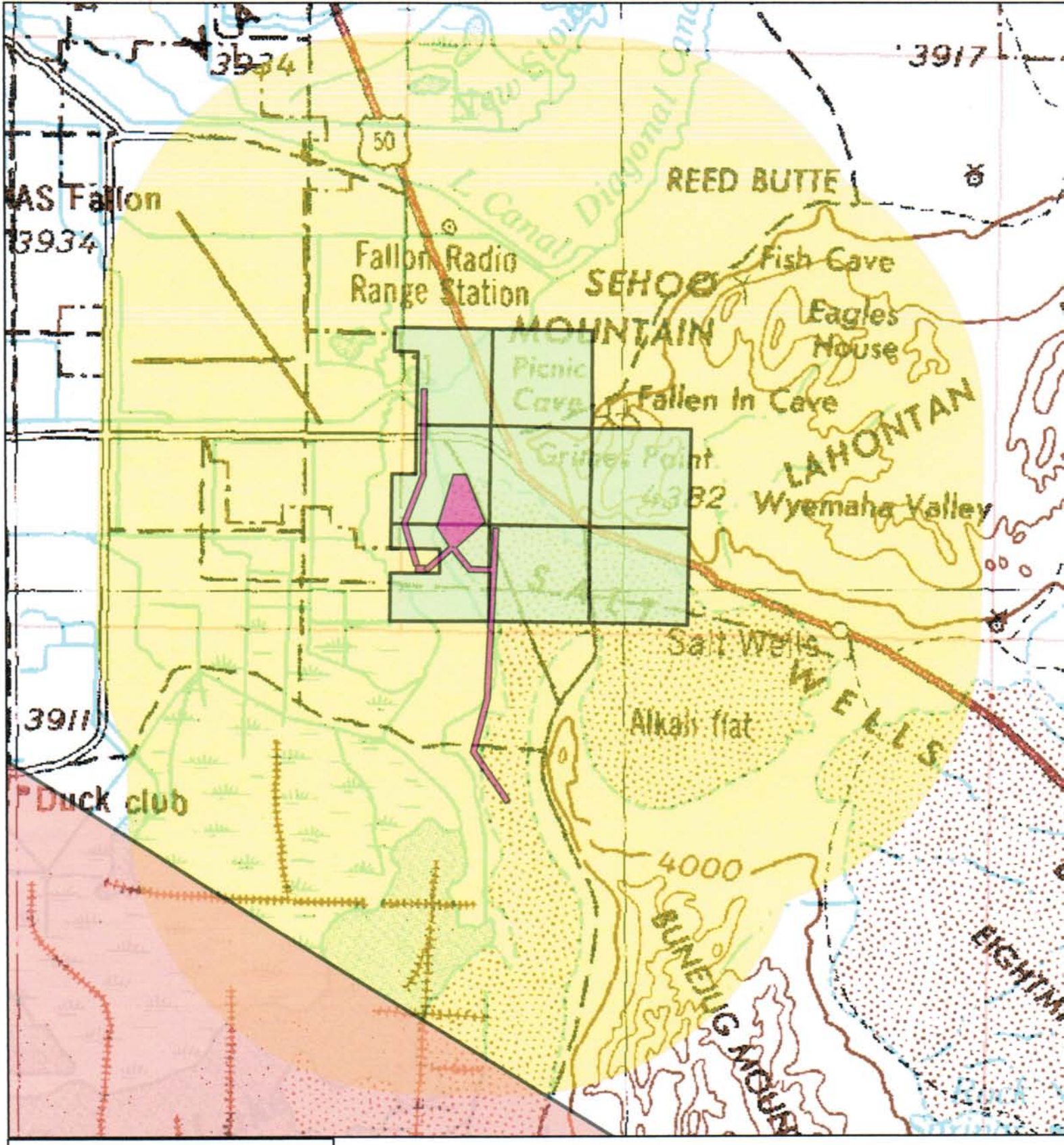

Legend

- NSO Ormat
- Ormat Lease Area
- 3 Mile Buffer
- Ferruginous Hawk Distribution

Salt Wells, Sierra Pacific Carson Lake, Ormat Project and Ferruginous Hawk Distribution

April 12, 2010

0 0.3 0.6 1.2 1.8 2.4 Miles

1 in = 1 miles

N

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Salt Wells, Carson Wells, Ormat Project, species recorded in project area and surrounding buffer

COMMON NAME	SPECIES
American bittern	Botaurus lentiginosus
American golden-plover	Pluvialis dominica
bald eagle	Haliaeetus leucocephalus
common sagebrush lizard	Sceloporus graciosus
Eurasian wigeon	Anas penelope
golden eagle	Aquila chrysaetos
Great Basin collared lizard	Crotaphytus bicinctores
green heron	Butorides virescens
least bittern	Ixobrychus exilis
long-tailed duck	Clangula hyemalis
long-tailed jaeger	Stercorarius longicaudus
mountain plover	Charadrius montanus
northern shrike	Lanius excubitor
osprey	Pandion haliaetus
pallid bat	Antrozous pallidus
peregrine falcon	Falco peregrinus
prairie falcon	Falco mexicanus
red phalarope	Phalaropus fulicaria
red-breasted merganser	Mergus serrator
red-shouldered hawk	Buteo lineatus
roughleg hawk	Buteo lagopus
ruddy turnstone	Arenaria interpres
ruff	Philomachus pugnax
sanderling	Calidris alba
sandhill crane	Grus canadensis
Say's phoebe	Sayornis saya
short-eared owl	Asio flammeus
tiger whiptail	Aspidoscelis tigris
whimbrel	Numenius phaeopus
white-faced ibis	Plegadis chihi
zebra-tailed Lizard	Callisaurus draconoides

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APPENDIX J
VISUAL SIMULATIONS

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Northwestern view from Highway 50.

Key Observation Point 1

Existing View
Highway 50

Figure J-1

Northwestern view from Highway 50.

Key Observation Point 1

Simulated View of Proposed Action
Highway 50

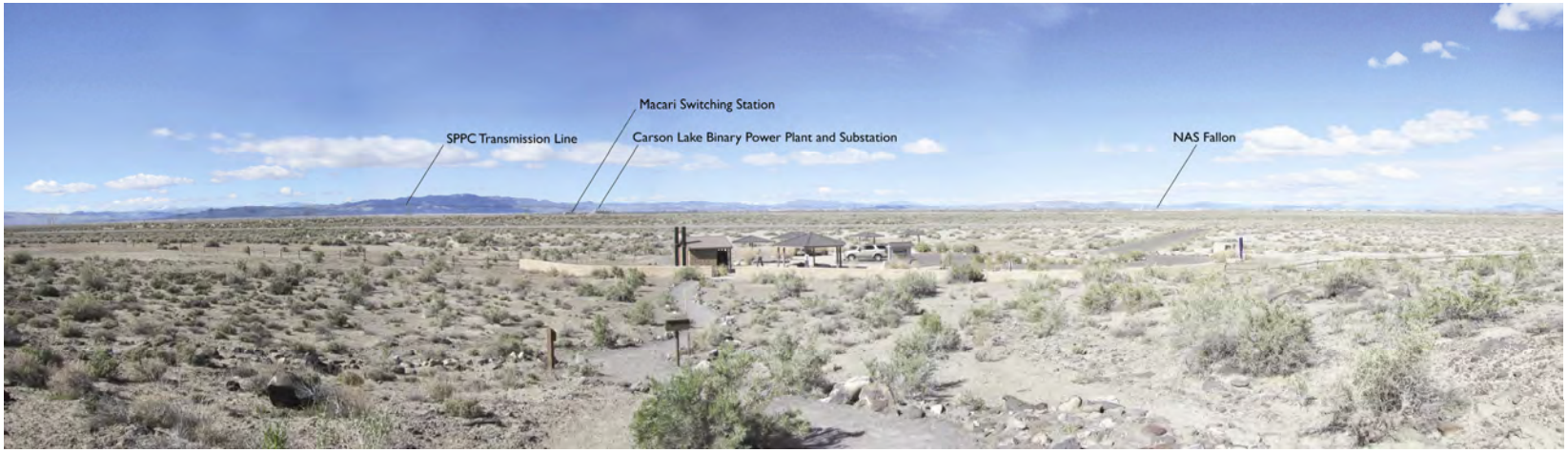
Figure J-2

Southwestern view from Grimes Point Lookout.

Key Observation Point 2

Existing View
Grimes Point Lookout

Figure J-3



Southwestern view from Grimes Point Lookout.

Key Observation Point 2

Simulated View of Proposed Action
Grimes Point Lookout

Figure J-4

Southeastern view across Sheckler Road.

Key Observation Point 3

Existing View
Sheckler Road

Figure J-5

Southeastern view across Sheckler Road.

Key Observation Point 3

Simulated View of Proposed Action
Sheckler Road

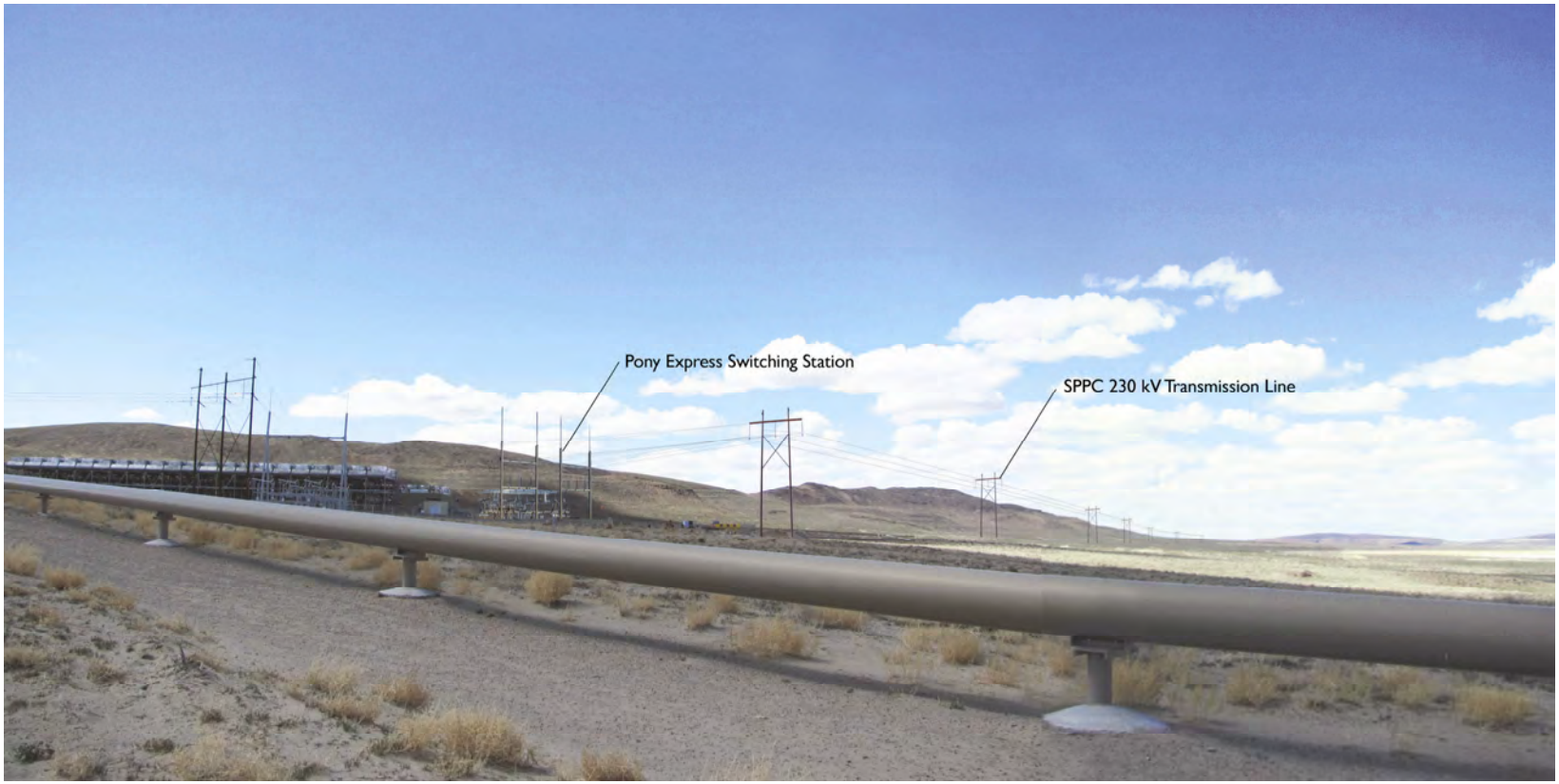
Figure J-6

Northwestern view near existing ENEL Power Plant.

Key Observation Point 4

Existing View
South of Fallon, NV

Figure J-7



Northwestern view near existing ENEL Power Plant

Key Observation Point 4

Simulated View of Proposed Action
South of Fallon, NV

Figure J-8

Northwestern view from Macari Lane.

Key Observation Point 5

Existing View
Macari Lane

Figure J-9

Northwestern view from Macari Lane.

Key Observation Point 5

Simulated View of Proposed Action
Macari Lane

Figure J-10

Northern view from the Pony Express Historic Trail.

Key Observation Point 6

Existing View
Pony Express Historic Trail

Figure J-11

Northern view from the Pony Express Historic Trail.

Key Observation Point 6

Simulated View of Proposed Action with Binary Plant
Pony Express Historic Trail

Figure J-12

Northern view from the Pony Express Historic Trail.

Key Observation Point 6

Simulated View of Proposed Action with Binary Plant and Vulcan Transmission Line Alternative
Pony Express Historic Trail

Figure J-13

Northern view from the Pony Express Historic Trail.

Key Observation Point 6

Simulated View of Proposed Action with Flash Plant
Pony Express Historic Trail

Figure J-14

Northern view from the Pony Express Historic Trail.

Key Observation Point 6

Simulated View of Proposed Action with Flash Plant
and Vulcan Transmission Line Alternative
Pony Express Historic Trail

Figure J-15

Southwestern View from Highway 50.

Key Observation Point 7

Existing View
Highway 50

Figure J-16

Southwestern View from Highway 50.

Key Observation Point 7

Simulated View of Proposed Action
Highway 50

Figure J-17

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