

**ENVIRONMENTAL ASSESSMENT
DOI-BLM-NV-C010-2010-0016-EA**

Patua Geothermal Project

Geothermal Unit N-85168X

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It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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List of Acronyms and Abbreviations

| | |
|--------|---|
| °F | degrees Fahrenheit |
| ACEC | Areas of Critical Environmental Concern |
| ACSR | aluminum conductor steel reinforced |
| APE | area of potential effect |
| AUM | animal unit months |
| BAQP | Bureau of Air Quality Planning |
| BOPE | Blowout prevention equipment |
| BLM | Bureau of Land Management |
| BWQP | Bureau of Water Quality Planning |
| CCDO | Carson City District Office |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CO | carbon monoxide |
| CUP | Commercial Use Permit |
| DCS | distributed control system |
| DOI | Department of the Interior |
| DSL | digital subscriber line |
| EA | Environmental Assessment |
| EO | Executive Order |
| EPA | Environmental Protection Agency |
| FEMA | Federal Emergency Management Agency |
| FEWWTF | Fernley East Wastewater Treatment Facility |
| FLPMA | Federal Land Policy and Management Act |
| FONSI | Finding of No Significant Impact |

LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|------------------|---|
| FWMA | Fernley Wildlife Management Area |
| LBAO | Lahontan Basin Area Office |
| GDP | Geothermal Drilling Permit |
| GHG | greenhouse gas |
| GLO | General Land Office |
| gpm | gallons per minute |
| H ₂ S | hydrogen sulfide |
| HF | H-frame |
| IDT | Interdisciplinary team |
| kV | kilovolts |
| kW | kilowatts |
| LADWP | Los Angeles Department of Water and Power |
| MDBM | Mount Diablo Base Meridian |
| MMPA | Mining and Mineral Policy Act |
| MW | megawatt |
| NAERC | North American Electric Reliability Company |
| NCG | non-condensable gas |
| NDEP | Nevada Department of Environmental Protection |
| NDOM | Nevada Division of Minerals |
| NDOW | Nevada Department of Wildlife |
| NEPA | National Environmental Policy Act |
| NESC | National Electrical Safety Code |
| NHPA | National Historic Preservation Act |
| NNHP | Nevada National Heritage Program |
| NO ₂ | nitrogen dioxide |
| NRHP | National Register of Historic Places |
| NVCRIS | Nevada Cultural Resources Information System |

| | |
|-------------------|---|
| OHV | Off-highway vehicle |
| PM _{2.5} | particulate matter smaller than 2.5 microns in aerodynamic diameter |
| PM ₁₀ | particulate matter smaller than 10 microns in aerodynamic diameter |
| ppm | parts per million |
| RCRA | Resource Conservation and Recovery Act |
| ROI | region of interest |
| ROW | right-of-way |
| rpm | revolutions per minute |
| SAD | Surface Area Disturbance |
| SCADA | supervisory control and data acquisition |
| SHPO | State Historic Preservation Office |
| SO ₂ | sulfur dioxide |
| SPCC | Spill Prevention, Control, and Countermeasure |
| SRF | strength reduction factors |
| SWPPP | Stormwater Pollution Prevention Plant |
| TCPs | Traditional Cultural Properties |
| UIC | Underground Injection Control |
| UNR | University of Nevada, Reno |
| US | United States |
| UTM | Universal Transverse Mercator |
| V | volts |
| VOCs | volatile organic compounds |
| VPC | Vulcan Power Company |
| WCRM | Western Cultural Resources Management, Inc. |

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1.1 Introduction

1.1.1 PROJECT BACKGROUND

Vulcan Power Company (VPC) has acquired the rights to all federal geothermal leases issued by the Department of the Interior (DOI), Bureau of Land Management (BLM) for the Patua Geothermal Unit N-85168X (Unit). The leases were acquired indirectly through agreements with private parties and directly for lease NVN-085705, which was acquired by VPC from the BLM. In addition, VPC has agreements with private landowners for the rights to the geothermal resources associated with the majority of the private lands within the Unit. The lease areas are located in Churchill and Lyon Counties, Nevada. The BLM manages the subsurface geothermal resources underlying the federal leases in the project area and the Bureau of Reclamation, Lahontan Basin Area Office (Reclamation) is the surface management agency. This Environmental Assessment (EA) analyzes the proposed project pursuant to the national Reclamation/BLM Interagency Agreement, December 1982. Reclamation does not maintain an Agency-specific migratory bird species of conservation concern list or an agency-specific sensitive species list other than those protected under the Endangered Species Act (1973); therefore, to be consistent with Reclamation policy the BLM will not address migratory birds of conservation concern as per IM 2008-05 or BLM designated sensitive species. Additionally, state species are also not addressed on federally managed lands.

VPC prepared a Right-of-Way Plan of Development, and a geothermal Utilization and Operations Plan for the Patua Geothermal Project. These plans were submitted to the Carson City District Office, Stillwater Field Office (CCDO), and the Lahontan Basin Area Office (LBAO) of Reclamation for review in October 2009, and were revised in February 2010. VPC is proposing to design, construct, and operate geothermal well pads and wells, geothermal fluid pipelines, a 120 kV transmission line, a 60 megawatt (MW) net power plant, and associated access roads. VPC anticipates that construction activities could begin late 2010 and could be completed in the first half of 2012.

This environmental analysis is jointly prepared between BLM and Reclamation. Reclamation will review the analysis concerning the ROW and determine whether to grant a ROW and license for the transmission line. State Lands Commission is responsible for the ROW in consultation with NDOW on state-managed lands. Elements of the project on state and private lands are included in this analysis for the purpose of providing contextual information concerning the proposed project. However, Reclamation and BLM do not have any decisions over activities occurring on private and/or state land.

BLM oversees approval of the geothermal utilization and operations plans (geothermal facilities on Reclamation-managed lands) in consultation with Reclamation and both agencies would determine through this analysis the terms and conditions under which it will authorize the geothermal facilities.

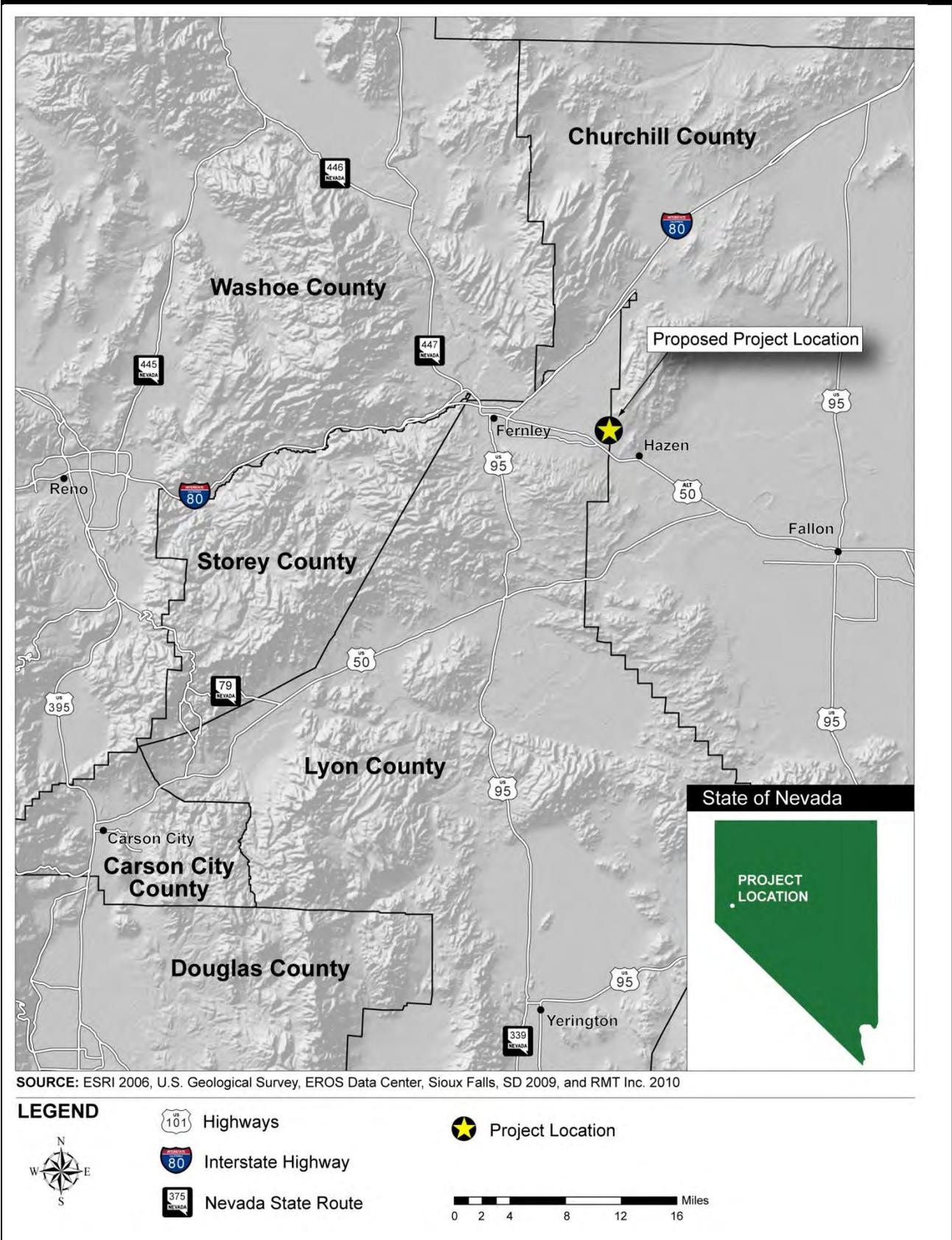
1.1.2 PROJECT LOCATION

The Patua Geothermal Project is located approximately 7 miles east of Fernley, Nevada, in Lyon and Churchill Counties. The project site is accessible from Alternative 50 (Alt 50) to the south. The project location is shown in Figure 1.1-1.

The proposed well pads, access roads, and pipelines would be located on lands managed by Reclamation and on private lands. The 60 MW geothermal power generation facility would be located on private land (Section 21, T20N, R26E, Mount Diablo Base Meridian (MDBM)) within the Unit. The power plant would connect to a proposed transmission line located on Reclamation-managed lands, State of Nevada-managed lands that are part of the Fernley Wildlife Management Area (FWMA), and private lands. The transmission line would connect to a substation located on private lands. The project area is shown in Figure 1.1-2. The geothermal leases within the Patua Unit are shown in Figure 1.1-3.

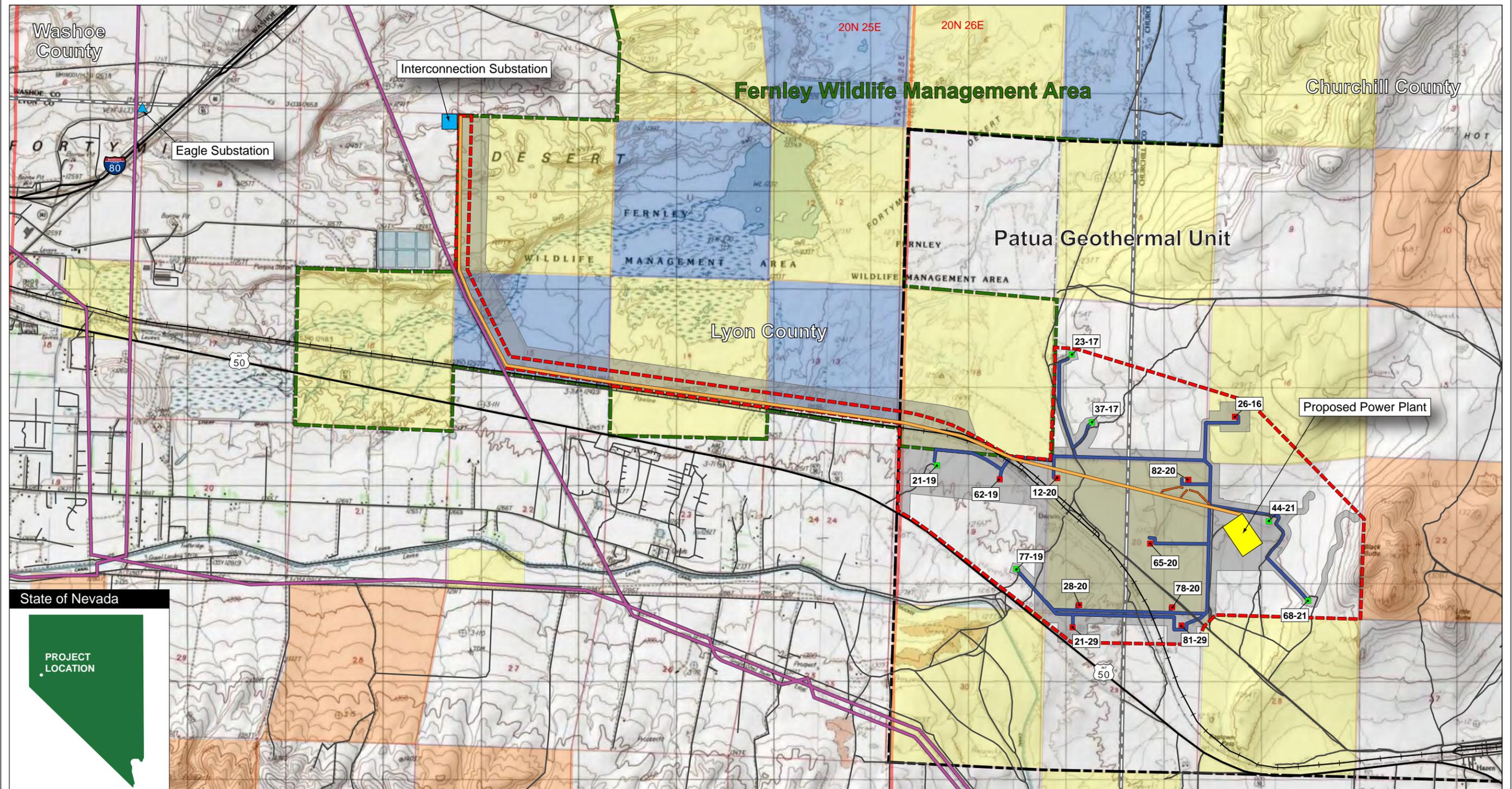
Geothermal drilling on Reclamation lands would occur within T20N, R26E, Sections 16 and 20, MDBM, and on private lands within Sections 29 and 19, T20N, R26E, MDBM. The transmission line would be located within portions of the following sections: Sections 18-21, T20N, R26E, , MDBM, and Sections 10 and 13-15, T20, R25E, , MDBM.

Figure 1.1-1: Patua Geothermal Project Location



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Figure 1.1-2: Project Area, Elements, and Land Ownership

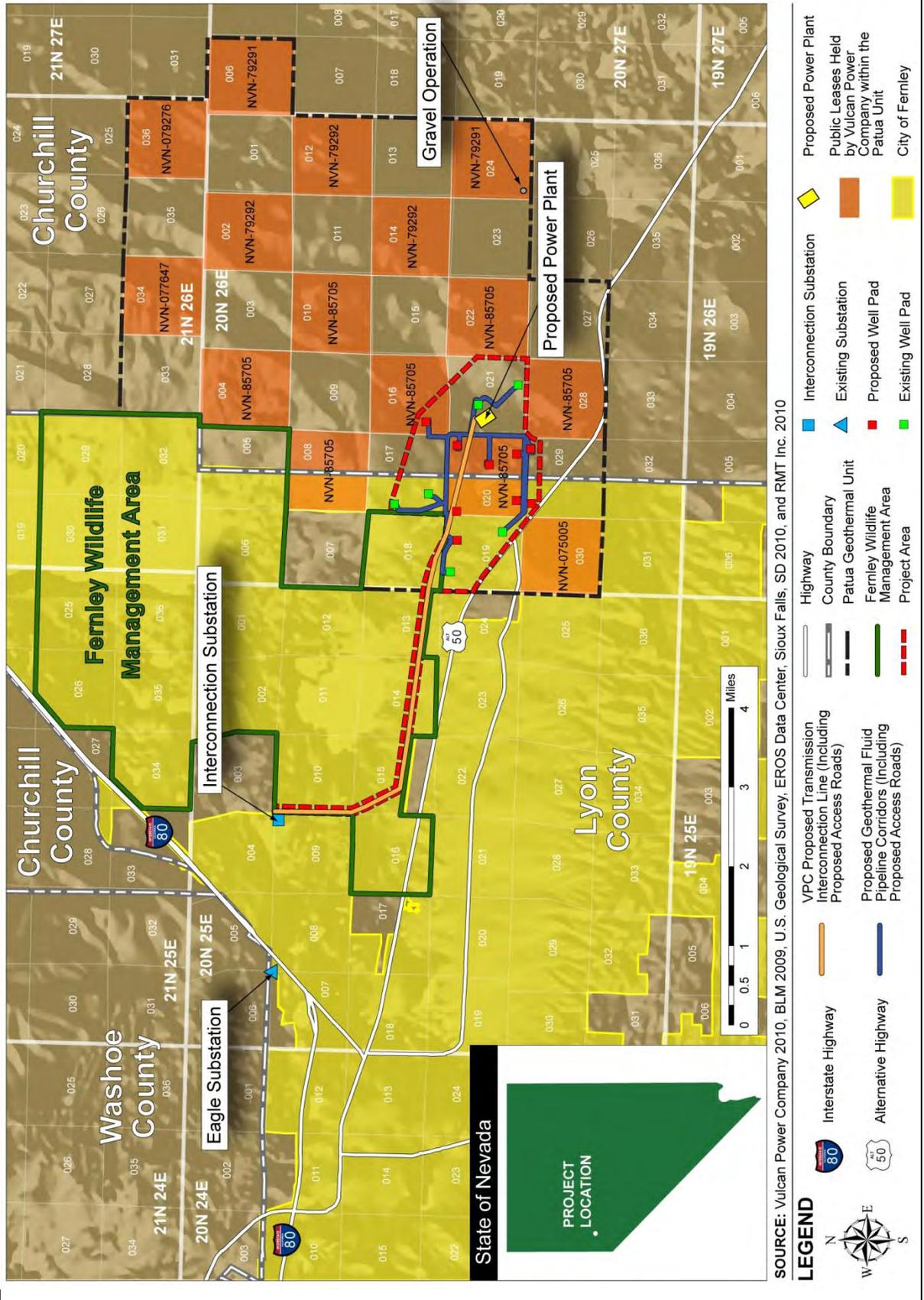


SOURCE: Vulcan Power Company 2010, BLM 2008, Platts 2010, City of Fernley ESRI 2006, U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 2009, and RMT Inc. 2010

| | | | | | | | |
|-------------------|---------------------|-------------|----------------------------|--|----------------------|----------------------------|---------------------------|
| LEGEND | Alternative Highway | Reclamation | Patua Geothermal Unit | VPC Proposed Transmission Interconnection Line (Including Proposed Access Roads) | Project Area | Interconnection Substation | Proposed Power Plant |
| | Interstate Highway | BLM | County Boundary | Proposed Geothermal Fluid Pipeline Corridors (Including Proposed Access Roads) | Fernley WMA Boundary | Existing Substation | Survey Area |
| | NV State | Road | Highway | Transmission Pole Access Route | Proposed Well Pad | Existing Well Pad | 0 .125 .25 .5 .75 1 Miles |
| | Private | Railroad | Existing Transmission Line | | | | |

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Figure 1.1-3: BLM Leases within the Patua Geothermal Unit



1.2 Purpose and Need

The purpose of the proposed action is to develop a portion of the geothermal resources on the geothermal leases in the southwest area of the Patua Geothermal Unit in order to produce electricity. The need for the project is to meet the requirements of the National Energy Policy Act of 2005, the BLM's implementation strategy titled *BLM Implementation of the National Energy Policy*, and other federal policies that encourage the use of alternative and renewable energy.

The Geothermal Steam Act of 1970, amended and supplemented by the National Energy Policy Act of 2005; the Mining and Mineral Policy Act (MMPA) of 1970; the Federal Land Policy and Management Act (FLPMA) of 1976; 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.

The DOI policy, consistent with Section 2 of the MMPA and sections 102(a)(7), (8), and (12) of FLPMA, is to encourage the development of mineral resources, including geothermal resources, on public lands. The Secretary of the Interior has the authority and responsibility to lease public lands and certain other federal lands, including Reclamation-managed lands, for geothermal development. Under the terms of the Geothermal Steam Act (and the National Energy Policy Act) and its implementing regulations, the BLM must respond to the plans and programs submitted by the lessee (or unit operator) and either approve, require modification, or deny these applications.

1.3 Land Use Plan Conformance Statement

The proposed action as described is in conformance with the Carson City District Office Consolidated Resource Management Plan, page MIN-1 "...encourages the development of federal mineral resources and reclamation of disturbed lands."

1.4 Relationship to Laws, Regulations, Policies, and Plans

The proposed action is consistent with federal laws and regulations; other plans, programs, and policies of other federal agencies; and state and local government, to the extent practical within federal law, regulation, and policy.

Specific approvals and permits would be required for constructing, operating, and maintaining the proposed geothermal project Table 1.4-1 lists the federal, state, and local permits, policies, and actions that may be required.

Table 1.4-1: Potential Regulatory Permits and Approvals for the Patua Geothermal Project

| Regulatory Agency | Permits or Approval |
|---|---|
| <i>Federal</i> | |
| BLM, CCDO Stillwater Field Office | Geothermal Drilling Permits (GDP), and issuance of a Commercial Use Permit and Facilities Construction Permit (for the well field on federal land) |
| Reclamation | Right-of-way license for the transmission line |
| <i>State</i> | |
| Nevada Division of State Lands | Right-of-way for the transmission line route in consultation with Nevada Department of Wildlife (NDOW) |
| State Historic Preservation Office (SHPO) | Review of cultural resources evaluation in compliance with Section 106 of the Historic Preservation Act |
| State Fire Marshall | Hazardous Materials Permit; Building Construction Approval |
| Nevada Department of Environmental Protection (NDEP), Bureau of Water Pollution Control | Construction Stormwater Permit /Stormwater Pollution Prevention Plan (SWPPP); Temporary Discharge Permit; Geothermal Water Production Injection and Surface Disposal Approval; Onsite Sewage Disposal System General Permit |
| NDEP, Bureau of Air Pollution Control | Surface Area Disturbance Permit (SAD); Class II Air Quality Operating Permit (if applicable); Chemical Accident Prevention Program (CAPP) |
| Public Utilities Commission of Nevada | Permit pursuant to Utilities Environmental Protection Act, Note: permit submitted on March 9, 2010; Application Pursuant to NAC 704.8901-704.8937 for Renewable Energy System Generators |
| Nevada Division of Minerals (NDOM) | State Drilling Permit; Underground Injection Control (UIC) permit for Class V Wells; Geothermal Area Permit |
| Nevada Division of Water Resources | Permit to Appropriate the Public Waters of the State of Nevada |
| Bureau of Health and Protective Services, Health Division | Drinking water supplies permit; Sewage Discharge Permit; Radiological Logging |
| <i>Local Permits</i> | |
| Churchill County Planning Department | Special Use Permit/Conditional Use Permit for power plant and transmission line |
| Churchill County Building Department | Building Permit; Septic Approval; Grading Permit |
| City of Fernley Planning Department | Planning Design Review and Special Use Permit for transmission line (visual simulation); Building Permit |
| City of Fernley Public Works Department | Civil Plan Review; Grading Permit |

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2: Proposed Action and Alternatives

2.1 Proposed Action

VPC is proposing to design, construct, and operate geothermal well pads and wells, geothermal fluid pipelines, transmission lines, and their associated access roads. These facilities would be connected to a new 60 MW net geothermal power generation facility, to be located on a privately owned section of land within the Unit. The elements of the proposed action include:

- Reclamation-managed lands
 - Construct approximately 6 miles of access roads to support well pads, pipeline, and transmission line construction and access
 - Construct four to six new well pads and drill one to five wells per pad
 - Construct approximately 3.7 miles of 120 kV transmission line segments
 - Construct approximately 1.1 to 2.2 miles of geothermal fluid pipelines
- State of Nevada-managed lands
 - Construct approximately 2.2 miles of new access roads
 - Construct approximately 2.2 miles of 120 kV transmission line segments
- Private land
 - Construct 6.75 miles of access roads
 - Construct one to three new well pads and drill one to five wells per pad
 - Drill additional wells on six existing pads
 - Construct a 60 MW net power plant
 - Construct approximately 0.5 miles of 120 kV transmission line segment
 - Construct up to approximately 6.75 miles of geothermal fluid pipelines

The project area is shown in Figure 1.1-2. The total area of disturbance for the project would not exceed approximately 137 acres. Table 2.1-1 and 2.1-2 lists the estimated total disturbance areas by component and land management/ownership.

Upon completion of the analysis and decision, VPC would begin development of the proposed project components. Development would begin with well field development, including access roads, well pads, and wells. The second stage of development would include construction of the power plant, associated piping, and transmission interconnection system. Once construction is finalized, utilization and power generation would begin.

Table 2.1-1: Disturbance Area Acreages by Land Management/Ownership for the Access Road, Well Pads, Pipeline, and Power Plant

| Land Management | Access Roads | Well Pads | Pipeline Alignment | Power Plant and Generation Substation | Temporary Disturbance for Staging/Laydown | Total Calculated | Not Expected to Exceed |
|---------------------------|-----------------|-----------------|--------------------|---------------------------------------|---|------------------|------------------------|
| Reclamation-Managed Lands | 5 acres | 18 acres | 1 acre | 0 acres | 0 acres | 24 acres | 30 acres |
| Private Lands | 13 acres | 9 acres | 5 acres | 22 acres | 18 acres | 67 acres | 80 acres |
| Total | 18 acres | 27 acres | 6 acres | 22 acres | 18 acres | 91 acres | 110 acres |

Table 2.1-2: Estimated Temporary and Permanent Disturbance for the Transmission Line

| Land Management | Permanent Disturbance | Temporary Disturbance ¹ | Total Calculated | Not Expected to Exceed |
|---|--|---|---------------------|------------------------|
| Reclamation-Managed Lands – Geothermal Leases | 1.75-2 acres for Access Roads 0.03 acres for Line Support Structures | 0.8 acres | 2.58-2.83 acres | 3.5 acres |
| Reclamation-Managed Lands – FWMA | 5-5.33 acres for access roads 0.06-0.07 acres for line support structures | 2.5 acres for conductor stringing and sagging sites | 7.56-7.9 acres | 10 acres |
| State of Nevada Lands | 3.5-4 acres for access roads 0.03-0.05 acres for line support structures | 1.5 acres for stringing and sagging sites | 5.03-5.55 acres | 7.5 acres |
| Private Lands | 1.25-1.5 acres for access roads 0.02 acres for line support structures | 1 acres for stringing and sagging sites 2 acres for staging area | 4.27-4.52 acres | 6 acres |
| Total | 12-13 acres | 8 acres | ~20-21 acres | 27 acres |

¹ The transmission line ROW would be an average of 75 feet wide over the entire transmission line route. Work could occur anywhere within this corridor, including off road access, lying down of poles, etc. The temporary disturbance calculation estimates only those areas within the corridor where vegetation and habitat would be removed; however, a larger area would be utilized.

2.1.1 DEVELOPMENT

Well Field Development

Access Roads

Description. The federal geothermal leases obtained by VPC include the right to construct and use roads and other facilities necessary or reasonably convenient to the development of the geothermal resource. Existing access roads would be used to the greatest extent feasible.

The project area would be accessed from Alt 50 onto California Road and then into a network of existing unpaved, unnamed roads. New access roads would need to be constructed from the existing roads to the well pad sites. Approximately six to eight access road spurs would need to be constructed on Reclamation-managed lands as part of the well field development. Additional access roads would also be constructed on the private lands. The construction corridor for the geothermal fluid supply and injection pipelines would be wide enough to accommodate vehicles for pipeline inspection and maintenance. All roads would be constructed within the existing project area as shown in Figure 1.1-2.

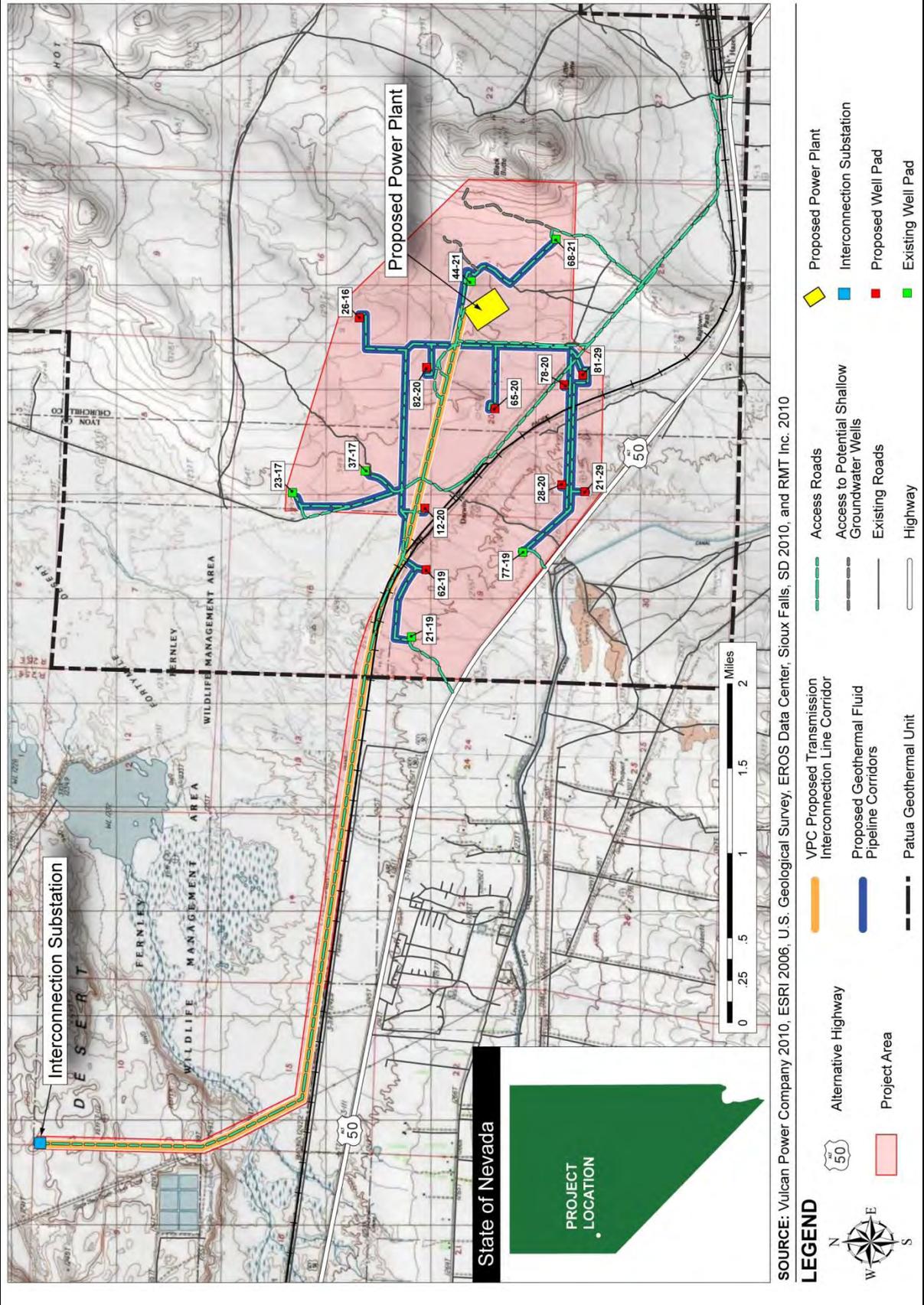
Design of new roads on Reclamation-managed lands would follow the guidelines for roads and access ways as specified in The Gold Book (BLM 2007 and USFS 2007).

Construction. New access roads within the well field would be constructed to approximately 15 feet wide by clearing brush and grading the surface to construct a roadway; gravel may be added where required. Existing unpaved roads would require improvement and application of a gravel base to support drill rig traffic during periods of rainfall or snow. Access roads are shown in Figure 2.1-1. All access roads will require typical improvements and maintenance to facilitate construction and operations traffic. Any suitable topsoil would be stockpiled in a designated, previously disturbed area and covered to prevent loss. In the event fill material is required, suitable material would be obtained from a permitted gravel operation (N-86320) and/or off-site commercial sources. Typically, grades would not exceed 8 percent. Where greater gradients, up to 16 percent are deemed necessary, prior approval from the surface management agency (Reclamation) would be obtained. Access roads would typically be constructed with not less than a 2 percent crown. Turnouts would be located at approximately 1,000 foot intervals or they would be intervisible (within sight of each other), whichever is the lesser.

Road drainage would be facilitated on an as needed basis by the incorporation of drainage dips, in-sloping or out-sloping, crowning, utilization of natural topography, ditches, and/or culverts. If during construction, it is determined that culverts or drainage crossings are required, they would be designed for a minimum 25-year storm frequency.

All vehicle traffic associated with the project would be restricted to the designated access roads. Speed limits of 10 to 30 mph would be observed on all unpaved roads in the project area in order to minimize generation of airborne dust. In order to minimize the effects of wind erosion, access roads and other disturbed areas would be watered on an as needed basis.

Figure 2.1-1: Access Roads



Well Pads

Description. VPC is proposing to construct four to six new well pads on Reclamation-managed lands (on BLM leases within the Unit), one to three new well pads on private land, and utilize the existing six well pads on private land. The township and range, section number, and Universal Transverse Mercator (UTM) coordinates for each well pad and road area are given in Table 2.1-3. New well pads on Reclamation-managed lands are all within the Unit on lease NVN-085705, in portions of Sections 16 and 20, and on private lands within the Unit in Sections 19 and 29.

New well pads would be approximately 350 feet by 350 feet in size, including 200 feet by 60 feet for a reserve pit. The reserve pits are used for the containment and temporary storage of drill

| Table 2.1-3: Well Pad Locations | | | | |
|---|-----------------------|-----------------------|---------------------------------|--------------|
| Kettleman Number | Township/Range | Section Number | UTM Coordinates (NAD 83) | |
| | | | E (X) | N (Y) |
| <i>Proposed Well Pads on Public (Reclamation managed) Lands*</i> | | | | |
| 26-16 | 20N/26E | 16 NW SW | 321626 | 4384909 |
| 12-20 | 20N/26E | 20 NW NW | 319805 | 4384285 |
| 82-20 | 20N/26E | 20 NE NE | 321148 | 4384269 |
| 65-20 | 20N/26E | 20 NW SE | 320756 | 4383616 |
| 28-20 | 20N/26E | 20 SW SW | 320029 | 4382981 |
| 78-20 | 20N/26E | 20 SE SE | 320984 | 4382958 |
| <i>Proposed Well Pads on Private Lands</i> | | | | |
| 81-29 | 20N/26E | 29 NE NE | 321078 | 4382779 |
| 62-19 | 20N/26E | 19 NW NE | 319215 | 4384273 |
| 21-29 | 20N/26E | 29 NW NW | 319961 | 4382760 |
| <i>Existing Well Pads on Private Lands</i> | | | | |
| 21-19 | 20N/26E | 19 NE NW | 318572 | 4384413 |
| 77-19 | 20N/26E | 19 NE SE | 319385 | 4383353 |
| 37-17 | 20N/26E | 17 SE SW | 320161 | 4384856 |
| 23-17 | 20N/26E | 17 SW NW | 319954 | 4385546 |
| 44-21 | 20N/26E | 21 SE NW | 321973 | 4383844 |
| 68-21 | 20N/26E | 21 SW SE | 322375 | 4383033 |
| Either well pads 28-20 and 78-20, and their associated pipelines, or, 21-29 and 81-29, and their associated pipelines would be built. | | | | |

cuttings, waste drilling mud, and storm water runoff from the constructed pad. No hazardous materials would be placed into the reserve pits. Geothermal fluid produced from the well during flow testing would also drain to the reserve pit. The reserve pit waste would be sampled for hazardous contaminants before disposal because geothermal fluid can sometimes contain naturally occurring heavy metals. 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. The layout of a typical well pad is shown in Figure 2.1-2.

Construction. Site preparation for the geothermal well pads consists of standard grading practices, including clearing and grubbing the native ground surface, as needed, and then constructing a nearly level well pad. The pad would have a minor slope downward to the excavated reserve pit in order to direct surface water. Each well pad is covered with compacted gravel to protect the pad surface from erosion and to provide a sufficient base for vehicular traffic and drill rig foundation. Any suitable topsoil would be stockpiled on site for later use during restoration. If additional base rock or other earth materials are needed for road or well pad construction or maintenance, they would be obtained locally from one of the following:

- The gravel operation within the Unit located east of Black Butte, in Section 24, T20N, R26E, MDBM, permitted separately under the jurisdiction of the Winnemucca District of the BLM, and through a Special Use Permit from Churchill County.
- The gravel operation is shown in Figure 1.1-3.
- Local commercial sources.

The estimated acreage and not to exceed of disturbance for construction of the well pads is shown in Table 2.1-1.

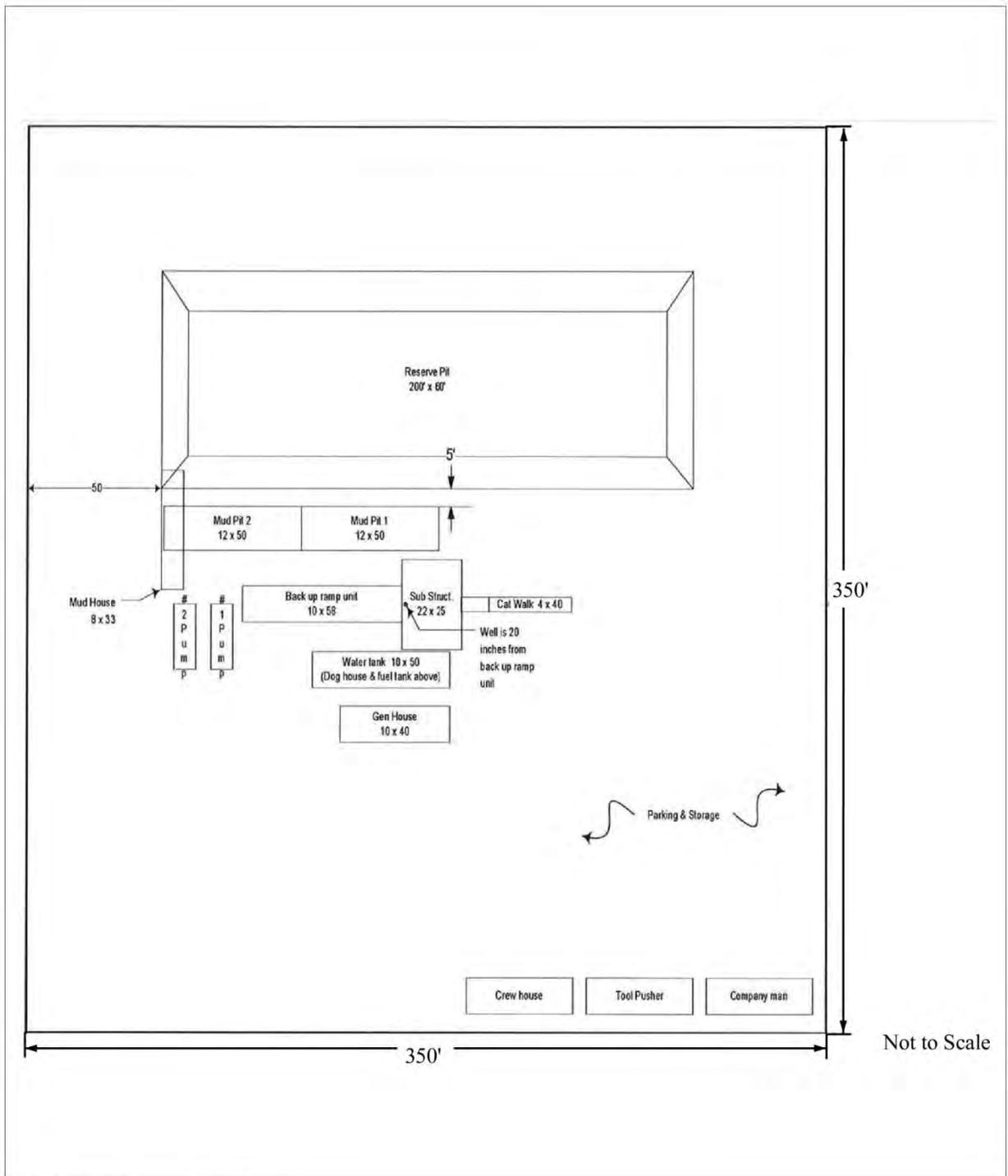
Production and Injection Wells

Description. The project would require drilling of several production and injection wells. Production wells would only be drilled on well pads, as previously described. VPC has identified tentative well pad locations, as shown in Figure 1.1-2, although well pads may be adjusted or realigned within the overall project area. Between one and five wells are expected per pad.

Based on the anticipated geothermal resource temperature of approximately 325 °F, it is estimated that approximately 41,500 gallons per minute (gpm) of geothermal fluid production would be required to support 60 MW net of electricity generation. Based on an expected individual production well flow rate of approximately 2,000 gpm and allowing for back-up wells, up to 23 individual production wells could be required to support 60 MW net of electricity generation.

Each production well would be outfitted with a well pump (line shaft or electric submersible) and its necessary electrical and control systems. The well flow rates, pressures, and temperatures would be continuously monitored in the power plant control room. The operators would be able to shut-in a well and shut-down each pump in the event of problems. The specific size and configuration of the well pump support facilities would vary depending upon the specific well pump type and manufacturer selected. Assuming a line shaft type pump, the production well pads would require a step-down transformer (12 kilovolts (kV) to 4,160 volts (V)); a power distribution center, which houses the motor control equipment; and a utilities system enclosure,

Figure 2.1-2: Layout of a Typical Well Pad



SOURCE: Vulcan Power Company 2010



which houses other auxiliary systems. A building, approximately 400 square feet in size, would be required to house the equipment at each well pad. The building would contain all electrical, instrumentation, and control equipment required to power and monitor the production well pump. The building would contain the production well pump and auxiliary equipment skids (i.e., lubrication, cooling water, etc.) that are required to support the production well pump. Required electric power will be delivered to the well pad via cables typically installed in steel conduit or cable trays constructed on the pipe supports adjacent to the pipeline; in some locations they will be direct buried along the pipeline route.

Geothermal fluid injection wells are a necessary component to the efficient and sustainable utilization of the geothermal resource. Injection wells are strategically placed in order to provide resource recharge, support reservoir pressure, and to ensure that injected geothermal fluids are not directly reproduced. Although unlikely, injection wells may be located on the same well pad as production wells; however, their depths would be significantly different from those of the production wells. A typical injection well pad has a sump and one to three injection wells. Each injection wellhead assembly consists of a set of shut in valves and monitoring instrumentation; the entire assembly can be on the order of 10 to 12 feet high.

The number and location of injection wells is a function of various resource variables that are not known at this time; therefore the number and location of injection wells cannot yet be reasonably estimated. The proposed maximum of 15 well pads, with four to six well pads on Reclamation-managed lands and the remaining on private lands (six of which are existing), would be sufficient to accommodate all production and injection wells.

Drilling. The geothermal drilling and testing operations would be conducted in accordance with federal, state, and local requirements. Prior to beginning drilling, a Geothermal Drilling Permit application (GDP) would be submitted to the BLM for each well in addition to the appropriate permits required by NDOM and NDEP. GDPs would be submitted for each well and would contain specific information regarding hole size, casing requirements, wellhead design, drilling fluids, cementing, directional drilling, blowout prevention equipment (BOPE), and testing. After permitting requirements have been satisfied, VPC would give at least 24 hours notification to the appropriate contacts at BLM and NDOM prior to spudding, setting casing, drill stem testing, or well testing operations.

The production wells are each designated to reach total depths of 7,000 to 10,000 feet. A typical 10,000 foot deep hole drilled by a standard rotary drill rig requires approximately 65 days to complete; drilling on a 24 hours per day 7 days per week basis. Drill crews would work in two shifts per day, consisting of 5 people per shift.

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 2.1-3 shows an example drill rig.

Figure 2.1-3: Typical Production Well Drill Rig

SOURCE: Vulcan Power Company 2010

All wells would be cased to a depth below the lowest groundwater aquifer to prevent commingling of fluids. A data collection system would be implemented during drilling to gather information about the hydrologic aquifers encountered during drilling, in accordance with lease stipulations.

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.

Each production well may need to be worked over or redrilled if mechanical or other problems that prevent proper completion of the well in the targeted geothermal reservoir are encountered while drilling or setting casing or if the well does not exhibit the anticipated permeability, productivity, or injectivity. Well redrilling may consist of reentering and redrilling the existing well bore, reentering the existing well bore and drilling and casing a new well bore, or moving the

rig over a few feet on the same well pad and drilling a new well bore through a new conductor casing. Well workovers or re-drilling may take place during production and utilization.

In order to maintain maximum sump capacities for future drilling and testing operations, VPC may choose to separate the drill cuttings from the drill mud prior to their disposal in the sump. These cuttings can then be used, at the discretion of the surface manager (Reclamation), as fill material for projects, such as road repair and pad construction. 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, volatile, and semi-volatile organic properties.

Well and Reservoir Testing. VPC plans to conduct two types of well tests on completed wells: rig tests and long-term stratum/reservoir tests. A rig test involves flowing the geothermal well for several hours with the drilling rig still in place to identify the temperature and pressure and determine that the wellhead pressure has stabilized, and that no additional drilling is needed. During a rig test, the well flows from the blooie line (the line from the wellhead) to a vertical atmospheric separator (also called a silencer or a muffler). After the rig test, the well is shut in, and the rig and blowout prevention equipment (BOPE) are removed from the well.

Long-term flow tests, lasting from 15 to 90 days, are conducted after the drilling rig has been moved off the well site and testing equipment has been set up adjacent to the wellhead. Long-term tests provide the data needed to determine the performance characteristics of a well and the hydraulic parameters of the stratum/strata where the geothermal reservoir is located. The pumping tests would also provide additional information on the chemistry of the geothermal reservoir and non-condensable gases (NCGs). The test equipment at Patua would be either a closed separator discharging to a stack pipe or an atmospheric separator. In both configurations, the separator receives two-phase flow through the blooie line and separates the steam from the water. The steam is vented to the atmosphere from the top of the separator, and the water is discharged to the sump after flowing through a weir. The closed separator operates at above atmospheric pressure and measures the flow of steam and water in the lines to the discharge points. In the second configuration, a James Tube is set up across the orifice in the blooie line measures the two-phase steam and water flow upstream of the separator. For both configurations, sample taps on the blooie line are used to collect water and steam samples.

VPC would discharge geothermal fluid from long-term pumping tests to the reserve pit at the well pad being drilled or convey the fluid to other well pads approved for this purpose. The reserve pits would be lined with local clay materials to impede infiltration of fluids to groundwater. VPC would inject the remaining fluids in accordance with the UIC permits and NDOM requirements.

Shut-In and Well Maintenance. Upon completion of well testing the well test equipment would be dismantled and either stored on the pad until needed at the next well, or it would be removed from the site. A pressure gage would be placed on one of the wing valves for occasional pressure checks. Wellheads would be maintained on a regular basis.

Well Abandonment and Pad Reclamation. Final site reclamation would be conducted on the well pads and access roads when it is determined that the well pads would no longer be used for exploration, utilization, or any other purposes. During operations, interim reclamation would be

conducted for the well pad areas no longer needed for operation or maintenance. The actual areas of the well pads that would undergo interim reclamation would be determined on a case-by-case basis and would be a function of the number of well heads and the configuration of pipelines and other required well facilities on each individual pad. All reclamation would be conducted in general accordance with the Gold Book (2007).

Native soil material and organic matter (topsoil) salvaged from site preparation operations would be reused as a top-dressing on berms and other areas requiring revegetation to the extent practical. Any topsoil stockpiles would be located on previously disturbed areas, such as portions of well pads, and would be situated so that wind and water erosion of the piles are minimized and the reclamation potential of the soil is maintained. Other erosion control measures may include surface seeding and moisture conditioning. Native topsoil generally contains native seeds and microorganisms essential for nutrient cycling and when reused should blend well with the adjacent undisturbed landscape. Any seed mix to be used for reclamation purposes would be developed by an experienced botanist in coordination with the BLM and Reclamation and would ultimately be based on seed availability and quality. Reseeding would not be undertaken in areas where soil conditions are inappropriate, or where the adjacent undisturbed land surface has little or no vegetation, as determined in coordination with a qualified biologist.

If any well or wells are determined to not have commercial potential, they may continue to be used for data collection or may be abandoned in conformance with the well abandonment requirements of the BLM and NDOM. Abandonment typically involves plugging the well bore with cement sufficient to ensure that fluids would not move across into different aquifers.

Construction of the well pad facilities would require 5 to 6 months from groundbreaking to substantial completion of the well pumps. Pump testing and commissioning would be performed after the geothermal fluid pipelines are finished. Final completion may follow substantial completion by 2 to 4 weeks. Construction of the well pad facilities would require approximately six workers over a period of 6 to 7 months.

Source and Consumption Rate of Water During Development

The amount of water required for drilling purposes would vary depending on many factors (hole diameter, hole depth, hole duration, mud requirements, etc.). Up to 20,000 gallons per day of water is required for production and injection well drilling. Water requirements for well pad, access road, pipeline, and power plant construction, and dust control would average substantially less. One portable water tank holding a total of at least 10,000 gallons would be maintained in the project area during construction. Additional water trucks would also be used to transport water to the site and would be used to water roads.

Water for drilling and construction could be obtained from one or a combination of the following sources:

- On-site water wells: Applications could be submitted to the NDWR for approval to drill one or more water wells for dust control and soil compaction purposes during construction of the proposed geothermal well pads and access roads.
- Water purchased from private parties: Numerous private parties have been identified in the area that have water available for sale on existing entitlements.

If obtained from on-site sources, water wells would be temporary, drilled by a licensed water well driller, and plugged and abandoned in accordance with NAC 534.420. Water wells would be drilled on the geothermal well pad in Reclamation sections so that there would be no additional ground disturbance, and within previously studied areas in the private sections. Dust control would be performed on an as needed basis during construction and maintenance operations to adequately suppress dust. More water would be required during hot and dry summer months than cold and wet winter months.

Generation System Development

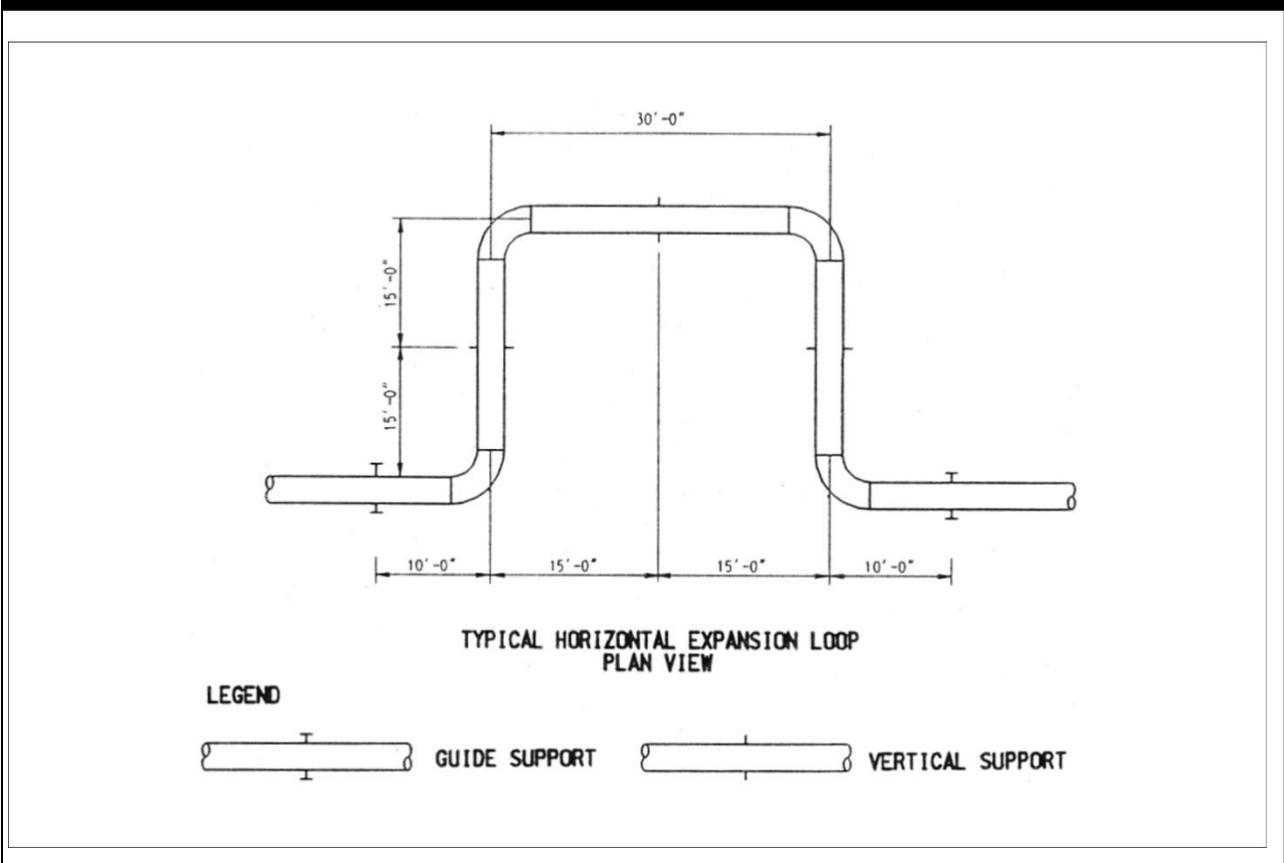
Collection and Injection System Piping

Description. The collection and injection system piping would be located on both Reclamation-managed lands and private lands. An estimated 1.1 miles of pipeline would be installed on Reclamation-managed lands and approximately 6.75 miles would be constructed on private lands.

The geothermal fluid pipelines transport the hot geothermal fluids from the production wells to the power plant and transport the cooler geothermal fluids from the power plant to the injection wells. The pipeline corridors are typically 5 to 6 feet wide with an adjacent access road having a width of approximately 14 to 15 feet, for a total corridor width of approximately 20 feet. The well field piping would consist of nominal 12- to 24-inch-diameter, seamless, welded steel pipe. The piping would have 2 to 3 inches of insulation with a protective aluminum sheath to minimize thermal losses and for personnel protection. The color of the outer layer would be selected to blend with the surrounding area. The pipeline would be placed above ground, except for sections along road crossings, where the pipeline would be installed underground.

The production and injection well pipelines would be designed to take into consideration, to the greatest extent possible, the natural contour of the topography, the pipeline routing, and the design of the pipe supports, to minimize the required number of expansion loops that would be utilized to keep the pipe stresses (induced statically, dynamically, and thermally) below the levels required by the ASME code book. When it becomes necessary, each expansion loop would be designed to accommodate its unique set of criteria, but an example of a horizontal expansion loop is shown in Figure 2.1-4. Although the figure depicts a typical expansion loop to be approximately 30 feet by 30 feet, expansion loops could be as large as 50 feet by 50 feet. The pipeline would be designed to minimize the number of thermal expansion loops, thereby requiring less piping and disturbing less area.

The pipelines would be above ground with supports placed at approximately 30 feet on center; however, certain sections of the pipeline could be buried underground in order to cross under roadways. Support foundations would consist of pre-fabricated concrete spread footings, founded as recommended by the project geotechnical engineer during construction.

Figure 2.1-4: Typical Horizontal Expansion Loop

The geothermal fluid pipelines would be designed to minimize failures. Special design consideration would be given to the strategic placement of thermal expansion loops and anchor supports, sufficient corrosion allowances and the installation of safety control systems.

The location of the geothermal pipeline corridor locations were chosen to accommodate the proposed geothermal well locations, which were chosen based on geologic and engineering analyses of subsurface data.

Construction. Pipeline construction requires little to no grading beneath the pipeline alignment. Actual disturbed areas beneath the pipeline consist only of the areas where pipe supports and their foundations would be located, except where the pipelines cross a road. Where pipelines cross roads, the pipe sections would be outfitted with a pipe sleeve and buried in an excavated trench. Pipe support foundations would be excavated approximately every 30 feet along the pipeline alignment and would comply with the recommendations of the project geotechnical engineer. Foundation excavations can be accomplished with very little surface disturbance along the route. Grading of the pipeline access roads, as necessary, may be required in certain areas for ease of maintenance during operations.

During construction, pipe sections would be delivered and placed along the pipeline corridor until they are ready to be lifted into place. A small crane would be used to lift the pipe sections onto the pipe supports and pipe jacks so they can be welded into place. A fire plan would be prepared and

approved by Reclamation prior to construction of the pipeline. Electric power and instrumentation cables would either be installed in steel conduit or cable trays constructed on the pipe supports, adjacent to the pipeline, or would be buried along the pipeline route. The estimated total acreage of disturbance for construction of the collection and injection system piping is shown in Table 2.1-1.

Construction of the geothermal piping system would occur simultaneously with construction on the well pad facilities. An estimated 9 to 10 months is required to construct the facilities in the pipeline corridor. Construction of the pipelines and the associated access roads requires approximately 30 workers over a period of approximately 11 to 12 months.

Power Plant and Generation Substation

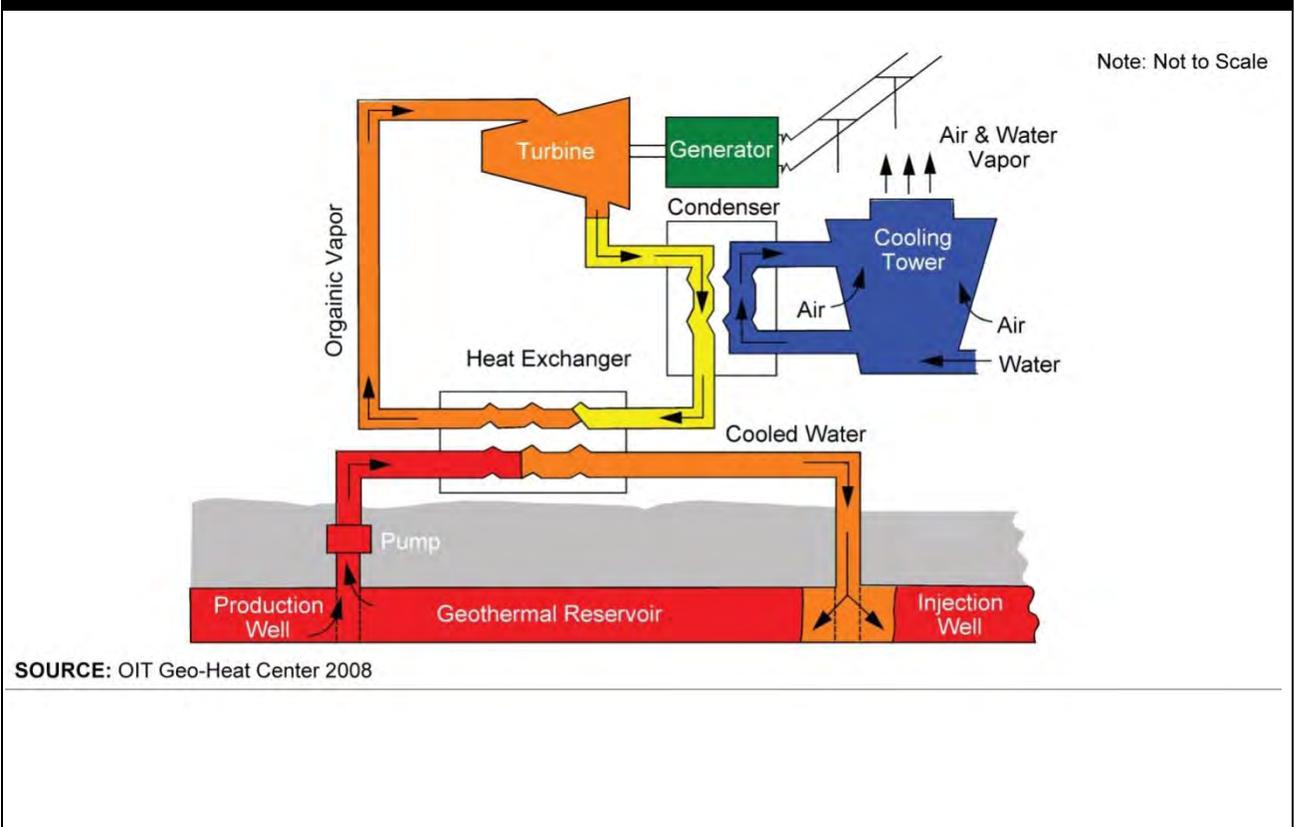
Description. The proposed power plant and generation substation would be located entirely on privately owned land within the Patua Geothermal Unit (Section 21, T20N, R26E, MDBM). The plant and substation would be sited to minimize environmental effects and to provide a suitable location amid the well field. The power plant and power plant substation would require an area of about 800 feet by 1,200 feet total (22 acres).

The facility would produce 60 MW (net) of electricity. The power plant would be engineered and constructed in accordance with applicable industry standards. The project would utilize project proven and commercially available geothermal technologies and equipment. The plant systems and equipment would be designed and selected for a commercial life of 30 years. An annual capacity factor of about 90% or greater is expected and is a reasonable estimate, based on existing operations of binary geothermal power plants.

VPC proposes to construct the power plant utilizing a binary power plant design. Heat is extracted from the geothermal fluid in heat exchangers and transferred to a hydrocarbon working fluid (typically pentane). The heated hydrocarbon working fluid is expanded through a turbo-expander generator system, converting the mechanical energy produced to electrical energy. Hydrocarbon working fluid vapor from the turbine exhaust would be condensed in either air cooled or water cooled condensers. The condensed hydrocarbon working fluid is then pumped to start the closed-system binary cycle again. The only anticipated emissions from the hydrocarbon working fluid cycle are minor emissions from the NCGs it vents. A schematic of a typical binary system is shown in Figure 2.1-5¹.

If a water cooled system is used, a constant source of water would be required during operation of the power plant. Generally speaking, during water cooled operations, water from the cooling tower is pumped to the condenser where it is used to condense the working fluid vapor from the

¹ Figure shows a water-cooled system. In an air-cooled system is used, there would be no water input to the cooling system.

Figure 2.1-5: Schematic Drawing of Binary Geothermal Power Plant Power Generation

turbine exhaust. After passing through the condenser, a portion of the cooling water, known as “blowdown”, is injected to the reservoir in order to maintain optimal levels of dissolved solids in the circulating cooling water flow. The remainder of the cooling water will return to the cooling tower where some of it will be evaporated. Blowdown and evaporation represent losses to the total circulating cooling water flow that must be supplemented during operation by a continuous supply of “make-up” water, equal to the sum of blowdown and evaporation. Approximately 4,500 gpm of water would be necessary for cooling if a water cooled power plant is used. The potential sources of water include:

- On-site wells
- Spent geothermal fluid or geothermal fluid from cooler portions of the reservoir

A permit from the NDWR would be required for use of water from on-site wells or spent geothermal fluid for cooling.

An air-cooled system on a binary power plant would have no make-up water requirement. A small amount of potable and domestic water would be required for the power plant office facilities, maintenance activities, and fire protection, and would likely be provided by an on-site well or would be purchased.

The fire protection system would consist of a 300,000-gallon water storage tank, two 100% 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.

For a binary plant, 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. A separate waterless fire suppression system would be installed in the control building. This product will not damage MCC and electrical equipment, yet is safe to use in the control room where personnel would be located.

The power plant would also include ancillary buildings such as an electrical room, operations office, rest room, lunch room, etc. All buildings would be painted to blend in with the surroundings. 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 storm water runoff that would affect nearby surface waters (i.e., wetlands or 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. Appropriate oil separation and disposal measures would be taken as required prior to release of runoff to the surface drainage. Parking at the power plant site would be provided once the site is cleared and the fence is erected around the site.

The areas disturbed for construction that are no longer needed for operation would be reseeded with native grasses and forbs. Reseeding would not be undertaken in areas where soil conditions are inappropriate or where the adjacent undisturbed land surface has little or no vegetation, as determined in coordination with a qualified biologist.

The stockpiled top soils would also be spread on the area to aid in revegetation.

Construction. Grading of the plant site would proceed after the plant layout has been finalized. The proposed area for location of the power plant has been surveyed for cultural and biological resources and all resources would be avoided. Prior to grading of the site, clearing and grubbing would take place. Topsoil would be stockpiled to aid in revegetation.

The power plant would be built to balance cuts and fills to the extent feasible. Excess excavated material not required as fill would be disposed of or stockpiled. All equipment and building foundations would bear on native soil or structural fill. Compaction of the soils would be in accordance with the recommendations in the geotechnical report and the detailed civil design. All disturbed lands not required for plant operations would be revegetated upon completion of construction. All buildings, insulation jacketing, and visible structures would be painted to blend in with the surroundings (usually "Desert Tan" or another, similar low-contrast color) in order to minimize the visual impacts in the area.

Grading design would be based on local topography as shown on topographic maps. Gravel where needed would be obtained from the existing permitted mining operation (BLM serial number N-86320) or commercial sources. All equipment would be brought to the project site on

trucks. The power plant construction site would be accessed from Alt 50 directly onto the access roads around the site.

Distribution System Development

Transmission Line

Description

Transmission Line and Power Poles. Approximately 6.4 mile of 120 kV transmission line would be constructed between the geothermal power generation facility and an independently proposed substation located in T20N, R25E, Section 9. The transmission line would be located on Reclamation-managed lands, NDOW managed lands, and private land as shown in Figure 1.1-2 and described in Table 2.1-4.

| | |
|--|---|
| Reclamation-managed lands within the lease area | An approximately 1-mile-long segment running approximately northwest through the northern half of Section 20, T20N, R26E, MDBM. Note: Because there are on- and off-lease components of the transmission line, VPC has agreed to have the on- and off-lease portions under one ROW license, approved by Reclamation. |
| Reclamation-managed lands within the Fernley Wildlife Management Area | An approximately 0.7-mile-long segment running approximately parallel to the railroad ROW west through the southwest quarter of Section 18, T20N, R26E, MDBM. |
| | An approximately 1-mile-long segment running approximately parallel to the railroad ROW west through the south half of Section 14, T20N, R25E, C. |
| | An approximately 1-mile-long segment running north through the west quarter of Section 10, T20N, R25E, MDBM. |
| State of Nevada (NDOW) managed lands within the Fernley Wildlife Management Area | An approximately 0.85-mile-long segment running approximately parallel to the railroad ROW west through the south half of Section 13, T20N, R25E, MDBM |
| | An approximately 1.3-mile-long segment running approximately parallel to the railroad ROW west, then approximately parallel to the PDCI transmission line ROW northwest, through the center and northwest quarter, respectively, of Section 15, T20N, R25E, MDBM |
| Private land | An approximately 0.3-mile-long segment running approximately northwest through the northeast quarter of Section 19, T20N, R26E, MDBM |
| | An approximately 0.2-mile-long segment running approximately northwest, from the power plant site, through the south half of the northwest quarter of Section 21, T20N, R26E MDBM. |

The project would require 300 amps per phase for a typical output of 60 MW transmitted at 120 kV. The line conductor would likely be 556 kcmil 26/7 aluminum conductor steel reinforced (ACSR) or 795 kcmil 26/7 ACSR. This selection is common for this voltage level and limits energy losses and voltage drop to less than 1 percent under maximum load. The transmission line is considered a critical line without which the project energy sales would not be possible. Therefore, the line would be designed and constructed using National Electrical Safety Code (NESC) Grade B load factors and strength reduction factors (SRF).

The transmission line must meet NESC Rule 232 and Reclamation requirements for clearances to ground. NESC 120kV required ground clearance is approximately 20.5 feet, to which a margin for design and construction variances is usually added for a design clearance of an estimated 24 feet. Reclamation requires a minimum of 40 feet clearance over pipeline and canal ROWs for 120 kV lines; in accordance with Reclamation's request one segment of the transmission line, located in Section 15, T20N, R25E, was heightened to achieve a 40 foot ground clearance above the Fernley East Wastewater Treatment Facility (FEWWTF) discharge into the Fernley Wildlife Management Area (FWMA). The line would be designed for providing the design clearance at a maximum operating temperature of 212°F, a typical temperature for ACSR conductor. The line would have additional capacity for potential future generation growth.

Two shield wires would be used for lightning protection. One of these shield wires would be a steel wire (3/8-inch EHS or similar) and the other may be a steel wire or optical ground wire, containing optical fibers for project use only (e.g., supervisory control and data acquisition (SCADA), protective relaying, controls and communications with NV Energy).

The line supports would typically be H-frame (HF) structures with two wood poles, set about 14-feet apart in cross country sections. For a span of 800 feet, common for such construction, two 60-90-foot Class 1 Douglas fir poles would be sufficient for clearance and strength. The poles would be embedded an estimated 10 feet into the soil and the above-grade height would be approximately 50-80 feet. Special situations like crossing over hills, crossing roadways, and spanning topographic depressions would require a range of structure heights to achieve necessary clearances. The structure would use single polymer suspension insulators to support the 120kV conductors. Its cross arm would be wood and approximately 32 feet wide. Top bracing above the cross arm may be used for additional support of the arm on long spans.

At angles in excess of about 5 to 10 degrees in the alignment (known as points of intersection), guyed 3-wood pole structures would be used. Additional easements would be required for these segments for driving anchors and guy installation. Points of intersection can also be self-supporting, self-weathering steel structures mounted on concrete pier foundations in a similar 3-pole arrangement or as a single pole with stacked conductor positions. The pier foundation dimensions would be determined from physical loads at the structure base and geotechnical soil investigations. The piers might be 5-8 feet in diameter and 15-30 feet deep for the 3-pole option. Piers might be 6-7 feet in diameter and 20-35 feet deep for the single pole option. Typical pole designs are shown in Appendix A.

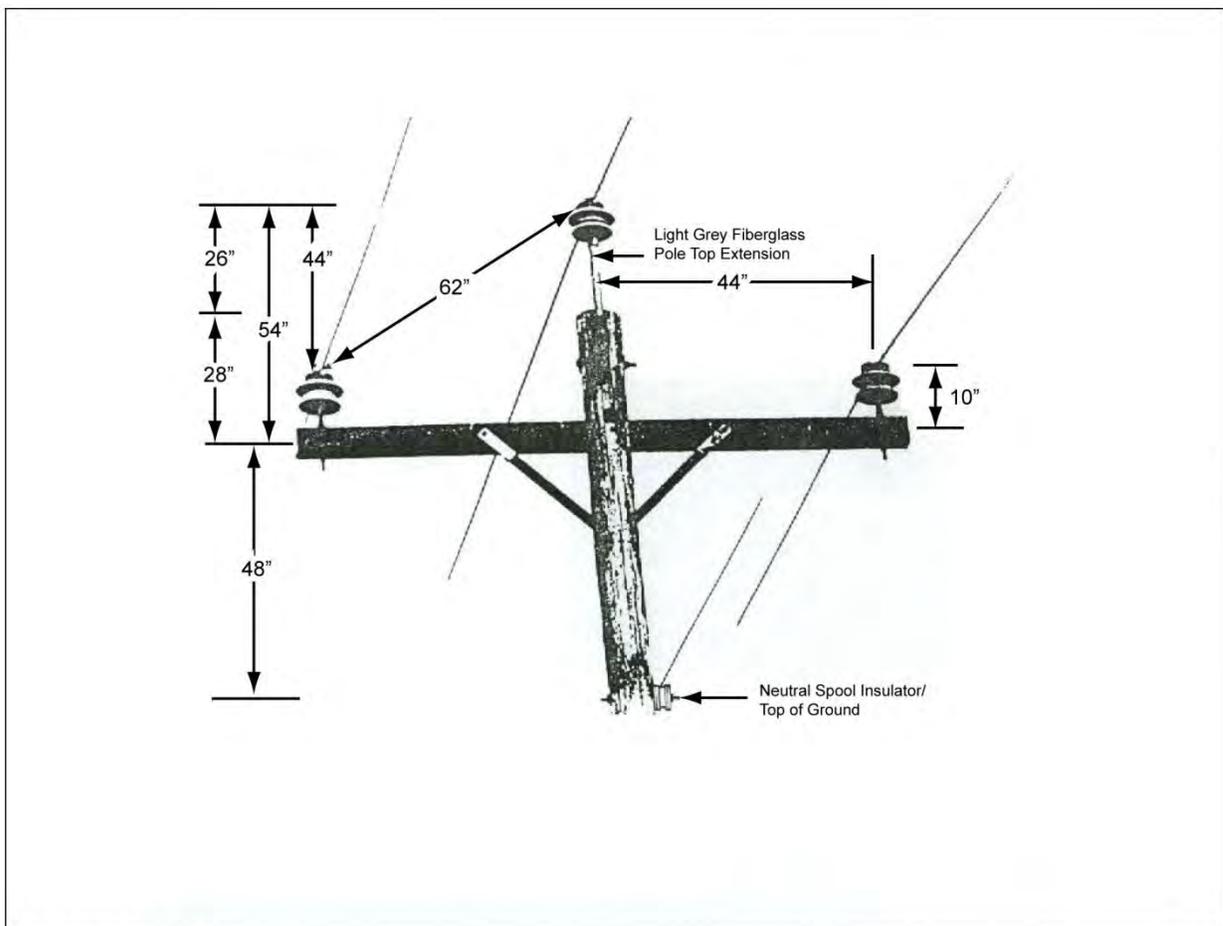
ROW for the proposed 120kV line using HF construction would typically be 75 feet wide, with the line structures centered in the ROW. Determination of a ROW width depends on the nature of the land adjacent to the ROW, structure width, conductor blowout conditions, insulator articulation,

and structure deflection. Although the minimum ROW width is approximately 75 feet, additional ROW area is required to accommodate guying where the alignment changes significantly in orientation.

Raptor and Waterfowl Protection Measures. Much of the proposed alignment traverses the southern extent of the Fernley Wildlife Management Area, where waterfowl and raptors are common. The structures would be designed with sufficient phase spacing to make it improbable that the wing span of the typical raptor or waterfowl can contact two phases, thus avoiding electrocution. Figure 2.1-6 shows the spacing as recommended by NDOW. No special framing is necessary on the HF structures since they are inherently safe for raptors, which would most likely perch on the tops of the poles, high above the 120kV phases.

If top arm bracing is not used another perching cross arm would be mounted or the insulator strings would be lengthened so that raptors cannot contact phase conductors upon taking off. Anti-nesting and perch spikes approved by NDOW would be installed on the tops of cross arms.

Figure 2.1-6: NDOW Recommended Phase Spacing



SOURCE: NDOW 2010

The flat, horizontal configuration of wires in HF construction also presents a smaller transverse profile (two wire levels) to flying birds than single pole construction (four wire levels). Anti-collision devices, developed in coordination with NDOW and the project's consulting wildlife biologist would be used on the shield wires and phase conductors on specific transmission line segments that are located at the west end of the line, within the boundaries of the FWMA. The specifications for the avian protection devices are provided in Appendix B.

Construction. The 6.4 mile transmission interconnection line connection to the proposed substation would be constructed by VPC contractors. The line would be constructed using trucks, wire line pullers, and cranes. The construction corridor would be approximately 75 feet wide.

A single two acre staging and construction management area would be sited adjacent to the ROW on private land. There would be three or four portable trailer office and locked storage containers for expensive and theft prone transmission line materials, such as copper grounding or aluminum hardware. The staging area on private land would avoid all cultural resources and wetland and riparian habitat. Construction activities would include minor clearing, access road improvement or construction, pole setting, framing of structures, pulling in new conductor, sagging the wires to specification, clipping in the wires at each attachment, punch list remediation, clean up, and project energization. An estimated ten conductor stringing and sagging sites would be required along the approximately 6.4-mile-long transmission line. Total temporary and permanent disturbance areas for the transmission line are presented in Table 2.1-2.

Major construction equipment would include pickup trucks, lineman bucket trucks, pole truck for delivering poles at sites, crane, bulldozers for grading access roads and assisting with sagging, truck mounted augers for drilling pole holes, flat bed truck for delivering incidental materials to the sites, puller-tensioners for stringing new conductor, 3-reel trailers, and backhoes or excavators.

Construction would take eight to twelve months and require approximately two full time line crews of about six to eight persons in each crew. All activities would be under the direction of a project manager.

Communications Facilities

Description. Communication facilities could consist of one of two options:

1. A dedicated land line telephone connection to the project site, with digital subscriber line (DSL) service if available. A fiber optic connection would be installed via the optical ground wire between the power plant substation and the planned new substation where the line would terminate for the SCADA system, control, protective relaying, and communications with NV Energy. Restricted access SCADA data on system performance would be streamed to the Project Control Center at the power plant for monitoring. The communication channels and network setup for the project would be coordinated with NV Energy and would adhere to the cyber security requirements of the North American Electric Reliability Company (NAERC).
2. In order to handle communications (command, control, voice, & internet) at 18 GHz Ethernet/T-1 speeds, VPC will arrange to have installed an 80 ft. tall tower at the power plant that will communicate with a tower at the provider's location. From that location, the signal would then be carried on the provider's existing Fiber Optic Network to VPC's centralized operations and maintenance facility that will be located off-site.

Construction. The communications facilities would be constructed along with the transmission line, as previously described.

Transmission Line Access Roads

Description. Access roads for the transmission line would be required during construction and during operation for maintenance purposes and would be located immediately adjacent and parallel to the transmission line. Typical access roads would be approximately 14 to 15 feet wide.

Existing two-track access occurs along much of the railroad alignment and would be used to the greatest extent feasible in order to limit the amount of grading along the route and within the FWMA. Several small wetland areas are located along the railroad alignment and in Section 15, T20N, R25E where the alignment turns north (Figure 1.1-2). Construction would be completed in the dry season in order to further avoid impacts to the wetlands. Alternate construction access, outside of the proposed 75 foot ROW, to two (2) transmission line structure locations in the northeast quarter of Section 20, T20N, R26E, has been identified, which will decrease ground disturbance. The alternate access is depicted on Figure 1.1-2.

Construction. Design of any new roads on Reclamation and NDOW managed lands would follow the guidelines for roads and access ways as specified in The Gold Book (BLM 2007 and USFS 2007).

Substation

The new transmission line would terminate at a new substation to be constructed on T20N R25E Section 9, at the boundary of NDOW-managed and privately owned land. The substation (and additional 120 kV transmission line connecting to the Eagle Substation) would be built entirely on private land by NV Energy and/or an independent developer.

2.1.2 UTILIZATION

Utilization Overview

This section describes well field and plant utilization, which includes a generalized description of the proposed facility operations. Utilization includes the use of the project components constructed during the development phase in order to generate and distribute electricity.

Utilization is divided into the following topics:

- Production: the withdrawal and transport of geothermal fluids from the well field
- Power Generation: the processes that occur within the power plant to generate electricity
- Injection: the return of cooled geothermal fluid back into the geothermal reservoir

Production

Based on the anticipated geothermal resource temperature of approximately 325° F, it is estimated that approximately 41,500 gpm of geothermal fluid production would be required to support 60 MW net of electricity generation. Based on an expected individual production well flow rate of approximately 2,000 gpm and allowing for back-up wells, up to 23 individual production wells could be required to support 60 MW net of electricity generation.

Geothermal fluids would be pumped from the production wells through the distribution system to the power plant. Each production wellhead would be equipped with an electrically actuated control valve that can be controlled from the power plant control room. This valve would be selected and designed for maximum reliability, good flow control characteristics, and ability to prevent leakage. Well performance data would be electronically transmitted by telemetry to and monitored from the control room. The gathering system would be regulated and controlled inside the plant, primarily through the modulation of the control valve at each well.

Each well control valve can be set and controlled individually by the control room operator through the Distributed Control System (DCS). There are two basic operational modes for well field shut-in via the wellhead control valve, as described below. In addition to the automatic and manual valving at the wells, flow at each well can be stopped from the control room.

Power Generation

Geothermal fluid would be supplied to the power plant from the production wells. The plant would operate 24 hours a day, 7 days a week. The hot geothermal fluid would be pumped from the production wells through pipelines to the tube side of the heat exchangers to heat the hydrocarbon working fluid, which turns the turbines. A diagram of a typical binary power plant is shown in Figure 2.1-5.

Injection Rates

The primary goal of an effective injection plan is to ensure the longevity and renewability of the geothermal resource. Because of the relatively small volume of fluids being injected when compared with the overall magnitude of the resource, little if any impacts are expected. After the heat has been removed from the geothermal liquid, the liquid flows to the injection wells through the injection pipeline. Injection of the geothermal fluid would help maintain reservoir pressure and replenish the reservoir, thereby prolonging the commercial life of the geothermal resource.

At the current design stage, it cannot be determined how many injection wells would be needed for the project. Each injection well would have manual wellhead isolation valves and regulating valves which allow disposal of the fluids to individual injection wells as required to balance the well field. Temperature and pressure would be measured at each injection well.

During normal operations of an air-cooled facility, the produced geothermal fluid would be confined under pressure as it moves through the power plant and would be injected back into the geothermal reservoir without flashing to steam or being exposed to the atmosphere.

Plant Start-up and Operating Procedures

Prior to start up, the facility would be checked to insure all mechanical equipment is ready for operation and all valves and electrical equipment are properly aligned and in a ready start position. Personnel and facility safety checks would be performed.

An automated startup sequence program would be executed by the plant controls system. During each step of the automated sequence, all plants variables and status are monitored by the control system. If any parameters exceed acceptable limits, the controls system would either abort or hold the start sequence until all limits are corrected and in acceptable ranges.

The first plant startup activity includes starting the well field. The geothermal fluid system is activated by turning on one or more geothermal well pumps, routing the pumped fluid to the plant through the gathering system piping, bypassing power and production units, and routing the fluid to an injection well(s). The flow is initiated to warm up the system.

Motive fluid feed pumps are started and geothermal fluid starts circulating in the system. The geothermal bypass valve is gradually closed raising the heat in the system and building pressure in the vaporizer. When the vaporizer reaches the required minimum pressure and all systems are in the acceptable ranges, the system advances to the next step.

When all systems pressures are at appropriate levels the turbine valves start to open and the turbine starts to roll up to speed. When turbine speed approaches synchronization speed of about 1800 revolutions per minute (rpm) the auto-synchronizer compares generator frequency and voltage with the grid and transmits correction signals to speed control and voltage control. When generator frequency, voltage and phase angle are the same as the grid, the synchronizer energizes and connects the generator to the grid.

Source and Consumption of Water During Utilization

The power plant would operate using geothermal fluids that are pumped from the reservoir, used in the plant operation, and then returned to the reservoir through injection wells. There would be no consumptive use of the geothermal resource and the fluids would not be released to the atmosphere if an air cooled system is used. If a water cooled system is used, some of the geothermal fluid may be used for cooling and would be lost via evaporation, or water from another source (such as a well or purchased water right) may be used. The quantity of water that would be required for a water cooled system would be on the order of 4,500 gpm. A water cooled system would only be used if feasible and proper entitlements are obtained.

Bottled water or other potable water would be used for domestic drinking water purposes at the site. A septic system and associated leach field would be constructed for the bathroom facilities. Water would be sourced from on-site wells or would be purchased.

2.1.3 DECOMMISSIONING

Decommissioning is the process by which the project is abandoned and, given the long-term duration of geothermal facility operations and changes in future site conditions, additional analysis may be necessary. In general, all project components lands would be decommissioned by removal of all surface components. Wells would be plugged and abandoned in accordance with NDOM requirements. Components would be recycled to the greatest extent feasible and all wastes would be properly disposed. Well pads, roads, and pipeline corridors would be recontoured and revegetated, as required by Reclamation or NDOW. Some wells may be utilized for continued hydrologic observation even after their useful life.

2.2 No Action Alternative

The No Action Alternative includes no action of any kind. The environment would remain the same as it currently exists. No geothermal exploration or development of any kind would occur. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities

described in the project description would occur. No impacts to the existing environment would occur as it would remain unchanged.

No other alternatives were assessed because there are no unresolved conflicts involving alternative uses of the resources [BLM NEPA Handbook H 1790-1, page IV-3].

2.3 Adopted Environmental Protection Measures

VPC would implement emergency plans for:

- Injuries
- Well blowouts
- Fire
- Spill or discharge contingencies (for drilling mud, geothermal fluid, lubricants, fuels, etc.)
- Hazardous gas control
- Drilling safety and action plans

The purpose of these plans is to provide guidance to field personnel and management in the event of a field related emergency. The plans are intended to be comprehensive in that they describe the nature of various hazards or problems that might be encountered and specify appropriate preventive or anticipatory actions and equipment, as well as specific responses, notifications and follow up procedures that are required in the event of a field emergency. Emergencies such as accidents and injuries are covered, as are fire hazards management and risk assessment.

VPC would comply with all special lease stipulations attached to leases NVN-085705(Appendix C). The project would comply with all local, state, and federal requirements.

VPC would inform all personnel, as well as well drilling, testing, and supply contractors, of policies regarding protection and undue degradation of the environment. The Applicant Proposed Environmental Protection Measures are intended to minimize impacts from occurring as a result of project development and operations. Protection of the environment is also discussed in detail in Chapter 4, Environmental Consequences.

The specific environmental protection measures listed by activity or environmental resource area below are incorporated into the applicant's proposed action as integral components of the proposed project. Refer to Appendix D for written confirmation of these environmental commitments.

Water Resources

- The reserve pit would be lined to prevent seepage of testing fluids into the underlying groundwater.
- Containment berms would be constructed around all hazardous material or potentially hazardous material storage areas. Off-pad stormwater is directed away from the well pads.
- BOPE would be maintained at the wellhead to allow well shutdown if an uncontrolled flow of fluid or gas occurs.

- A cement and casing program for construction of any wells would be implemented to prevent water quality effects on groundwater during or after well installation. Borehole geophysics analyses (cement bond logs) would be conducted to document that well-casing grouting activities provide an effective seal, isolating the geothermal aquifer from shallow alluvial aquifers.
- No ground disturbance would be conducted within 650 feet of a canal or water feature on federal leased land prior to Reclamation's consent.
- VPC would obtain necessary permits for work in waters and/or groundwater discharge permits and would provide a Notice of Intent to NDEP prior to well pad construction.
- A hydrologic evaluation program will be implemented, which will be site specific and its intensity will be commensurate with the level of development drilling.

Wetlands/Riparian Zones

- Transmission lines would span wetlands to the extent feasible.
- Dips or culverts would be installed for access roads so as not to impact flows.
- Construction of the transmission line would occur in the dry season
- Existing two-track roads would be used to the greatest extent feasible
- BMPs to prevent release of fuels or other construction materials would be implemented, including VPC's SWPPP and Spill Prevention, Control, and Countermeasure (SPCC) Plan, which would be prepared and submitted to the BLM and Reclamation prior to construction.
- When permanent new access roads must cross ephemeral washes, rolling dips would be installed. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. Culverts may be used wherever rolling dips are not feasible

Floodplains

- Roads would be constructed with culverts properly sized to convey at least a 25-year storm event.
- Existing two-track would be used as access roads to the greatest extent feasible along the roads to minimize the amount of additional base material and construction necessary.

Vegetation

- Reclamation of well pads and access roads would occur when it is determined that they would no longer be used for exploration, utilization, or any other purposes. During operations, interim reclamation would be conducted for the well pad areas no longer needed for operation or maintenance. All reclamation would be performed in accordance with the Gold Book (2007).
- Reclamation would be performed in accordance with lease stipulations. Reclamation would include re-contouring of disturbed areas to blend in with the surrounding topography and use of appropriate methods to seed with a diverse perennial seed mix. The seed mix used to reclaim disturbed areas would be certified weed free. The seed mix would be developed by an experienced botanist in coordination with the BLM, Reclamation, and/or NDOW and would be based on seed availability and quality.

Reseeding would not be undertaken in areas where soil conditions are inappropriate or where the adjacent undisturbed land surface has little or no vegetation, as determined in coordination with a qualified biologist. Native soil material and organic matter (topsoil) salvaged from the site preparation operations would be reused as a top-dressing on berms and other areas requiring revegetation to the extent practical.

- A qualified botanist would perform vegetation surveys in the blooming period prior to construction of the transmission line and access roads in T20N R25E, Section 10 for Nevada dune beardtongue (*Penstemon arenarius*) and Lahontan indigo bush (*Psoralea kingii*). If any individuals of these two plants are found they would be avoided or a replanting and restoration plan would be prepared and implemented.

Invasive and Non-native Species

- The potential to increase the spread of invasive, non-native species would be minimized through the implementation of the Noxious Weed Abatement Plan, included in Appendix E to this EA for project construction, operation, and decommissioning.

Wildlife

- Vehicles would not travel off designated access roads or out of approved right-of-ways or easements.
- Willows or roosting habitat would be avoided to the greatest extent feasible. If willows have to be removed, the vegetation would be inspected by a qualified biologist for bats and Nevada viceroy (*Limenitis archippus*) just prior to removal. If a bat or viceroy is found, the habitat would not be removed until the bat or butterfly has left the area.

Migratory Birds

- The transmission line would be designed to minimize effects to migratory birds and waterfowl within the FWMA, including incorporation of appropriate spacing between lines to make it improbable that the wing span of a large migratory bird can connect two phases.
- Anti-perch spikes would be installed on the top of cross-arms.
- Anti-collision devices approved by NDOW would be used on the shield wires and phase conductors along the transmission line segments that are oriented north/northwest at the west end of the line, within the boundaries of the FWMA.
- Habitat for migratory birds would be eliminated within areas of proposed disturbance prior to the nesting season. In the event this elimination measure is not implemented, if ground disturbing activities do take place during the migratory bird nesting season, migratory bird nest surveys would be conducted early in the nesting season by a qualified biologist acceptable to BLM/Reclamation and/or NDOW. The survey would be conducted to identify either breeding adult birds or nest sites within the specific areas to be disturbed. If active nests are present within these areas to be disturbed, VPC would coordinate with BLM/Reclamation and/or NDOW to develop appropriate protection measures for these sites, which may include avoidance, construction constraints, and/or the establishment of buffers.
- To minimize impacts to migratory birds and other wildlife through habitat alteration well pads and roads would be recontoured and reseeded following completion of

construction. Reseeding would not be undertaken in areas where soil conditions are inappropriate or where the adjacent undisturbed land surface has little or no vegetation, as determined in coordination with a qualified biologist.

- Topsoil would be salvaged and reused whenever possible and in a timely manner.
- During drilling, if the reserve pit contains oil-based contaminants (such as from runoff or drilling muds) the pits would be fitted with exclusion devices such as netting or floating balls, in accordance with lease stipulations.

Cultural Resources

- If any construction or operations activities require disturbance beyond the existing survey boundaries, additional surveys would be completed and any resources found would be avoided or properly mitigated.
- A thirty meter buffer would be placed around historic properties identified and an archaeological monitor would be on site during the construction of any areas within the 30 meter buffer.
- If subsurface cultural resources are found during construction, all work in the vicinity of the resource would cease and the BLM, Reclamation, and/or NDOW environmental personnel would be notified immediately. The appropriate measures as requested by the BLM, Reclamation, NDOW, and/or SHPO to protect the resource would be implemented until it could be adequately evaluated by the permitted archaeologist, and the BLM, Reclamation, and/or NDOW archaeologist, if necessary.

Native American Religious Concerns

- If human remains are identified during construction of any of the components of the proposed project, work within 300 feet of the discovery would be stopped and the remains would be protected from further exposure or damage. The coroner and Reclamation, NDOW, or SHPO (depending on land ownership) would be contacted. If the remains are determined to be Native American, the agencies would follow the procedures set forth in 43 CFR Part 10, Native American Graves Protection and Repatriation Regulations. Procedures for handling the discovery of human remains would follow Reclamation Manual Directives and Standards LND 07-01 (Inadvertent Discovery of Human Remains on Reclamation Lands) if remains are located on Reclamation-managed lands. If remains are found on private land, NRS 383 would be implemented with SHPO as the lead agency.

Minerals Resources

- Fill materials would be obtained from the permitted mine located east of Black Butte, in Section 24, T20N, R26E (assigned serial number N-86320) or purchased from commercial sources.

Soils

- Any suitable topsoil will be stockpiled onsite for later use during restoration. Access roads would follow existing routes to the extent possible. In areas where new access roads must be constructed across slopes, erosion control measures would be installed as necessary, in accordance with Gold Book standards (BLM 2007a).

- Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or rip rap, would be installed where necessary immediately after completion of construction activities to avoid erosion and runoff. Only certified weed-free BMPs would be used.
- Additional gravel would be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation and severe compaction.
- The NDEP Bureau of Air Pollution Control SAD permit documenting the BMPs to be used would be implemented for the project because the surface disturbed would be greater than 5 acres.
- Vehicle travel on unpaved roads would be limited to 30 mph.
- Existing two-track access roads would be used along the transmission route to minimize the amount of new surface disturbance and potential for erosion during construction of the transmission line.
- Any topsoil stockpiles will be located on previously disturbed areas, such as portions of well pads, and will be situated so that wind and water erosion of the piles are minimized and the reclamation potential of the soil is maintained. Other erosion control measures may include surface seeding and moisture conditioning.

Wastes, Hazardous or Solid

- Containment berms would be constructed around all hazardous material or potentially hazardous material storage. Off-pad stormwater would be directed away from the well pads.
- An emergency response plan would be implemented that includes contingencies for hazardous materials spills and disposals.
- VPC would adhere to general geothermal lease stipulations for geothermal developers to address the potential impacts involved with transport, use, and disposal of hazardous materials, including the development and implementation of an emergency response plan.
- VPC would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes. Wastes considered hazardous by the State of Nevada would be transported and disposed of according to applicable federal, state, and local regulations.
- VPC would prepare and implement a hazardous material spill prevention plan to minimize impacts to the environment from hazardous materials.
- Fueling and routine maintenance of equipment and vehicles would be performed off site or within designated areas with appropriate spill controls to minimize effects.
- Drilling mud and fluid would be directed to reserve pits. At the conclusion of drilling and testing, the liquid portions of the containment basin contents would be evaporated, pumped back down the well, or removed and disposed of off-site in a facility authorized to receive such wastes. The remaining contents, typically consisting of non-toxic drilling mud and cuttings, would be tested as required by the Nevada Bureau of Water Quality Planning (BWQP). If non-toxic and as authorized by the BWQP, these materials would be spread and dried on the well site, mixed with soil and buried in the on-site reserve pit in conformance with the applicable requirements of the BWQP,

Reclamation, and the BLM. Testing results and location of buried waste would be provided to Reclamation and BLM.

- A blow-out prevention plan and BOPE would be implemented.
- Operation of the geothermal facilities would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes and therefore minimize impacts to the environment.

Air Quality

- The SAD Air Quality Operating Permit (AP1629-2517), obtained for the project, stipulates that a plan for fugitive dust control must be implemented. The fugitive dust control plan would include dust suppression processes (e.g., watering access roads and well pads) to minimize localized increases in particulate matter concentrations.
- Dust emissions from venting steam would be reduced by injecting water into the blowout line.
- Vehicle speeds would be minimized on exposed soils to 10 to 30 miles per hour (mph) to reduce fugitive dust generation from vehicle travel.
- Diesel generators over 37 kW (50 horse power) shall be diesel-fired units that are certified to meet the US Environmental Protection Agency's (EPA) Tier II Emission Standards and are equipped with an exhaust particulate filter system.
- H₂S emissions would be minimized through the use of properly weighted drilling mud which is expected to keep the well from flowing during drilling. Data collection devices would be installed and operated during all phases of drilling and testing. An H₂S abatement plan would be developed and implemented during long-term flow-testing if it becomes apparent during drilling operations that H₂S abatement is necessary to minimize potential nuisance odors. Measures to reduce H₂S, if necessary, could include but are not limited to:
 - Reducing the number of wells venting simultaneously, as applicable
 - Implementing additional wellhead abatement measures, such as caustic injection between the flash tank and the portable silencer
 - All drill rigs would be equipped with alarms to detect unsafe levels of NCGs.

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3: Affected Environment

3.1 Introduction

3.1.1 SCOPING AND ISSUE IDENTIFICATION

In accordance with NEPA, this document has been prepared with input from interested agencies, organizations, and individuals within the region. Potentially affected agencies and the tribes were contacted to solicit concerns to guide the development of the EA and the alternatives. The BLM's interdisciplinary team (IDT) was consulted for specific resource concerns and information at a meeting held on March 22, 2010.

The following issues were identified during the IDT meeting as needing to be addressed in the environmental assessment: Cultural Resources; Invasive, Nonnative and Noxious Species; Migratory Birds; Native American Religious Concerns; Wastes; Water Quality; Wetlands/Riparian Zones; Lands; Wildlife; Livestock; Soils and Minerals. Subsequent evaluation and coordination with Reclamation resulted in a determination that Air Quality, and Floodplains should also be addressed.

The following issues were identified as not being present in the proposed project area: Areas of Critical Environmental Concern; Farm Lands; Threatened and/or Endangered Species; Wild and Scenic Rivers; and Wilderness. No threatened and endangered species are known to occur in the project area or were identified during project surveys.

3.1.2 PROPOSED ACTION GENERAL SETTING

The project is located within the Great Basin and Range physiographic province at the northwestern edge of the Carson Desert. The project region is generally characterized by low, rolling, arid terrain. Predominant vegetation includes greasewood and shadscale. The area to the northwest of the proposed well field and to the north of the transmission line is part of the FWMA where wetland and riparian habitat and vegetation types dominate. The project area is generally rural but with visible development. The City of Fernley is located seven miles to the west of the project area.

3.1.3 SUPPLEMENTAL AUTHORITIES

Appendix 1 of BLM's NEPA Handbook (H-1790-1) identifies Supplemental Authorities that are subject to requirements specified by statute or executive order and must be considered in all BLM environmental documents. The elements are the various resources, such as air quality and biological resources that could be affected by Federal actions. The supplemental authorities are specified by statutes or executive orders additional to NEPA, such as the Clean Water Act and the Endangered Species Act that must be considered in all BLM environmental documents.

BLM and Reclamation specialists evaluated the potential applicability of the supplemental authorities and the potential impact of the Proposed Action on the resource elements. On the basis of this evaluation, the BLM has determined the elements to be analyzed in detail in this EA. Table 3.1-1 summarizes the elements listed in Appendix 1 of the BLM's NEPA Handbook and

| Table 3.1-1: Supplemental Authorities | | | | |
|--|--------------------|-----------------------------|--------------------------------|--------------------------|
| Supplemental Authority | Not Present | Present/Not Affected | Present/May Be Affected | Section Discussed |
| Air Quality | | | X | 3.17, 4.17 |
| Areas of Critical Environmental Concern (ACEC) | X | | | N/A |
| Cultural Resources | | | X | 3.11, 4.11 |
| Environmental Justice | X | | | N/A |
| Farm Lands (prime or unique) | X | | | N/A |
| Floodplains | | | X | 3.6; 4.6 |
| Invasive, Nonnative Species | | | X | 3.8;4.8 |
| Migratory Birds | | | X | 3.10; 4.10 |
| Native American Religious Concerns | | | X | 3.12; 4.12 |
| Threatened or Endangered Species | X | | | N/A |
| Wastes, Hazardous or Solid | | | X | 3.16; 4.16 |
| Water Quality (Surface/Ground) | | | X | 3.4; 4.4 |
| Wetlands/Riparian Zones | | | X | 3.5; 4.5 |
| Wild and Scenic Rivers | X | | | N/A |
| Wilderness | X | | | N/A |

SOURCE: BLM 2010; Reclamation 2010

documents the BLM's determination of which elements are relevant to the analysis in this EA. Each of the resource elements in Table 3.1-1 is described in this Affected Environment section and subsequently analyzed in Section 4: Environmental Consequences.

3.1.4 RESOURCES OR USES OTHER THAN SUPPLEMENTAL AUTHORITIES

Resources or uses presented in Table 3.1-2, which are not Supplemental Authorities as defined by BLM's Handbook H-1790-1, are present in the area. BLM specialists have evaluated the potential impact of the Proposed Action on these resources and documented their findings in the table below. Resources or uses that may be affected by the Proposed Action are further described in this EA.

Table 3.1-2: Resources or Uses Other than Supplemental Authorities

| Resource or Uses | Present/Not Affected | Present/May Be Affected | Section of EA |
|----------------------|----------------------|-------------------------|---------------|
| Lands and Recreation | | X | 3.2; 4.2 |
| Vegetation | | X | 3.7; 4.7 |
| Wildlife | | X | 3.9; 4.9 |
| Livestock | | X | 3.3; 4.3 |
| Soils | | X | 3.15; 4.15 |
| Minerals | | X | 3.14; 4.14 |
| Socioeconomics | | X | 3.13; 4.13 |

SOURCE: BLM 2010; Reclamation 2010

3.1.4 RESOURCES PRESENT AND BROUGHT FORWARD FOR ANALYSIS

The following resources are present in the area and are addressed in this EA.

- Lands and Recreation
- Livestock
- Water Quality
- Wetlands
- Floodplains
- Vegetation
- Invasive, Non-Native, Noxious Species
- Wildlife
- Migratory Birds
- Cultural Resources
- Native American Religious Concerns
- Socioeconomics
- Minerals
- Soils
- Wastes, Hazardous or Solid
- Air Quality

The environmental setting for these resources is presented in Section 3.2 through 3.16.

3.2 Lands

3.2.1 LAND USE

The project site is located in the west-central portion of Nevada in Lyon and Churchill Counties. Churchill County encompasses approximately 5,000 square miles, of which approximately 91 percent is publicly owned. Lyon County is approximately 2,000 square miles, of which 85 percent is publicly owned (Lyon County 2010a).

The City of Fernley in Lyon County is the only population center near the project area. The City of Fernley is located approximately 7 miles west of the project area, and had a population of approximately 8,500 people in 2000 (US Census Bureau 2010). Private lands, Reclamation-managed lands, and State of Nevada-managed lands are located in a checkerboard fashion throughout the project area (see Figure 1.1-2).

Portions of the project area fall within geothermal lease NVN-085705, administered by the BLM but located on land managed by Reclamation. This lease, along with the private land in the area, is part of the Patua Geothermal Unit (N-85168X). BLM issued leases in the Patua Geothermal Unit are shown in Figure 1.1-3.

Alt 50 passes just to the south of the project area. A Southern Pacific railroad right-of-way is located just to the south of the proposed transmission line route. The FWMA is a 13,019-acre wildlife management area located on lands managed by both the State of Nevada (overseen by NDOW) and Reclamation (Kelly, pers. comm. 2010). There currently is no land use or management plan implemented for the FWMA (Bull, pers. comm. 2010).

The proposed project would be located on federal and private lands. The current uses of the land include:

- Cattle grazing
- Wildlife preserve/recreation areas as part of the FWMA
- Privately owned unoccupied/unutilized lands
- Utilities, railroad, and road rights-of-way
- Drainage for Newlands Irrigation Project

3.2.2 RECREATION

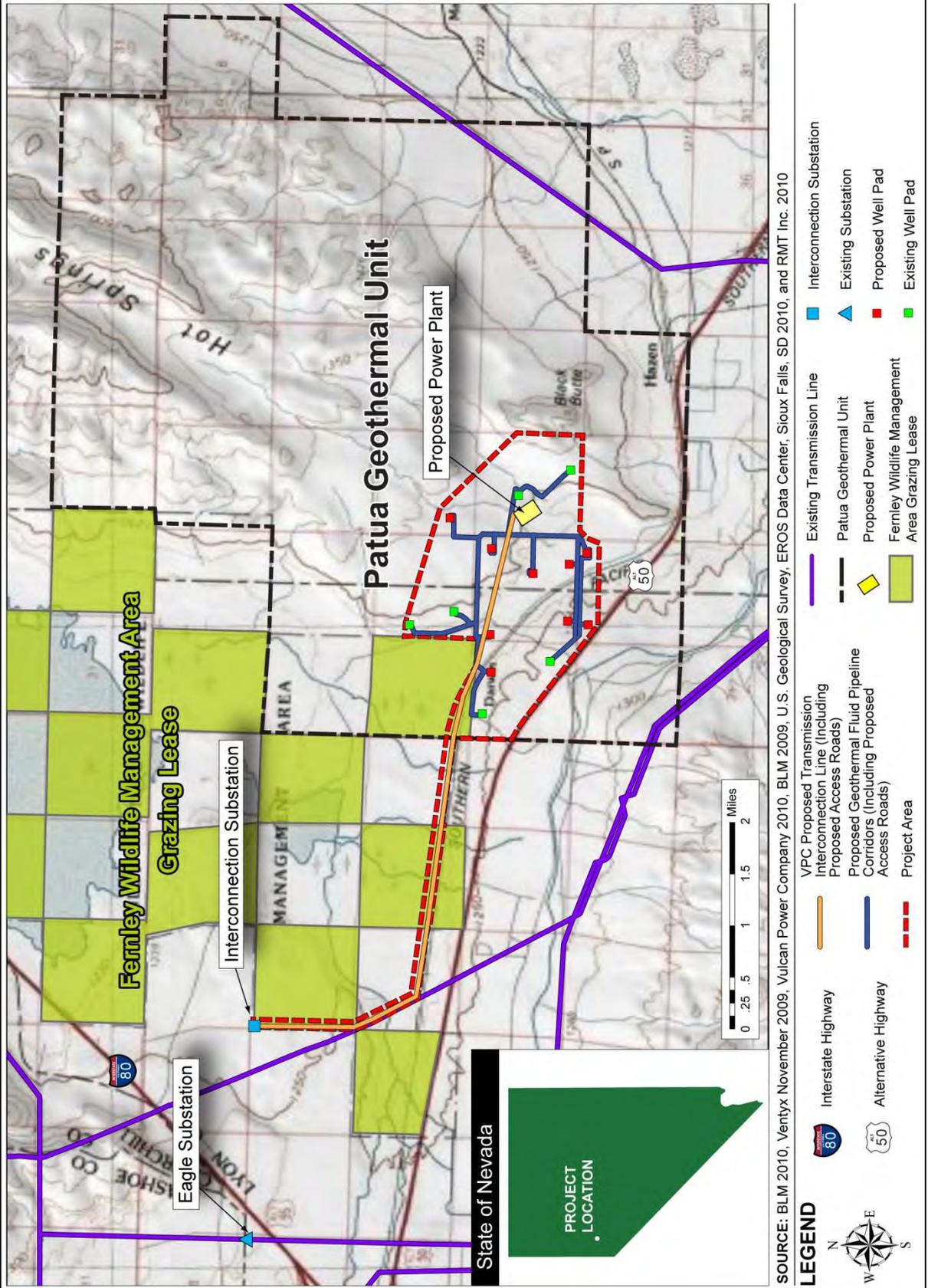
The well field and power plant would be located on Reclamation-managed lands and private lands. Reclamation determines which activities are authorized within its management boundaries. Reclamation lands are considered closed to off-road vehicle use, unless designated as open (43 Code of Federal Regulations (CFR) 420 and 43 CFR 423). The transmission line traverses property managed by Reclamation, NDOW, and private land. As stated above, Reclamation lands are closed to off-road vehicle use. The Reclamation has partnered with NDOW, who manages the FWMA. Permitted recreational activities within the FWMA include camping, fishing, and hunting (NDOW 2010).

3.3 Livestock

One grazing lease is located in the project area. This lease, known as the “Fernley Wildlife Management Area,” is grazed by one rancher. The total acreage of grazing land is 7,323 acres and the season of use is from August 1st through February 15th. The number of permitted livestock on a lease on public land is determined by how many animal unit months (AUMs) that land would support. An AUM is the amount of forage needed to sustain one mature cow, five sheep, or five goats for 1 month (BLM 2008). The Fernley Wildlife Management Area lease is permitted for 400 AUMs. The lease area is shown in Figure 3.1-1. NDOW does not currently administer grazing leases on the NDOW-managed lands (Kelly, pers comm. 2010).

Private ranchers within agriculturally zoned districts may also have grazing activities on their properties, based on the zoning code within the County (Lyon County 2010b, Churchill County 2010).

Figure 3.3-1: Fernley Wildlife Management Area Grazing Lease



3.4 Water Resources

3.4.1 SURFACE WATER

The project is located within the Massie Slough, Sheepherder Canyon, and Fernley Sink Watersheds. Surface waters in the project vicinity include non-jurisdictional wetlands (discussed under Section 3.5 Wetland and Riparian Zones) and the Truckee Canal. The Truckee River and the Carson River, the nearest Traditionally Navigable Waters to the lease area are approximately 7 miles away and there is no surface water connection to the surface water in the project area. The open water and main wetland areas within the FWMA are within 2-3 miles of the lease area. There is a hot spring and associated wetland complex within 1 mile of the lease area, to the northwest, in T20N, R26E, Section 18, on Reclamation-managed lands that are not included in the leased areas. Surface waters and wetlands within the project area are shown in Figure 3.4-1.

Prior to the construction of the Truckee Canal as part of the Newlands project in the early 1900's there are no reports of hot springs in the vicinity of the project, despite the conduct of surveys that included the area (King 1870-1880). Compilations of data for thermal and mineral water do not indicate the presence of these hot springs until after the construction of the canal (Peale 1886; Waring 1965; Garside and Schilling 1979). The canal provides nearly all the recharge to the Fernley Hydrographic Area (Van Denburgh and Arteaga 1985), within which the hot spring is located. A well documented rise in groundwater levels of 40 to 50 feet in Big and Little Soda Lakes in the Carson Desert, approximately 10 miles to the east of the project area, was caused by the importation of water by the Truckee Canal (Rush 1972). It can therefore be reasonably expected that the water table in the Fernley Hydrographic Area also rose in response to the importation of water. This rise could have led to discharge of the thermal water at the surface as springs rather than in the subsurface at a depth controlled by the depth of the water table. The hot spring currently has some recreational value, habitat, and aesthetic value. The wetland values include wildlife value, habitat value, water quality value, and aesthetic value. Wetlands are discussed further in Section 3.5.

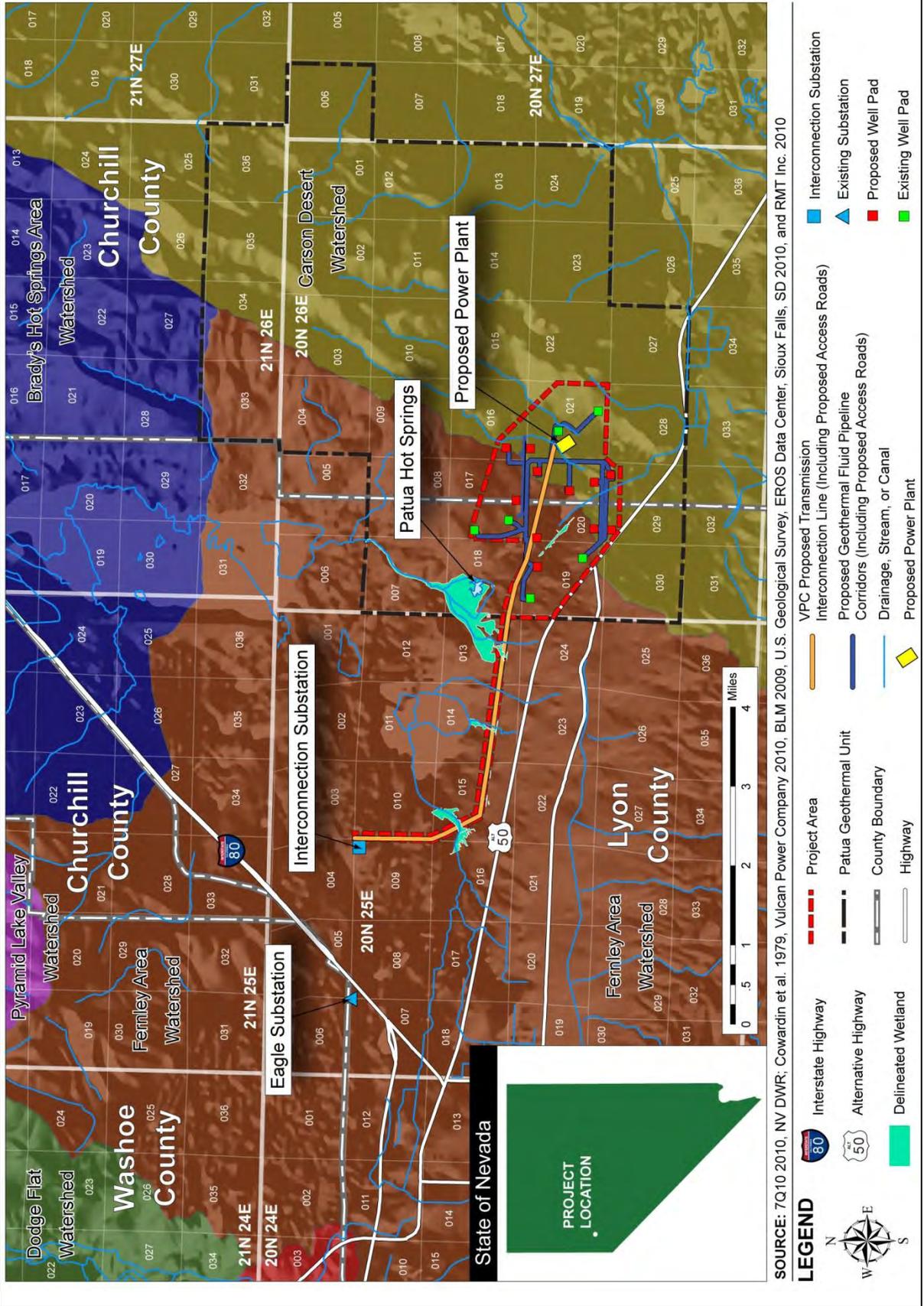
Water chemistry data for the Truckee Canal is expected to be similar to that in the Truckee River near the point of diversion for the canal. The Truckee River at Derby Dam where the Truckee Canal diverts from the Truckee River is 303(d) listed for temperature and turbidity (NDEP 2006a). The Carson River where the Truckee Canal discharges at the Lahontan Reservoir is 303(d) listed for boron, iron, manganese, mercury in fish tissue, mercury in sediment, and molybdenum (NDEP 2006a).

The water chemistry of the hot spring was collected in 2002 by researchers at the University of Nevada, Reno. The data is available in Appendix F. The temperature of the hot springs has been reported to range from 105 °F to over 160 °F (UNR 2010).

3.4.2 GROUNDWATER

The lease area lies within hydrographic areas, demarked as the Carson Desert (basin 101) and Fernley (basin 76) Hydrographic Area. These two basins are hydrographically disconnected from each other. The watersheds are shown in Figure 3.4-1. Sources of ground water include

Figure 3.4-1: Surface Waters within the Project Vicinity



precipitation, groundwater infiltration from the Truckee Canal and groundwater percolation associated with irrigation. The Carson River supplies water used within the Carson Desert (Basin 101).

Groundwater uses within a two mile vicinity of the lease area include:

- Irrigation
- Municipal supply
- Industrial use
- Commercial use
- Domestic use
- Mining and milling
- Stock watering

The closest existing groundwater wells and the use of the water for both Basin 76 and 101 are presented in Table 3.4-1. The wells located within two miles of the lease area, the distance in feet for each of those wells, and the use of the water is identified in the Table 3.4-1.

Groundwater quality is expected to be similar to surface water quality and is influenced by the Truckee Canal, the Fernley East Wastewater Treatment Facility (FEWWTF), and the geothermal resource in the area.

| Table 3.4-1: Nearest Groundwater Wells and Water Uses to the Project Area | | | | | | | |
|--|--------|--------|--------------------|---------------------|---------------------------------|--------------------|-------------------------------------|
| Basin | County | Source | Use | Amount (acre-ft/yr) | Well Owner | Depth of Well (Ft) | Distance to nearest Patua well (ft) |
| 076 | LY | UG | Stock watering | 4.48 | Private Landowner | 580 | 9959 |
| 076 | LY | UG | Irrigation | 1129.60 | Fernley Estates | 580 | 8705 |
| 076 | LY | UG | Commercial | 2.42 | Private Landowner | | 9959 |
| 076 | LY | UG | Irrigation | 547.31 | Fernley Estates | 390 | 11046 |
| 076 | LY | UG | Irrigation | 1624.80 | Federal Land Bank of Sacramento | | 11046 |
| 076 | LY | UG | Mining and Milling | 475.99 | Private Landowner | 400 | 7489 |
| 076 | LY | UG | Irrigation | 1624.80 | Private Landowner | 500 | 10787 |
| 076 | LY | UG | Commercial | 2.69 | Diablo Transportation, Inc. | 62 | 8324 |

Table 3.4-1 (continued): Nearest Groundwater Wells and Water Uses to the Project Area

| Basin | County | Source | Use | Amount (acre-ft/yr) | Well Owner | Depth of Well (Ft) | Distance to nearest Patua well (ft) |
|-------|--------|--------|--------------------|---------------------|---------------------------------|--------------------|-------------------------------------|
| 076 | LY | UG | Commercial | 21.39 | Private Landowner | 340 | 4588 |
| 076 | LY | UG | Mining and Milling | 12.49 | Private Landowner | 400 | 7489 |
| 076 | LY | UG | Quasi-Municipal | 35.76 | Town of Fernley | Unknown | 10312 |
| 076 | LY | UG | Quasi-Municipal | 40.00 | Town of Fernley | Unknown | 10312 |
| 076 | LY | UG | Quasi-Municipal | 40.00 | Town of Fernley | | 10312 |
| 076 | LY | UG | Quasi-Municipal | 40.00 | Town of Fernley | | 10312 |
| 101 | CH | SPR | Domestic | 7.24 | Private Landowner | | 6604 |
| 101 | CH | UG | Commercial | 3.07 | Continental Equipment Company | 235 | 13002 |
| 101 | CH | UG | Quasi-Municipal | 20.00 | Matthews Land, Inc. | | 14664 |
| 101 | CH | UG | Quasi-Municipal | 20.00 | Matthews Land, Inc. | | 14664 |
| 101 | CH | UG | Industrial | 4.48 | Falcon Ridge Investment Company | | 14664 |
| 101 | CH | UG | Commercial | 4.48 | BLT Ready Mix | 840 | 3342 |
| 101 | CH | UG | Commercial | 4.48 | Vista Equipment Inc. | | 3342 |
| 101 | CH | UG | Commercial | 4.48 | Western Nevada Rail Park, LLC | | 904 |

NOTES:

LY: Lyon County

CH: Churchill County

UG: Underground well

SPR: Spring

SOURCE: 7Q10 2010

3.5 Wetlands/Riparian Zones

Wetland delineations were conducted on October 22, 2009. The delineations are currently under review by the US Army Corps of Engineers. The preliminary finding is that there are no federal jurisdictional waters in the project area pursuant to *Rapanos et al vs. United States* (2006) and subsequent guidance issued by the US EPA and US Army Corps of Engineers (Corps) including the Corps Jurisdictional Determination Form Instructional Guidebook. Non-jurisdictional wetland and riparian habitat was noted. The non-jurisdictional wetland and riparian areas are shown in Figure 3.4-1.

Waters and wetlands within the project area would fall under the jurisdiction of the State of Nevada. The discharge of fill material associated with the Project to waters or wetlands would require a permit for Working in Waters from NDEP. Riparian and non-jurisdictional wetland areas in the project area include two larger wetland complexes and small isolated areas of hydrophytic vegetation adjacent to the railroad. Each of these areas exhibit different habitats. No additional surface water bodies were identified within the study area.

One of the larger wetlands is supported hydrologically by effluent from the FEWWFT, which is permitted to discharge up to 2.20 million gallons per day to support the wetland and waterfowl habitat in the FWMA (Huffman and Carpenter 2009). This wetland is 375 feet wide at the point of crossing of the proposed transmission line. The second larger wetland is located within T20N R26E, Sections 18 and 13, north and west of several proposed well pads and project features. This wetland area is supported hydrologically by groundwater upwelling from springs located within Section 18, and areas that are supported by shallow groundwater, which is likely influenced by seepage from the Truckee Canal. The transmission line route crosses two sections of this wetland, in one area 20 feet wide and a second area 100 feet wide. The small areas of hydrophytic vegetation adjacent to the railroad are influenced by shallow groundwater and modified hydrology due to the presence of the railroad.

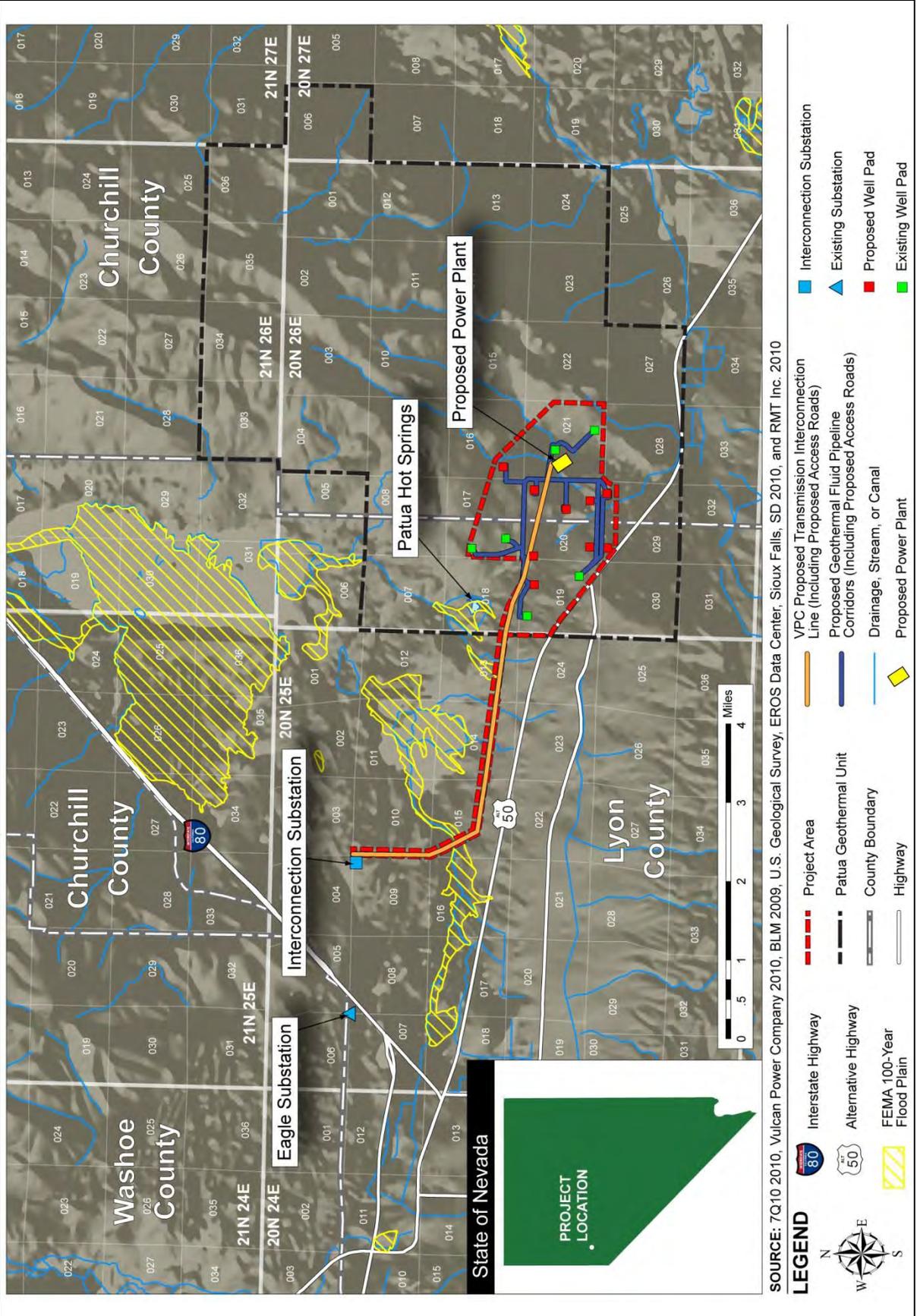
3.6 Floodplains

The BLM generally considers the base floodplain as is described in the Floodplain Management Guidelines for implementing Executive Order 11988 for the purposes of NEPA analysis. The base floodplain is defined as “the lowland and relatively flat areas adjoining inland and coastal waters..., including at a minimum, that area subject to a one percent or greater chance of flooding in any given year”(EPA 1977).

The base floodplain is similar to the 100-year flood zone commonly shown on maps prepared by the Federal Emergency Management Agency (FEMA). The guidelines require that the base floodplain is the minimum area considered. Floodplain management may include additional flood-prone areas that have significant resource values.

The wetland areas associated with the FWMA are located within a FEMA 100-year floodplain (Huffman and Carpenter 2009). The 100-year floodplain intersects with the transmission line as shown in Figure 3.6-1.

Figure 3.6-1: 100-Year Floodplain within the Project Area



The Nevada desert in the vicinity of the project area is prone to flooding. Most floods in the area result from rain-on-snow events. Warm, moist air from the Pacific Ocean brings rain to the mountainous, snowy areas, and causes snow melt rates to increase. A levee associated with an irrigation canal once failed in the City of Fernley have collapsed in the past, causing flooding to the southwest of the project site. The project area has a mix of well drained and poorly drained soil types (see Section 3.15 Soils) and may be prone to flooding (USDA 2010).

3.7 Vegetation

Based on the Southwest Regional Gap Analysis Project, the Nevada Department of Wildlife's Wildlife Action Plan (2006) characterized Nevada's vegetative land cover into 8 broad ecological system groups and linked those with Key Habitat types, which are further refined into Ecological Systems characterized by plant communities or associations (USGS 2005). Within the project area there are two Key Habitats:

- Intermountain Cold Desert Scrub
- Marshes

Intermountain Cold Desert Scrub is divided into the following Ecological Systems:

- Intermountain Basin Mixed Salt Desert Scrub
- Intermountain Basins Greasewood Flat

The well field and power plant would be located on private lands and Reclamation-managed lands on BLM leases. The Ecological Systems within the well field and power plant boundaries are Intermountain Basins Greasewood Flat and Intermountain Basins Mixed Salt Desert Scrub, within the Intermountain Cold Desert Scrub Key Habitat (WRC 2009). The transmission line would be located on lands managed by Reclamation and the State of Nevada, NDOW. The transmission line traverses Intermountain Cold Desert Scrub and Marshes (NDOW 2006). Species associated with each Key Habitat Type are presented in Table 3.7-1.

A botanical resources survey report was prepared in November 2009. A table documenting all plants observed within the study is included in the report. During the preparation of the report, a database query was performed through the Nevada National Heritage Program (NNHP).

Table 3.7-1: Plant Species Found within the Project Area

| Key Habitat Type | Associated Species | Well Field and Power Plant | Transmission Line |
|---------------------------------|--|----------------------------|-------------------|
| Intermountain Cold Desert Scrub | Shadscale (<i>Atriplex confertifolia</i>) | X | X |
| | Greasewood (<i>Sarcobates vermiculatus</i>) | X | X |
| | Winterfat (<i>Krascheninnikovia lanata</i>) | X | X |
| | Torrey seablite (<i>Suaeda moquinii</i>) | X | X |
| | Four-wing saltbush (<i>Atriplex canescens</i>) | X | X |
| | Nevada ephedra (<i>Ephedra nevadensis</i>) | X | X |
| | Budsage (<i>Artemisia spinescens</i>) | X | X |
| | Spiny horsebrush (<i>Tetradymia spinosa</i>) | | X |
| | Dune horsebrush (<i>Tetradymia tetramers</i>) | | X |
| | Green rabbitbrush (<i>Crysothamnus viscidiflorus</i>) | | X |
| | Iodinebush (<i>Allenrolfea occidentalis</i>) | X | X |
| | Quailbush (<i>Atriplex lentiformis</i>) | X | X |
| | Indian ricegrass (<i>Oryzopsis hymenoides</i>) | X | X |
| | Needle-and-thread grass (<i>Stipa comata</i>) | X | X |
| Marshes | Cattails (<i>Typha latifolia</i> , <i>T. angustifolia</i>) | | X |
| | Hardstem bulrush (<i>Scirpus acutus</i>) | | X |
| | Alkali bulrush (<i>Scirpus maritimus</i>) | | X |
| | Common three-square (<i>Scirpus pungens</i>) | | X |
| | Tall whitetop (<i>Lepidium latifolium</i>) | | X |
| | Mugwort (<i>Artemisia douglasiana</i>) | | X |
| | Saltgrass (<i>Distichlis spicata</i>) | | X |
| | Creeping wildrye (<i>Leymus triticoides</i>) | | X |
| | Halogeton (<i>Halogeton glomerata</i>) | | X |

SOURCE: Reynolds 2010; NDOW 2006

3.8 Invasive and Non-Native Species

The State of Nevada lists 47 noxious weed species that require control (Nevada Administrative Code 555.10; Nevada Department of Agriculture, 2008). Six of these species were encountered in the project area during field surveys conducted between May 18-22, September 12-15, and October 23-25. The species identified include:

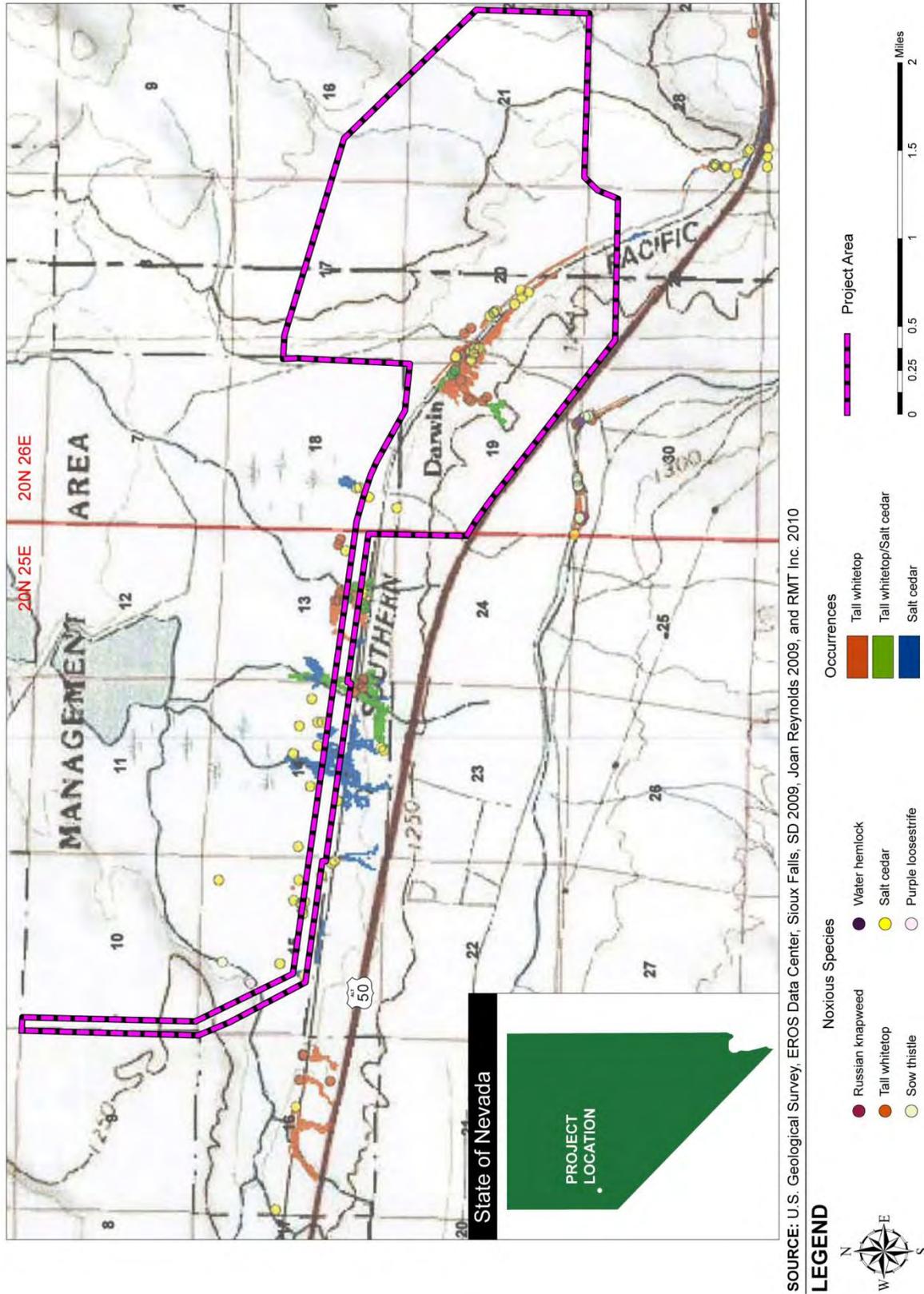
- Tall whitetop
- Salt cedar
- Russian knapweed
- Sow thistle
- Purple loosestrife
- Water hemlock

Table 3.8-1 includes a description of the location and size of each of these invasive species. Figure 3.8-1 shows the locations of these invasive species.

| Invasive Species Name | Description of Location | Size |
|--|--|--|
| Tall whitetop (<i>Lepidium latifolium</i>) | Found during the surveys in all of the wetland areas and irrigation canals, frequently found as the dominant ground cover along the fringes of open water and wetland habitats. Scattered individuals of tall whitetop extended out into the salt flats in numerous areas. | 108 acres |
| Salt cedar (<i>Tamarisk ramosissima</i>) | Found growing as an overstory dominant within the tall whitetop infestations. | 70 acres comprised of 5810 trees (27 acres contained both salt cedar and tall whitetop) |
| Russian knapweed (<i>Centaurea repens</i>) | Found along the Truckee Canal in Section 30. | <0.24 acres |
| Sow thistle (<i>Sonchus arvensis</i>) | Found along the Truckee Canal in Section 30 and on the southern edge of the wetland within the FWMA in Section 15. | <0.24 acres |
| Purple loosestrife (<i>Lythrum salicaria</i>) | One occurrence along the northwest portion of the wetland in Section 15 of the FWMA | Approximately 20 plants in a small cluster |
| Water hemlock (<i>Cicuta maculate var. angustifolia</i>) | Individual plants found along the Truckee Canal. | Individual plants in a few locations |

SOURCE: Reynolds 2009

Figure 3.8-1: Invasive Species found in the Project Area



3.9 Wildlife

The project area is located between the western portion of the Hot Springs Mountains and the southern portion of the Forty Mile Desert. The elevation in the project area ranges from approximately 3,600 to 4,800 feet above mean sea level. The majority of the project area is flat and is situated in a large valley. Slopes in the Hot Springs Mountains tend to be steep in the drainages and all aspects are found. Portions of the project area are located within and adjacent to the FWMA (Fox 2009).

The predominant vegetative community in the project area is salt shrubs, which provide limited habitat for many Great Basin wildlife species and does not maintain a high diversity or density of wildlife species. The western portion of the project area within the wetlands and the FWMA supports a wider variety of species, including at least one species of amphibian and numerous species of waterfowl. Rodents, and lagomorphs occur throughout the project area, as do lizards and snakes. The project area is a mix of native and non-native vegetation, with an extensive presence of non-native, invasive species occurring along the proposed transmission line route associated with the railroad. A list of wildlife species encountered during project surveys are presented in Appendix G. Appendix G also includes a list of NDOW special-status species by County.

Within the project area there are two Key Habitats as defined by the NDOW Wildlife Action Plan (2006):

- Intermountain Cold Desert Scrub
- Marshes

Intermountain Cold Desert Scrub is divided into four Ecological Systems. The following two are present in the project area: Intermountain Basin Mixed Salt Desert Scrub and Intermountain Basins Greasewood Flat. Each of these wildlife habitats and the typical wildlife that they could support are detailed in Table 3.9-1.

Table 3.9-1: Wildlife Species Assemblages by Key Habitat that Could Occur in the Project Area

| Key Habitat | Ecological System | Key Habitat Description | Species Assemblages | Value |
|---------------------------------|---|--|--|---|
| Intermountain Cold Desert Scrub | Intermountain Basin Mixed Salt Desert Scrub | Salt-tolerant shrubs dominated by shadscale or greasewood with Indian ricegrass common | <ul style="list-style-type: none"> ▪ Loggerhead shrike ▪ Sage sparrow ▪ Brewer’s sparrow ▪ Sage thrasher ▪ Black-throated sparrow | Nesting, protection from predators, thermal cover |
| | Intermountain Basins Greasewood Flat | | <ul style="list-style-type: none"> ▪ Burrowing owl ▪ Long-nosed leopard lizard ▪ Kit fox | Burrowing and denning habitat |

Table 3.9-1 (continued): Wildlife Species Assemblages by Key Habitat that Could Occur in the Project Area

| Key Habitat | Ecological System | Key Habitat Description | Species Assemblages | Value |
|-------------|---|--|--|---|
| | | | <ul style="list-style-type: none"> ▪ Prairie falcon ▪ Pallid bat ▪ Desert horned lizard | Prey populations |
| Marshes | North American Arid West Emergent Marsh | Water salinity affects the species present, which include: cattail, hardstem bulrush, alkali bulrush, common three-square, whitetop, saltgrass | <ul style="list-style-type: none"> ▪ Long-billed curlew ▪ American avocet ▪ Willet | Flooded shortgrass and tall grass nesters |
| | | | <ul style="list-style-type: none"> ▪ Prairie falcon | Prey Populations |

SOURCE: Reynolds 2009; Fox 2009; NDOW 2006

3.10 Migratory Birds

3.10.1 MIGRATORY BIRDS

On January 11, 2001, President Clinton signed Executive Order 13186 (Land Bird Strategic Project) placing emphasis on conservation and management of migratory birds. The species are not protected under the Endangered Species Act, but most are protected under the Migratory Bird Treaty Act of 1918.

Vegetation in the project area is described based on the guidance of NDOW's Nevada Wildlife Action Plan (2006). Intermountain Basins Greasewood Flat and Intermountain Basins Mixed Salt Desert Scrub occupy the majority of the project area. Marsh habitat is also found near irrigation canals and drainages. The key habitats are described in more detail in Section 3.7 Vegetation and Section 3.9 Wildlife.

Migratory birds that could occur in the project area are listed on Table 3.10-1. The list includes USFWS species identified as Bird Species of Conservation Concern and Game Birds of Conservation Concern (USFWS 2008).

Wildlife surveys were performed within the project area in September and October 2009. During the surveys eight species of raptors, including barn owl, golden eagle, great horned owl, northern harrier, osprey, prairie falcon, red-tailed hawk, and turkey vulture were detected in the project area.

Table 3.10-1: Migratory Bird Species of Concern

| Common Name | Scientific Name | Habitat Association | Presence/Absence of Suitable Habitat | Project Area |
|---|--------------------------------|--|---|---|
| <i>USFWS Bird Species of Conservation Concern</i> | | | | |
| Snowy plover | <i>Charadrius alexandrinus</i> | Beaches, dry mud or salt flats, sandy shores of rivers, lakes and ponds. | May be present Migratory/foraging habitat | Transmission Line Corridor |
| Loggerhead shrike | <i>Lanius ludovicianus</i> | Open country with scattered trees and shrubs, savanna, desert scrub, and occasionally open woodland. | Known present Migratory/foraging habitat | Well field, Power Plant, and Transmission Line Corridor |
| Golden eagle | <i>Aquila chrysaetos</i> | Generally open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions. | Known present Migratory/foraging habitat | Well field, Power Plant, and Transmission Line Corridor |
| Burrowing owl | <i>Athene cunicularia</i> | Open dry shrub/steppe grasslands, agricultural and rangelands, and desert habitats associated with burrowing animals. | May be present Breeding/foraging habitat | Well Field, Power Plant, and Transmission Line Corridor |
| Long-billed curlew | <i>Numenius americanus</i> | Short-grass grasslands and sometimes wheatfields or fallow fields; nests usually close to standing water | May be present Breeding/migratory/foraging habitat | Transmission Line Corridor |
| Prairie falcon | <i>Falco mexicanus</i> | Primarily open situations, especially in mountainous areas, steppe, plains or prairies. | Known present Migratory/foraging habitat | Well field, Power Plant, and Transmission Line Corridor |
| Willet | <i>Tringa semipalmata</i> | Marshes, tidal mudflats, beaches, lake margins, mangroves, tidal channels, river mouths, coastal lagoons, sandy or rocky shores, less frequently open grassland. | May be present Breeding/migratory/foraging habitat | Transmission Line Corridor |
| American avocet | <i>Recurvirostra americana</i> | Lowland marshes, mudflats, ponds, alkaline lakes, and estuaries. | May be present Breeding/migratory/foraging habitat | Transmission Line Corridor |

Table 3.10-1 (continued): Migratory Bird Species of Concern

| Common Name | Scientific Name | Habitat Association | Presence/Absence of Suitable Habitat | Project Area |
|---|---------------------------|---|---|---|
| <i>USFWS Game Birds of Conservation Concern</i> | | | | |
| Mourning dove | <i>Zenaidura macroura</i> | Open woodland, forest edge, cultivated lands with scattered trees and bushes, parks and suburban areas, arid and desert country and second growth | Known present Migratory and foraging habitat | Well field, Power Plant, and Transmission Line Corridor |
| Mallard | <i>Anas platyrhynchos</i> | Primarily shallow waters such as ponds, lakes, marshes, and flooded fields | Known present Breeding/migratory /foraging habitat | Transmission Line Corridor |

SOURCE: USFWS 2008; Fox 2009; Reynolds 2009

Golden Eagle

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 Eagle 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."

"Important eagle-use area" is defined in the Eagle 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 National Environmental Policy Act analysis of golden eagles and their habitat for all renewable energy projects (BLM Instruction Memorandum No. 2010-156).

Table 3.10-2 lists golden eagle sightings within a 2 mile radius of the project area. An inactive golden eagle nest is located on the south face of Black Butte within 1,135 feet of the project area. The NDOW has records of this nesting territory being active for approximately 20 years. However, the nest was surveyed by NDOW in 2006-2009 and was not active. It was surveyed by Wildlife Resource Consultants in 2010 and was not active. Two golden eagle perch sites with feathers, pellets, and white-wash were noted in the upper elevations of Black Butte. At their closest points, the northernmost perch site is approximately 2,673 feet from the project area while the southernmost perch site is approximately 1,552 feet from the project area.

Table 3.10-2: Golden Eagle Sightings in and Within a 2-mile radius of the Patua Project Area

| Type of Sighting | Year of Observation | Distance to Project Area (feet) | Source of Information |
|--------------------------------|---------------------|---------------------------------|-------------------------------------|
| Inactive nest | 2010* | 1,135 | NDOW, Wildlife Resource Consultants |
| Golden eagle perch (northern) | 2010 | 2,673 | Wildlife Resource Consultants |
| Golden eagle perch (southern) | 2010 | 1,552 | Wildlife Resource Consultants |
| 2 adult golden eagles | 2009 | Within project area | Wildlife Resource Consultants |
| Adult golden eagle (soaring) | 2009 | Within project area | Wildlife Resource Consultants |
| *Nest inactive, see text above | | | |

On September 9, 2009 two adult golden eagles were recorded perched on transmission line towers southeast of the sewage disposal facility. The tower is adjacent to an area actively used for piling dirt. Dump trucks were working only about 100 meters west of the birds who did not move. An adult was also observed soaring over the project area on October 9, 2009. No immature golden eagles were observed in or near the project area.

3.11 Cultural Resources

Cultural resources are protected primarily through the National Historic Preservation Act (NHPA) of 1966 and the regulations implementing Section 106 of that Act (36 CFR § 800), the Archaeological and Historic Preservation Act of 1974, and the Archaeological Resources Protection Act of 1979. Section 106 of the NHPA requires federal agencies to consider the effects of their actions on cultural resources that meet the criteria and are considered eligible for inclusion in the NRHP. These cultural resources are known as "historic properties." Criteria for inclusion on the NRHP are provided in 36 CFR § 60.4. Section 101(d)(6)(A) of the NHPA allows properties of traditional religious and cultural importance to a tribe to be determined eligible for inclusion on the NRHP.

The area of potential effect (APE) for this project encompassed all proposed and existing well pads, proposed access roads, proposed pipeline ROWs, and the proposed transmission line route.

Prior to initiating fieldwork, Western Cultural Resources Management, Inc. (WCRM) conducted archival review at BLM CCDO, the BLM Winnemucca District Office, the Nevada State Museum, and on the Nevada Cultural Resources Information System (NVCRIS). WCRM also reviewed the General Land Office (GLO) plat database. The literature search determined that eleven surveys were previously conducted within 1 mile of the project area and 14 sites are located within 1 mile of the project area. Of the 14 sites, eight are prehistoric and 6 are historic. Three of the previously identified sites are located within the project area:

- The historic Darwin Siding Station (26Ly1419/CrNV-03-1920), which has not been evaluated for NRHP eligibility
- The historic Hazen Drain (26Ch2307/CrNV-03-7539), which is identified as a Contributing Element to the Newlands Reclamation Project National Register District
- An unevaluated two-track historic road and associated debris (26ly935/CrNV-5317). The road was not previously evaluated for NRHP eligibility.

Field surveys followed the literature review. A larger area was surveyed to allow for flexibility in siting of facilities during project implementation. The survey area is shown in Figure 1.1-2. Field surveys were conducted for the project in two phases. The first phase occurred from October 6-28, 2009 and the second phase occurred from November 7-11, 2009. The first mobilization surveyed approximately 1,220 acres including the power plant site and the well pads. The second mobilization surveyed 541 acres accounting for the 1,000-foot-wide transmission corridor, two tied wells, and access to the two wells. Coverage was achieved by traversing parallel transect lines generally oriented to cardinal directions with surveyors spaced intervals no more than 30 meters apart (per BLM and State guidelines). Isolated artifacts and features were noted, measured, and illustrated as appropriate.

The field surveys resulted in the discovery and recordation of sixteen sites and 43 isolated finds. The three previously identified sites were re-examined and updated (for a total of 19 sites). Four of the 19 total sites are recommended eligible to the NRHP, as shown in Table 3.11-1. The lack of preservation and poor overall physical integrity of most project sites affected their eligibility for NRHP listing.

The eligible aspects of the four sites include ethnohistoric components and pre-contact components. Other than several roads, canals, and some graded areas, inventoried lands are relatively free of modern impacts.

Table 3.11-1: Sites Recommended Eligible to the NRHP

| State Number | Agency Number | Site Type |
|--------------|---------------|---------------------------------|
| 26Ch2307 | CrNV-03-7539 | Hazen Drain |
| 26Ly1419 | CrNV-03-1920 | Darwin/Patna Siding Station |
| 26Ly1431 | - | Complex Flaked Stone Assemblage |
| 26Ly1434 | Cr-NV-03-7537 | Southern Pacific Railroad |

SOURCE: WCRM 2009

3.12 Native American Religious Concerns

The project area is located within the Lahontan basin sub-region of the Great Basin located within the Fortymile Desert between the Hot Springs Mountains to the northeast and the Virginia Range to the southwest (WCRM 2009). Carson Lake, which is currently dry, and the Carson Sink are located to the southeast and east of the site, respectively. The Carson Desert is one of several

adjacent basins that were once a part of a much larger basin containing pluvial Lake Lahontan. It is rimmed by the Hot Spring Mountains and the West Humboldt Range to the west, and the Cocoon Mountains, Lahontan Mountains, and Stillwater Range to the east.

Ethnographic information indicates that Northern Paiute occupied the study area. The Northern Paiute continue to have a presence in the project region today; their way of life is characterized by the concept of living in harmony with the natural environment. Rituals and ceremonies address the need to ensure that plants, animals, and physical elements flourish. The continued welfare of the people depends on these rituals and ceremonies being performed properly. 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 are especially important in connection with places where spirits may live or places regarded as power spots.

No traditional cultural properties (TCPs) have been identified by the Carson City BLM as occurring within the project area or that can be affected by project activities.

The American Indian Religious Freedom Act of 1978 also allows for access to sites of religious importance to Native Americans. The Native American Graves Protection and Repatriation Act of 1990 provides for the repatriation of human remains and funerary items to identified Native American descendants. In accordance with provisions of these acts, the BLM initiated consultation with the Fallon Paiute Tribe and the Pyramid Lake Tribe. The BLM is also consulting with federal, state, and local agencies, Tribal governments, and stakeholder groups (see Chapter 6 for a listing). The Native American coordination process included letters, phone calls, and on site meetings.

On April 15, 2010 representatives from WRCM, Reclamation, the BLM, the Fallon Paiute Tribe and the Pyramid Lake Tribe conducted a field tour. The BLM is conducting ongoing consultation specific to the Patua Geothermal project with the Fallon Paiute Shoshone Tribe and the Walker River Paiute Tribe. Concern over a prehistoric site identified in the cultural review was identified; however, the project can avoid the site, which minimized concerns.

3.13 Socioeconomics

The lease area of the proposed project covers 915 acres of Reclamation-managed land, 100 acres of State of Nevada-managed lands, and 1,528 acres of private lands. Churchill and Lyon Counties were identified as the region of interest (ROI) for the socioeconomic analysis, since most of the effects on the population and economy would occur within this local region (Table 3.13-1). Data for the City of Fernley is presented where appropriate, since Fernley is the nearest city to the Patua Geothermal Project.

Racial and ethnic data for Churchill and Lyon Counties for the year 2008 are illustrated in Tables 3.13-2 and 3.13-3. According to US Census Bureau data, Churchill County residents are predominantly white. The largest minority within the County is Hispanic/Latino, followed by American Indian/Alaska Native. The largest minority in Lyon County is also Hispanic/Latino.

Table 3.13-1: Population in the Project Area

| | 2000 | 2006-2008* |
|------------------|-----------|---------------|
| State of Nevada | 1,998,257 | 2,554,344 |
| Churchill County | 23,982 | 24,766 |
| City of Fernley | 8,543 | Not Available |
| Lyon County | 34,501 | 51,890 |

SOURCE: US Census Bureau 2010; *: 2006-2008 American Community Survey 3-Year Estimates Data

Table 3.13-2: Demographic Changes in Churchill County (2000 and 2006-2008)

| | 2000 | 2006-2008 | Percentage (2008) | Percent Change |
|--------------------------------|--------|-----------|-------------------|----------------|
| Total Population | 23,982 | 24,766 | N/A | 3.3 |
| White | 20,192 | 20,939 | 84.6 | 3.7 |
| Black/African American | 384 | 285 | 1.2 | -25.8 |
| American Indian/ Alaska Native | 1,151 | 1,157 | 4.7 | 0.5 |
| Asian | 648 | 236 | 0.9 | -63.6 |
| Pacific Islander* | 48 | 56 | 0.2 | 16.7 |
| Other | 767 | 608 | 2.5 | -20.7 |
| Two or more* | 791 | 1485 | 6.00 | 87.7 |
| Hispanic/Latino** | 2,086 | 2521 | 10.2 | 20.9 |

NOTES: * Asians and Pacific Islanders were grouped together.

** In combination with other races. The categorical figures/percentages may add up to more than the total population (100 percent) because individuals may report more than one race.

SOURCE: US Census Bureau 2010

Table 3.13-3: Demographic Changes in Lyon County (2000 and 2006-2008)

| | 2000 | 2006-2008 | Percentage (2008) | Percent Change |
|--------------------------------|--------|-----------|-------------------|----------------|
| Total Population | 34,501 | 51,890 | N/A | 50.4 |
| White | 30,576 | 46,682 | 90.0 | 52.7 |
| Black/African American | 225 | 858 | 1.7 | 281.3 |
| American Indian/ Alaska Native | 884 | 1,306 | 2.5 | 47.7 |

Table 3.13-3 (continued): Demographic Changes in Lyon County (2000 and 2006-2008)

| | 2000 | 2006-2008 | Percentage (2008) | Percent Change |
|-------------------|-------|-----------|-------------------|----------------|
| Asian | 210 | 202 | 0.4 | -3.8 |
| Pacific Islander* | 47 | 56 | 0.1 | 19.1 |
| Other | 1,585 | 1,169 | 2.3 | -26.2 |
| Two or more | 1,014 | 1,617 | 3.1 | 59.5 |
| Hispanic/Latino** | 3,784 | 5,082 | 9.8 | 34.3 |

NOTES: * Asians and Pacific Islanders were grouped together.
 ** In combination with other races. The categorical figures/percentages may add up to more than the total population (100 percent) because individuals may report more than one race.

SOURCE: US Census Bureau 2010

The US Census Bureau uses a set of income thresholds that vary by family size and composition to determine which families are considered living below the poverty line. If a family’s total income is less than its threshold, the family is considered poor. The poverty thresholds do not vary geographically, but they are updated annually for inflation using the Consumer Price Index. For example, in 2009 the average estimated poverty threshold for an individual (under 65 years) was an annual income of \$11,161; for a four-person household (with two related individuals under 18), it was \$21,756 (US Census Bureau 2010).

Table 3.13-4 provides income statistics for Churchill and Lyon Counties and Nevada. Both counties have median household incomes lower than the Nevada average, and poverty rates higher than the statewide level.

Table 3.13-4: Income and Poverty Statistics (2006-2008)

| | Churchill County | Lyon County | Nevada |
|--|------------------|-------------|----------|
| Median Household Income | \$51,024 | \$47,095 | \$56,348 |
| Percentage of Population Living in Poverty | 10.2% | 14.2% | 10.8% |

SOURCE: US Census Bureau 2010

3.14 Mineral Resources

The project area is located to the west-southwest of the Hot Springs Mountains. There are no active mining claims in the project area. The area to the west of the Hot Springs Mountains is located within the Leete Mining District. The Leete Mining Site is approximately 15 miles north of the proposed well field. This mining district is known for salt and borax mining. Metallic mineral deposits are confined to the Northern Hot Springs Mountains. Hydrothermal mineral deposits produced and mined in the area include (BLM 2006):

- Gold
- Silver
- Mercury (cinnabar)

Gravel mining is also a predominant mining operation in the project vicinity. Several gravel mines are noted on the topographic map to the west of the Leete Mining Site. VPC would obtain base rock and other earth materials from a permitted gravel operation (N-86320) within the Unit, located east of Black Butte, in Section 24, T20N, R26E.

The Geothermal Steam Act gave BLM the responsibility and authority for leasing geothermal rights for geothermal development and for reviewing and authorizing the development. The geothermal resource temperature in the project area is expected to be 325 °F (BLM 2002). No development of the resource to-date has occurred although VPC has drilled several exploration wells on private lands.

3.15 Soils

The project area is associated with Parran soils. These soils are typically very deep and poorly drained (USDA 2010). The project area contains several soil type associations. These soil associations are listed in Table 3.15-1 and shown in Figure 3.15-1.

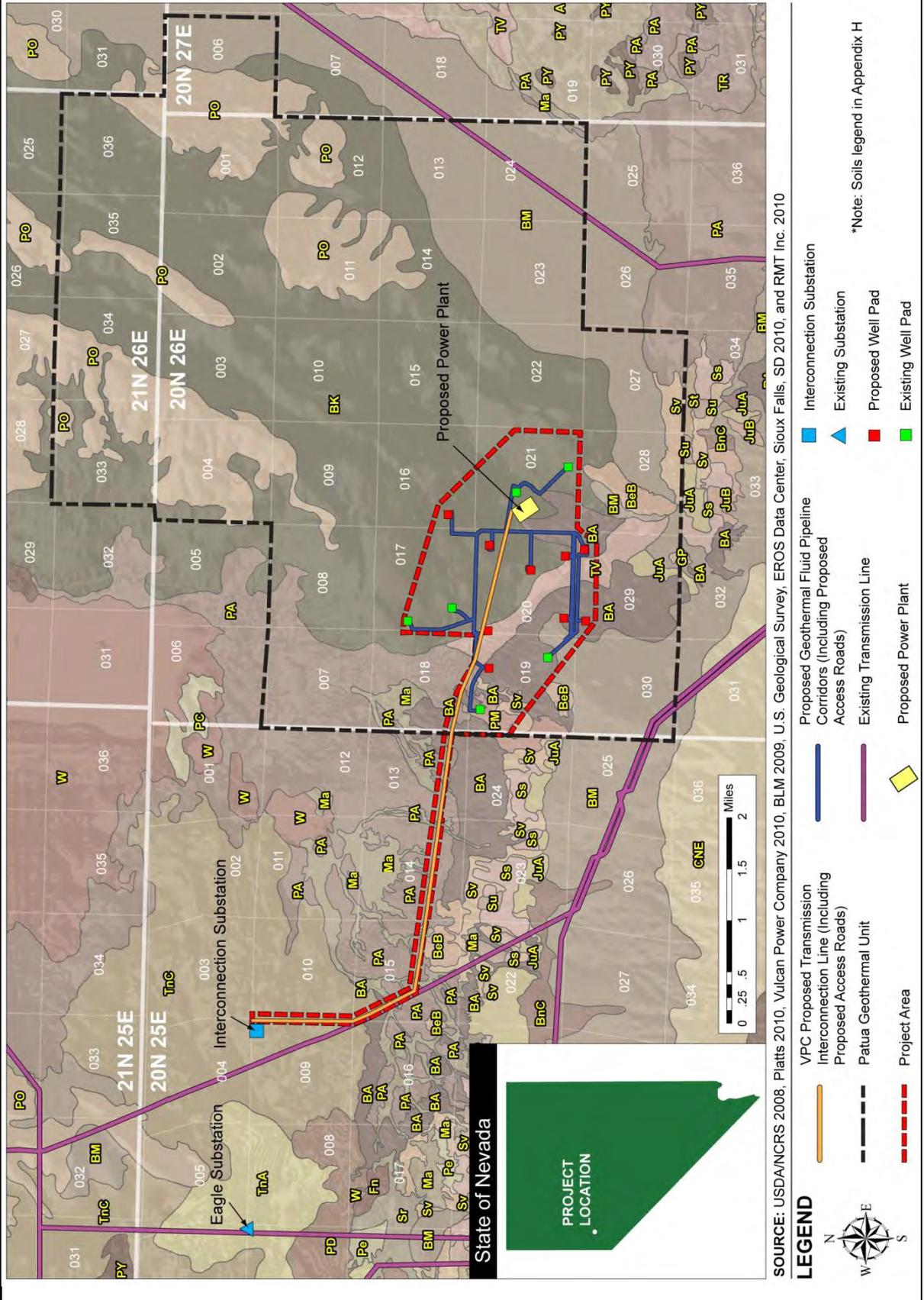
| Soil Type | Landform | Drainage Class | Parent Material | Frequency of Ponding | Project Component |
|--|--------------------------------------|---------------------|--|----------------------|-------------------|
| Pirouette-Theon-Weena association | Hills | Well drained | Residuum and colluviums derived from volcanic rocks, residuum derived from sedimentary rocks | None | Well Field |
| Bluewing gravelly loamy sand, 2 to 8 percent slopes | Alluvial fans, inset fans, piedmonts | Excessively drained | Mixed alluvium | None | Well Field |
| Theon very gravelly sandy loam, 8 to 30 percent slopes | Hills | Well drained | Residuum and colluviums derived from volcanic rocks | None | Well Field |
| Badland-Mazuma complex, 2 to 30 percent slopes | Lake terraces | Well drained | Mixed alluvium | None | Well Field |

Table 3.15-1 (continued): Soils in the Project Area

| Soil Type | Landform | Drainage Class | Parent Material | Frequency of Ponding | Project Component |
|--|--|---|--|----------------------|--------------------------------|
| Swingler clay loam, strongly saline, 0 to 2 percent slopes | Lake terraces | Well drained | Mixed alluvium over lacustrine deposits | None | Well Field |
| Isolde-Parran-Appian association | Dunes, lake terraces, lake plains | Excessively drained, well drained, somewhat poorly drained (Parran) | Eolian deposits, mixed alluvium over lacustrine deposits, lacustrine deposits | None | Well Field |
| Bango-Hawsley | Beach terraces, sand sheets | Well drained, somewhat excessively drained | Mixed alluvium over lacustrine deposits, mixed alluvium and water re-worked eolian sand | None | Well Field |
| Tuffman-Bluewing-Labou association | Beach terraces, inset fans | Well drained, excessively drained | Alluvium derived from tufa and/or alluvium derived from volcanic rock, mixed alluvium, lacustrine deposits | None | Well Field |
| Biddleman-Mazuma-Weena association | Beach terraces, lake terraces, pediments | Well drained | Mixed alluvium, residuum derived from sedimentary rocks | None | Well Field, Power Plant |
| Parran-Sondoa association | Lake plains, stream terraces | Somewhat poorly drained (Parran), well drained | Lacustrine deposits, alluvium derived from mixed rocks over lacustrine deposits | None | Power Plant, Transmission Line |
| Hawsley loamy sand, 2 to 8 percent slopes | Sand sheets | Somewhat excessively drained | Mixed alluvium and water re-worked eolian sand | None | Transmission Line |
| Pelic-Turupah complex, 0 to 1 percent slopes | Flood plains | Very poorly to somewhat poorly drained | Mixed alluvium | Frequent | Transmission Line |
| Bango sandy loam, 2 to 4 percent slopes | Lake terraces | Well drained | Mixed alluvium over lacustrine deposits | None | Transmission Line |

SOURCE: USDA 2010

Figure 3.15-1: Soils Found in the Project Area



3.16 Wastes, Hazardous or Solid

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a federal fund to clean up uncontrolled or abandoned hazardous waste sites and certain other releases of pollutants and contaminants into the environment. Section 120(h) of CERCLA requires that property contaminated by the federal government be restored before being conveyed outside the federal government (USEPA 2002).

The Resource Conservation and Recovery Act (RCRA) gave the EPA the authority to control hazardous waste from when it was created to its disposal and includes the generation, transportation, treatment, storage, and disposal of hazardous waste. Drilling fluids, produced water, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy are exempt from RCRA Subtitle C (USEPA 1993).

The project area is undeveloped and no hazardous materials are known to be present. There is no evidence to suggest that hazardous material was stored for one or more years, disposed of, or released on the project area. One major highway, Alt 50, provides access to the site. There are six existing well pads in use on private lands within the project area. There are no known incidences of release of hazardous materials from these existing well pads.

Solid waste facilities are located within Churchill County and neighboring Storey County. Both Russell Pass Landfill in Fallon, NV and Lockwood Regional Landfill, approximately 10 miles east of Reno, NV are Class 1 facilities and are permitted to accept more than 25,000 tons of solid waste (including construction and demolition debris, industrial and special waste, and drum management-liquid) daily (Kauffman pers. comm. 2010).

3.17 Air Quality

The proposed project is located in the intermountain west, which tends to be dominated meteorologically by recurring high and low pressure systems. The closest city to the project site, Fernley, Nevada, experiences a high desert climate with hot summers and cold winters. Average mean temperatures are 72 degrees Fahrenheit in the summer and 34 degrees in the winter (Western Regional Climate Center 2010). Summer is often marked by stationary high-pressure systems that develop over the region. These systems augment clear-sky conditions but also can result in large-scale stagnation of underlying air when light wind conditions persist (Western Regional Climate Center 2010). Thunderstorms that develop in the afternoons, most often in summer, also generate dust. Dust storms can cause substantial decreases in air quality, and can severely reduce visibility. Levels of particulate matter in the air are elevated during and following dust storms. Vehicle travel on unpaved roads is another large contributor to fugitive dust emissions.

The State of Nevada is required to identify geographic areas that are not in compliance with federal and/or state air quality standards. The NDEP, Bureau of Air Quality Planning (BAQP), operates an ambient air quality monitoring network of gaseous and particulate pollutant monitors throughout rural Nevada. The state has ten air quality monitoring stations, the closest of which is located in Fernley, Nevada; the station is approximately 7 miles west of the proposed project area (NDEP 2006b). The project area is located within Lyon and Churchill Counties, which are in

compliance with federal and state air quality standards and have no non-attainment statuses for criteria pollutants, which include nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter smaller than 10 microns in aerodynamic diameter (PM₁₀), particulate matter smaller than 2.5 microns in aerodynamic diameter (PM_{2.5}), ozone, and lead (BAQP 2003, EPA 2010). Appendix I lists the ambient air quality standards applicable in Nevada. An air quality conformity analysis is not required for the proposed project because there are no criteria pollutants with a non-attainment status within the air shed, per 40 CFR 93, Subpart B.

NDEP has also established an ambient air quality standard of 0.08 parts per million (ppm) or 112 micrograms per cubic meter for hydrogen sulfide (H₂S). Nevada Administrative Code 445B.22097 provides the minimum standards of quality for Nevada ambient air.

The Final Mandatory Reporting of Greenhouse Gases Rule issued by the EPA, as signed on September 22, 2009, requires suppliers of fossil fuels or industrial greenhouse gases (GHG), manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions to submit annual reports to the EPA. NDEP also requires GHG emissions reporting; however, NDEP has exempted geothermal projects from GHG reporting.

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Environmental Consequences

4.1 Introduction

This section describes the effects of the proposed project on the environmental resources identified and described in Section 3: Affected Environment.

4.2 Land Use

4.2.1 PROPOSED ACTION

The proposed access roads, well pads, and exploratory wells would be located within the BLM geothermal lease area and would be consistent with the conditions of the BLM geothermal leases. Although the lease area may contain existing valid surface uses (such as easements, rights-of-way, and range improvements), these uses are largely nonexclusive, so compatible rights can be granted.

The geothermal leases also require that lease stipulations are incorporated into the design of the project. The lease stipulations are included in Appendix C. These stipulations only apply to the BLM lease areas on Reclamation-managed lands.

The proposed transmission line and associated access roads would be located within the BLM geothermal lease area, other Reclamation-managed lands, State of Nevada-managed lands, and on private lands. The transmission line and access roads are adjacent to the existing Southern Pacific Railroad line and the existing Los Angeles Department of Water and Power (LADWP) transmission line within the boundaries of the FWMA. Based on the transmission line design discussed in Section 2.0, the transmission line would not conflict with land uses in the area. The placement of the line along the southern-most outer boundary of the FWMA and just north of the railroad alignment was determined to be the best position to minimize interference with the functions of the FWMA. The proposed use of anti-collision devices and the design of the transmission lines would minimize effects to migratory birds and waterfowl utilizing the FWMA.

Decommissioning would include the removal of project facilities and associated structures, and would not alter any existing land uses. Decommissioning and restoration would not conflict with the multiple-use objectives of Reclamation and NDOW managed lands. Impacts would be similar to construction impacts and would be minimal.

4.2.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development activities in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the project description would occur. No impacts to land uses would occur.

4.3 Livestock

4.3.1 PROPOSED ACTION

The Fernley Wildlife Management Area grazing lease overlaps portions of the proposed transmission line. There is currently no grazing in the areas of the proposed power plant, well pads, and pipelines.

During construction, approximately 163 acres of land would be in use for construction of the transmission line (assuming a 75-foot-wide transmission construction corridor), which is approximately 9 of 400 AUMs, or 2 percent. Cattle would avoid this area during construction. The potential impacts would be temporary (part of one season) and would occur at the edge of the lease area. Construction of the transmission line would likely occur during the dry season (to minimize effects to the wetlands), when cattle grazing is not permitted (February 16th through July 31st). If some overlap in construction and grazing occurs, impacts would be minimal. Cattle would likely access the entire area once construction is complete. Permanent loss of grazing habitat would be limited to the area around each pole (a few square feet per pole), which would be minimal. Existing access roads may be improved, which could result in a permanent additional loss of grazing habitat of approximately 34 acres or approximately 2 AUMs (0.5 percent). The project would not compromise livestock access to available water sources if the area were to be used for grazing in the future. Maintenance vehicles would access the transmission line periodically along the access roads. Vehicles would travel at low speeds to minimize potential for injury to cattle, were access to occur during the permitted grazing season and cattle were in the area.

Decommissioning would include the removal of project facilities and associated structures. Decommissioning and restoration would return the 34 acres of previously disturbed areas within the grazing lease to land that could potentially be utilized again for livestock grazing.

4.3.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the project description would occur.

4.4 Water Resources

4.4.1 PROPOSED ACTION

Water Quality

Surface water runoff would increase slightly at the well pads due to vegetation removal and soil compaction. Surface water contamination is further minimized as all stormwater, drilling muds and fluids, and storage tanks drain to the reserve pit. The reserve pit would be clay lined to prevent seepage of geothermal fluids into the underlying groundwater. Containment berms would be constructed around all hazardous material or potentially hazardous material storage areas. Off-pad stormwater would be directed away from the well pads.

Blowouts have the potential to release water pollutants. BOPE would minimize the risk of impacts related to uncontrolled production of geothermal fluids. BOPE would be maintained at the wellhead to allow well shutdown if an uncontrolled flow of fluid or gas occurs. The nearest surface waters to well pads are greater than 1,500 feet away.

A grouting and casing program for construction of any wells would be implemented to prevent water quality effects on groundwater during or after well installation. Borehole geophysics analyses (cement bond logs) would be conducted to document that well-casing grouting activities provide an effective seal, isolating the geothermal aquifer from shallow alluvial aquifers and therefore minimizing potential impacts on surface washes, springs, seeps, or floodplains.

The geothermal lease stipulates that there is no surface occupancy or ground disturbance within 650 feet from canals and other water features. The closest proposed well pad on Reclamation lands is more than a mile from the Truckee Canal. VPC would not conduct any ground disturbance within 650 feet of a canal or water feature on BLM leased lands without prior BLM and Reclamation consent. VPC would obtain Reclamation approval and necessary permits for working in waters and/or groundwater discharge permits and provide a Notice of Intent to NDEP prior to well pad construction.

Decommissioning activities would include capping wells and reclaiming the area. No other activities that could degrade water quality would occur, other than use of construction equipment and vehicles. There is a low risk of fuel spills from use of construction equipment and vehicles; however, spill control and containment measures would minimize risks to water quality. The risk of impacts to water quality would be minimal.

Hydrology

Well Field and Power Plant

Wetlands are located to the west and north of the proposed well field. Thermal springs (hot springs) are located approximately 1 mile north of the well field area. A hydrologic connection is not known to exist between the hot springs and the geothermal aquifer, although the hot springs appear to be greatly influenced by local ground water seepage from the Truckee Canal. Historic records of the hot springs are limited and current uses are associated with the marsh-type habitat that the springs support. There are no sanctioned recreational uses of these hot springs, which are located on Reclamation-managed land. Geothermal drilling would not affect the wetland or spring hydrology because the wells would be cased to prevent withdrawal of water from an aquifer shallower than the geothermal aquifer.

Short-term flow testing (rig tests) would result in the permanent loss of some geothermal aquifer water. An estimated 2,000 gpm of flow is expected for each well and each well would be flowed for several hours. An estimated 1 million gallons or more of geothermal fluid may be withdrawn per well during rig tests, which is a small amount compared with the likely overall geothermal reservoir. The water would be withdrawn from the deep geothermal aquifer and is not expected to have any effects on the wetlands in the area, which are likely sourced and influenced largely by seepage from the Truckee Canal. Water from rig tests would be directed to the reserve pits where it would evaporate. Reserve pits would be lined with clay to prevent contamination. Long-term

testing, which can last up to 90 days, would likely include injection of withdrawn fluid and therefore would result in much less loss of geothermal water.

VPC is proposing a binary plant, where all of the geothermal fluid is returned to the geothermal reservoir (unless some is used for wet cooling), which would minimize the potential for effects to the hot springs.

The type of cooling for the proposed project has not yet been determined, but could include geothermal fluid, groundwater, or air cooling. If VPC uses geothermal fluid for cooling, this action would require a permit and review by the State Engineer. As previously stated, a hydrologic connection is not known to exist between the hot springs and the geothermal aquifer, as the hot springs appear to be greatly influenced by the Truckee Canal. The habitat and wetlands would be minimally impacted by withdrawal of geothermal fluid because the geothermal reservoir fluids would be withdrawn thousands of feet below the shallow aquifers that supply the wetlands.

If VPC were to use groundwater for cooling, a state permit would be acquired and the State Engineer's rules would require that existing uses of water are not impacted. If the groundwater is used for cooling, groundwater wells are expected to be located in a deep aquifer that is separate from the shallow aquifer that is likely supporting the wetlands. There would be minimal expected effects to the wetlands supported by shallow groundwater due to the separation of aquifers. Groundwater withdrawal for cooling would cause drawdown; however, the drawdown would generally be in the well field area, and not the wetlands.

In accordance with lease stipulations, VPC would prepare and submit a hydrologic baseline data collection plan for approval by the BLM and/or Reclamation, prior to drilling. The plan would be implemented during drilling and project operation.

Dry cooling would require no additional water consumption and, therefore, would have few to no effects on wetlands.

Decommissioning would involve the plugging of the wells and removal of the project components. Cessation of withdrawal and injection would return the geothermal reservoir to natural conditions. No effects to hydrology would occur.

Transmission Line

Construction and operation of the transmission lines would have minimal impacts to the hydrology of the area. Transmission lines would span wetlands and dips or culverts would be installed so as not to impact flows.

4.4.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the project description would occur. No impacts to water quality or hydrology would occur.

4.5 Wetlands and Riparian Areas

4.5.1 PROPOSED ACTION

Construction of the well field and power plant would have no direct effects on wetlands and riparian areas because no wetlands or riparian areas occur in this area. Construction of the transmission lines would mostly span wetlands. Construction of the transmission line would occur in the dry season to minimize effects to wetlands. Existing two-track roads would be used to the greatest extent feasible. The release of hazardous materials to the environment could affect wetland and riparian areas near the proposed transmission line. BMPs to prevent such a release, including implementation of VPC's SWPPP and SPCC plan, would minimize impacts to wetlands and riparian areas during construction of the transmission line and associated features. When permanent new access roads must cross ephemeral washes, rolling dips would be installed. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. Culverts may be used wherever rolling dips are not feasible.

The project has the potential to indirectly affect wetlands through potential groundwater withdrawal, which is described in Section 4.4 Water Resources.

Decommissioning would include removal of the project components, including the transmission line and access roads. Minor disturbance would be required, similar to construction. Work in wetlands and riparian areas would be minimal because poles would not be installed through the wetland areas. Effects would be minimal.

4.5.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the project description would occur. The transmission line would not be built and no changes to the existing wetlands or riparian areas would occur.

4.6 Floodplains

4.6.1 PROPOSED ACTION

The well field (including associated pipelines) and power plant site are located outside of the boundary of the 100-year floodplain. Construction and operation of these components of the project would have no effects related to flooding.

The wetland areas associated with the FWMA are located within a FEMA 100-year floodplain (Huffman and Carpenter 2009). The 100-year floodplain intersects the transmission line as shown in Figure 3.5-1. The transmission line would likely span the floodplain. If the floodplain cannot be spanned, the transmission line would only increase the footprint of built structures in the floodplain by the size of the pole bases. This small increase in built structures would not have a substantial effect on flooding or cause an expansion of the floodplain. The poles are designed to withstand saturated conditions. Construction would occur in the dry season to minimize effects to wetland and riparian habitat and for constructability purposes.

Access roads for the transmission line construction and for maintenance after construction may be constructed through portions of the floodplain. Roads would be constructed with culverts properly sized to convey a minimum 25-year flood frequency. The design of the roads would not result in an increase in the floodplain. Existing two-track roads would be used for access along the transmission line to the greatest extent feasible to minimize the amount of additional base material and construction necessary. Impacts would be minimal.

All project components and access roads would be removed and restored during decommissioning. Decommissioning would have minimal impacts on people or property from flooding because no additional structures would be placed within a floodplain.

4.6.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the project description would occur. There would be no impacts to floodplains.

4.7 Vegetation

4.7.1 PROPOSED ACTION

Impacts to vegetation would be minimized by reseeding all areas of access roads and well pads not required for subsequent energy production using a BLM-approved native seed mixture. Reseeding would not be undertaken in areas where soil conditions are inappropriate or where the adjacent undisturbed land surface has little or no vegetation, as determined in coordination with a qualified biologist. Topsoil would be salvaged whenever possible and reused in a timely manner. All reclamation would be performed in accordance with the Gold Book (2007) and lease stipulations. Native soil material and organic matter (topsoil) salvaged from the site preparation operations would be reused as a top-dressing on berms and other areas requiring revegetation to the extent practical.

The vegetation in the area of the proposed well field and power plant is comprised of Intermountain Cold Desert Scrub habitat. Construction of the proposed well field, power plant, and associated features would require permanent and temporary disturbance of approximately 110 acres. Disturbance and loss of approximately 91 acres of this habitat would have minimal effects to wildlife because it does not support a wide variety of wildlife and the habitat is very common in the region.

Vegetation in the area of the proposed transmission line route includes areas of wetland habitat, irrigation canals, and drainages as well as desert scrub habitat. An estimated 13 acres of permanent disturbance and an estimated additional 8 acres of temporary disturbance would occur as a result of construction and operation of the proposed transmission line. A total not-to-exceed

vegetation removal is estimated at 27 acres². Wetlands would be spanned to minimize effects. Vegetation in the area of the proposed transmission line route is highly disturbed by invasive species, likely from the construction and use of the railroad and old transmission line in the vicinity (see Section 4.8 Invasive and Non-native Species). Some wetland plant species could still be disturbed, however; best management practices described in Section 4.4 would be implemented to minimize effects to the surrounding habitat and water quality. The loss of some habitat would be minor due to the low quality of the habitat in the area and the relatively small portion that would be disturbed.

Sand dune habitat is also located in Section 10, the northwestern portion of the proposed transmission line route. Sand dune habitat can support some vulnerable plant species. A qualified botanist would perform plant surveys in the blooming period prior to construction of the transmission line and access roads in T20N R25E, Section 10 for Nevada dune beardtongue (*Penstemon arenarius*) and Lahontan indigo bush (*Psoralea kingii*). If any individuals of these two plants are found they would be avoided or a replanting and restoration plan would be prepared and implemented. Impacts would be minimized.

Withdrawal of groundwater for project construction and for operation of the power plant could affect hydrophytic marsh vegetation that is supported by the wetlands and hot spring in the area, through lowering of the water table, if a wet cooling system is used and groundwater in the area is used to supply the plant's cooling system. This potential impact is discussed in Section 4.4 Water Resources.

Impacts from decommissioning and restoration would be similar to those expected during construction. A small amount of vegetation may need to be cleared to facilitate the removal of access roads, the power plant, pipelines, and transmission line (i.e., such as for staging areas). Disturbed areas would be revegetated as required by Reclamation and NDOW, and impacts would be minimal.

4.7.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. Vegetation would remain unchanged.

4.8 Invasive and Non-Native Species

4.8.1 PROPOSED ACTION

Construction and implementation of the proposed project has the potential to increase the spread of invasive, non-native species. Weed seeds can germinate when soils are disturbed by

² The transmission line ROW would be an average of 75 feet wide over the entire transmission line route. Work could occur anywhere within this corridor, including off road access, lying down of poles, etc. The temporary disturbance calculation estimates only areas within the corridor where vegetation and habitat would be removed; however, a larger area would be utilized. Vegetation disturbance could occur but vegetation would not be removed across the entire corridor.

construction activities, particularly where available soil moisture is increased by application of water for dust suppression. Weeds also could be introduced by construction equipment brought to the project from infested areas or by the use of seed mixtures or mulching materials containing weed seeds.

The potential to increase the spread of invasive, non-native species would be minimized through the implementation of the Noxious Weed Abatement Plan, included in Appendix E to this EA. The plan includes implementing a combination of cultural, mechanical, and chemical controls.

Cultural controls include seeding areas devoid of vegetation, using weed-free mulches, and using machinery and equipment that are not contaminated with weed seeds. Interim seeding of stockpiles or other disturbed areas with aggressive annual species such as rye or barley wheat would be used to control the spread of weeds. Mechanical control methods physically destroy the weed including hand pulling, cultivating, mowing, and root plowing. Chemical methods include use of herbicides.

The Noxious Weed Abatement Plan includes the following measures to minimize the potential for spread of non-native, invasive species. The list is not exhaustive. Refer to Appendix E for the complete plan.

- Noxious weed free staging areas would be selected for project construction.
- Equipment contaminated with soils from areas with known noxious occurrences would be washed with power or high-pressure washers, cleaning off all mud, dirt, and plant parts, on tires and the undercarriage in a designated wash station before proceeding to weed-free areas. Wash water and soils would be contained.
- Soils from washing stations and other known noxious weed infested areas would be disposed of at the nearest landfill or designated disposal area.
- If noxious weed infested soil is used for fill material, it would be placed at depth as to not allow for germination of the seeds.
- Ground disturbance and vegetation removal would be minimized to the extent possible and practical.
- The entrances to the project site would be restricted to vehicles or other traffic that may transport weed seeds or plant material.
- All workers would be required to inspect and clean their boots, clothing and tools to prevent weed seeds and/or plant parts from spreading to weed-free areas after working in noxious weed infested areas.
- All equipment would be thoroughly cleaned when operating in weed-infested areas prior to mobilizing to another location.
- Noxious weed infested areas would be avoided to the greatest extent feasible and top soil fill would not be salvaged from known noxious weed locations.
- VPC would document and monitor the effectiveness of the control/treatment measures. The weed control program would be continued until such a time (for approximately 3 years) that the revegetation species are established and are self-maintaining. Weed management would continue through the life of the project. VPC would be responsible for ensuring that monitoring occurs. Monitoring would be performed by a qualified professional.

The plan also includes methods to address the specific infestations of tall whitetop, salt cedar, purple loosestrife, Russian knapweed, sow thistle, and water hemlock. These species would be treated where encountered in the construction area. Effects from the spread of invasive species would be minimal with implementation of the Noxious Weed Abatement Plan (Appendix E).

Impacts from decommissioning would be similar to those expected during construction. Some ground disturbance would be required during the removal of the access roads, power plant, pipeline, and transmission line. Disturbed areas would be revegetated with a weed-free mix, as required by Reclamation, the BLM, and NDOW. The Noxious Weed Abatement Plan would be updated and implemented to reduce the potential spread of invasive species that may occur in the area at that time. Impacts would be minimal.

4.8.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the project description would occur.

4.9 Wildlife

4.9.1 PROPOSED ACTION

The project area supports limited habitat for many Great Basin wildlife species and has the low diversity of wildlife species typical of desert scrub and greasewood flats.

Construction Impacts

Direct impacts to wildlife species could result from mortality or injury from equipment during project construction. Vehicles would not travel off-road, which would reduce the likelihood of mortality.

Several species of bats could forage and roost along the proposed transmission line route in Marsh habitat. Bats could forage over the canal and roost in willows or other trees near the canal. Willows or tree-roosting habitat would be avoided to the greatest extent feasible. A special status butterfly species, the Nevada viceroy (*Lemenitis archippus*) could also occur in the area of the transmission line, within the willow habitat. Willow habitat would be avoided to the greatest extent feasible during construction. If willows have to be removed, the vegetation would be inspected by a qualified biologist for bats and Nevada viceroy just prior to removal. If bats or viceroy larvae are found, the willows would not be removed until the bat has left the area or the viceroy larvae have transformed or have been relocated. Impacts would be minimal.

Indirect effects to wildlife during construction could include loss of approximately 137 acres of foraging and breeding habitat (of which 36 would be temporary), which could result in reduced breeding success for species that are sensitive to human activity. Effective habitat loss from disturbance may encompass a larger area for some species because they would avoid larger areas of human activity and presence. Noise, human presence, and heavy equipment during construction would likely temporarily displace wildlife that may be present in or near the project area. Some mortality or reduced breeding success of common species such as lizards and rodents would have minimal impacts to populations due to the abundance of these species in the area.

Indirect effects to bats from construction could also occur. No roosting habitat, such as trees and rock outcrops, is located near the proposed well field, pipelines, or power plant. Therefore, no bat roosting habitat would be affected by these project components. The area for these components could be used as foraging habitat by bats that roost in the cliffs to the east or near the canal to the south. Bats are nocturnal and forage at night. Construction would only occur during the day, thus human disturbance during foraging would be minimized. Drilling would generate noise and could occur 24 hours a day, and could displace any foraging bats from the immediate vicinity of the drill rig. While the project would result in the loss of 137 acres of potential foraging habitat, bats could utilize the abundant unaffected surrounding habitat.

Impacts would be temporary and short term for the duration of the proposed construction and drilling activities. Wildlife would be able to return to the disturbed areas upon completion of ground-disturbing activities. No population-level impacts to wildlife species are expected as a result of project construction. Because wildlife would likely return to the area after construction is complete and because similar habitat is available near the project area, impacts to wildlife from construction activities are expected to be minor.

Operational Impacts

Operation of a complete geothermal project, including well pads, access roads, pipelines, power plants, and transmission lines, typically occupies a small percent of a productive geothermal area. Direct impacts are limited after construction is complete; however, long-term indirect impacts could still occur due to permanent habitat loss, as well as from habitat fragmentation from these features and with interactions with humans.

The project components would be located mostly within desert scrub and greasewood flat communities. The project is generally located adjacent to Alt 50 on a regional scale. Alt 50 acts as a barrier to wildlife movement. The geothermal well field, pipelines, roads, and transmission in the area would permanently disturb approximately 101 acres. The overall availability of adjacent, similar habitat is approximately 21,000 acres. The project area is currently near the edge of a habitat (on a regional scale), as it is generally adjacent to Alt 50. Large landscape, particularly to the north, is available for wildlife, and an increased "edge effect" of project development would be minimal, given it is already bordered by a wildlife movement bounding feature.

Given the relative homogeneity of the habitat in the area, and the mobility of many of the common wildlife species found in the area (i.e., raptors, bats, coyotes, and rabbits), isolation of populations or species is expected to be minimal. Open space can be found between the project components. Roads are relatively narrow (i.e., 15 feet wide) and unpaved, which can be easily crossed by small animals such as nocturnal and diurnal rodents. Pipelines are built at least several inches to a few feet above the ground surface so that small animals can pass underneath. Access roads for the transmission lines would be mostly along existing two-track roads. Traffic on the roads during operation would be relatively infrequent. Under normal circumstances, access would be once per day to each well pad and much less frequently along the transmission corridor. Although an increase in mortality of wildlife from vehicles could occur, vehicle speeds will naturally be reduced on dirt roads, thus reducing potential animal-vehicle collisions. Thus, overall effects to wildlife and wildlife populations in the area would be minimal.

Changes in vegetative composition and changes to the type, quality, and amount of foraging habitat can also impact wildlife species. Impacts to vegetation composition would be minimized through the implementation of reclamation of disturbed areas and long-term implementation of the Noxious Weed Abatement Plan (Appendix E). Some vegetation would be permanently lost for the project components; however, given the availability of similar habitat in the area, the loss would be minimal.

Human presence and built features would persist as part of project development; however, wildlife would be expected to become acclimated to the project and re-inhabit some areas. Permanent loss of habitat would not be considered adverse due to the relatively small size and area that the project features would disturb compared with the availability of similar habitat in the project area. The area is also very close to existing disturbances such as US Alt 50 and the railroad.

Decommissioning

Impacts from decommissioning would be similar to those expected during construction of the project elements and features. Removal of infrastructure would temporarily disrupt habitat; however, disturbed areas would be revegetated such that the areas would return to the dominant vegetation types for the habitat in the area. Impacts would be minimal.

4.9.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to wildlife would occur.

4.10 Migratory Birds

4.10.1 PROPOSED ACTION

Migratory Birds

Project construction and operation could have direct and indirect impacts to migratory birds and their life requisites, as summarized in Table 4.10-1.

Clearing of vegetation during the avian breeding season could lead to the loss of nests, eggs, and/or young. This potential effect is not likely to occur because vegetation would be cleared within the areas of proposed disturbance prior to the nesting season. If vegetation must be removed during the migratory bird nesting season, surveys for nesting birds would be conducted by a qualified wildlife biologist within three weeks of the vegetation removal. If active nests are located within the areas that will be disturbed, VPC will consult with BLM/Reclamation and/or NDOW to develop appropriate protection measures for the nests. Such measures may include the establishment of buffers around the nest until the young have fledged or the nest has failed.

Impacts to migratory birds' could also occur during drilling if the reserve pit contains oil-based contaminants (such as from runoff or drilling muds), as migratory birds may use the pits for bathing and loafing. Ingestion of oil and contaminants or coating of the birds' feathers could cause mortality to migratory birds. In order to minimize this potential effect, the pits would be fitted

Table 4.10-1: Summary of Effects to Migratory Birds

| Phase | Type of Effect | Effects | Life Requisite Effects |
|--------------|----------------|---|---|
| Construction | Direct | Physical disturbance to nesting birds, if present | Breeding |
| | | Exposure to chemical constituents in reserve pits | Health and life of the bird |
| | Indirect | Temporary loss of habitat through ground disturbance | Breeding, foraging, and protection from predators |
| | | Construction noise | Breeding and foraging |
| Operation | Direct | Electrocution from contact between transmission lines | Migration |
| | Indirect | Permanent loss of habitat | Breeding and foraging |
| | | Operational noise | Breeding and foraging |

with exclusion devices such as netting or floating balls, in accordance with lease stipulations, if they are to contain oil-based contaminants.

Indirect effects to migratory birds during construction could include loss of approximately 137 acres of foraging and breeding habitat (of which 35 would be temporary). A larger area would be affected as work could occur within the entire 75 foot wide corridor for the length of the transmission line.

Effects due to loss of habitat would be minimal because large tracts of similar habitat are adjacent to the project area. Approximately 21,000 acres of undisturbed, similar habitat is located within a 2-mile radius of the project area, with most of that habitat found to the north and east. Migratory birds are also mobile and can forage over large distances, such that the temporary loss of 36 acres of habitat during construction should have minimal impacts on breeding and foraging habitat.

To further minimize impacts to breeding and foraging habitat due to habitat alteration well pads and roads would be recontoured and reseeded following completion of construction. Reseeding would not be undertaken in areas where soil conditions are inappropriate or where the adjacent undisturbed land surface has little or no vegetation, as determined in coordination with a qualified biologist. Topsoil would be salvaged and reused whenever possible and in a timely manner.

Construction, human activity, and increased noise in the project area from construction and drilling could temporarily displace migratory birds from the project area. However, large tracts of similar habitat are found adjacent to the project area, and some less sensitive species of migratory birds would likely return to the area after construction (DeLong et. al. 2004). During project operation, direct effects to migratory birds could occur from the proposed new transmission lines in the project area. Birds with large wing spans, such as raptors and some wading birds such as egrets, can be at risk for electrocution from transmission lines. However, the proposed

transmission line would be designed with sufficient phase spacing to make it improbable that the wing span of the typical raptor can contact two phases, thus avoiding electrocution. The determined spacing would be approved by NDOW prior to construction. HF structures are inherently safe for migratory birds, which could perch on the top of the poles. Anti-perch spikes would be installed on the tops of cross arms to discourage close contact with the transmission lines and potential electrocution.

The transmission line crosses over a wetland area just to the southeast of the wastewater treatment facility. This wetland area conveys flows from the wastewater treatment area to the FWMA and is likely movement corridor for waterfowl and migratory birds. The risk of electrocution or injury from contact with the transmission wires is highest in this location. To minimize these potential effects, anti-collision devices, as approved by NDOW would be installed on the segments at the west end of the transmission line within the boundaries of the FWMA in order to minimize effects to migratory birds. Avian protection devices are described in Appendix B.

Noise during operation of the project could permanently displace avian species, affecting their migration and foraging behavior. However, large tracts of similar habitat are found adjacent to the project areas (approximately 21,000 acres within a 2-mile radius of the project area), and migratory birds would likely return to the area after construction. Migratory birds are also very mobile predators that can forage over several square miles in a day.

Impacts from decommissioning would be similar to those expected during construction. Some ground disturbance would be required for the removal of the access roads, power plant, pipeline, and transmission line. Disturbed areas would be revegetated with a weed-free mix and well pads and roads would be recontoured. Temporary effects to migratory birds would occur due to noise and human presence. Measures used during project construction, such as conducting nesting surveys for work performed in the avian breeding season, would be implemented to ensure that decommissioning impacts are minimal.

Golden Eagle

No physical loss of project area golden eagle nesting habitat, which consists of large trees and rock outcrops (e.g., Black Butte, Little Butte) would occur as a result of the project. An inactive golden eagle nest is located within 1,135 feet of the project area. Although this nest has been inactive for the past five years, it is possible that golden eagles could reoccupy this site or construct an alternate nest at another location on Black Butte or within this territory. Activities associated with project construction and operation that could indirectly impact nesting golden eagles, potentially causing nest site abandonment and mortality to eggs and/or young, include human activity, mechanical activity, and noise.

Impacts to nesting golden eagles depend on the source or type of disturbance and the distance between the disturbance and the nest (Richardson and Miller 1997). Researchers have recommended variable quantitative buffer zones between active golden eagle nests and variable sources of disturbance (e.g., noise, visual, pedestrian, vehicle). Suggested buffer zones range from a minimum of 656 feet to 5,280 feet (Call 1979; Craig 1979; Suter and Jones 1981; Holmes et al. 1993; Richardson and Miller 1997). It has also been recommended that the size of buffer zones should be

developed based on a combination of buffer zone and viewshed (Camp et al. 1997) and/or should consider the prior history of disturbance to individual raptors (Stalmaster and Newman 1978).

Only a small portion of one access road is located within 2,640 feet (½ mile) of Black Butte. Two existing well pads, some pipeline and associated access roads, and the southeast portion of the power plant site are located within 5,280 feet (1 mile) of Black Butte. These project features would be permanent; therefore, buffer zones could not be implemented. The associated human and mechanical activity and noise could adversely affect nesting by golden eagles on Black Butte. The documented nest is outside the viewshed of these project features because it is located on the south-facing slope of Black Butte and is oriented to the east with a chunk of rock obscuring the view to the west. This location is likely to reduce potential visual disturbance from the project to any nesting golden eagles. Moreover, the lack of activity at this nest for the past five years suggests it might no longer be functional.

Because the project consists of a permanent facility and operation, it is unlikely that golden eagles would construct a nest on the west-facing slope of Black Butte. However, if eagles did construct a nest, it would be assumed that they habituated to the proposed project. The project would not physically limit nesting habitat on Black Butte and other potential nest faces are present on the east facing slope of Black Butte.

Golden eagle fatalities could occur as a result of electrocution with power line structures (APLIC 2006). The approximately 6.4 miles of 120kV project transmission lines could pose a risk of electrocution to golden eagles. Foraging golden eagles currently perch on the existing 500 kV power poles in the area as there are few natural perches (Lehman et al. 2007). Because natural perches are limited in the project area, golden eagles could also use the project's power poles as hunting perches. The portion of the power line running east-west is adjacent to existing uses (i.e., the railroad) and may inhibit use in this area.

To protect golden eagles from possible electrocution, the power line pole structures would be designed with sufficient phase spacing to make it improbable that the wing span of the typical raptor or waterfowl can contact two phases, thus avoiding electrocution. Figure 2.1-6 shows the spacing as recommended by NDOW. Anti-perch spikes would be installed on the top of cross-arms. Additionally, anti-collision devices approved by NDOW would be used on the shield wires along the transmission line segments that are at the west end of the line, within the boundaries of the FWMA, which would minimize electrocution risk. Avian protection devices are described in Appendix B.

As described above, potential impacts to golden eagles from reserve pits that might contain oil-based contaminants would be minimized because the pits would be fitted with exclusion devices such as netting or floating balls.

Activities associated with the project, including human presence, mechanical activity, and noise, could decrease golden eagle foraging efficiency and disrupt typical behavior patterns. Golden eagles may alter their behavior by avoiding affected portions of the project area during construction and operation. This displacement could result in a spatial redistribution of individuals or habitat-use patterns. However, the project does not limit or affect the surrounding environment and golden eagles would have comparable foraging opportunities within these areas.

Construction and operation of the well field, power plant, and associated facilities would temporarily and permanently disturb up to approximately 110 acres of habitat and construction and operation of the transmission line would temporarily and permanently disturb 27 acres. This disturbance would result in the removal of vegetation and alteration of habitat needed by golden eagle prey species. Black-tailed hares and cottontails are the primary prey species of golden eagles (Eakle and Grub 1986 cited in Kockert et al. 2002). Both species occupy the project area and the surrounding environment. Golden eagles that occur in and near the project could prey on the lagomorphs within the project area. Impacts to golden eagle prey habitat are likely to be minimal because the affected area represents a 0.65 percent of the habitat within a 2-mile radius of the project area. The habitat that would be disturbed or removed is not unique or limiting in the landscape nor does it provide a known prey concentration. Golden eagles should have comparable foraging opportunities within the surrounding areas.

Golden eagle prey species could also be subject to individual mortality or behavioral changes during project construction and operation. Direct mortality of prey species could occur as a result of vehicle collisions. However, speeds are naturally slower on dirt roads, reducing the likelihood of prey fatalities. Moreover, lagomorphs are primarily active late in the afternoon and early evening, and vehicle traffic associated with the project would occur during the day. Golden eagles are known to feed on road-killed wildlife such as black-tailed hares. Eagles flushed from a carcass could be at risk of collision with vehicles. However, the slower vehicle speed due to the dirt roads should provide sufficient time for eagles to become airborne and for vehicles to slow and avoid hitting the birds. In comparison to the cumulative risk of vehicle collisions in the surrounding area, including within the Alt 50 corridor, the risk of collisions caused by the proposed activities would be minimal. Because project activities would occur during the day, disturbance and behavioral changes to prey species active at night would not occur.

4.10.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to migratory birds would occur.

4.11 Cultural Resources

4.11.1 PROPOSED ACTION

Four archaeological resources were recommended as eligible for listing in the National Register of Historic Places (NRHP). Construction and operation of the proposed project would avoid all known resources identified during the survey activities (identified in Table 3.11-2) in accordance with the State Protocol Agreement between the Bureau of Land Management and the Nevada State Historic Preservation Office for Implementing the National Historic Preservation Act, 2009, Appendix H., Sections A and B. The project elements or features shown in Figure 1.1-2 are tentative and may be built anywhere within the overall project area also identified in that figure. If any construction or operations activities require disturbance beyond the existing survey boundaries, additional surveys would be completed and any resources found would be avoided.

A thirty meter buffer would be placed around historic properties identified and an archaeological monitor would be on site during the construction of any areas within the 30 meter buffer.

Project construction also has the potential to affect undiscovered or subsurface resources. Vehicles and workers would stay within the clearly delineated and flagged project areas during all project operations. The allowable travel areas would be clearly flagged and staff would be informed (before project commencement) to stay within the identified areas and that any effects on, defacement of, or removal and/or disturbance of archaeological, historical, or sacred material is prohibited and subject to disciplinary action.

If subsurface cultural resources are found during construction, all work in the vicinity of the resource would cease and VPC would notify the BLM, Reclamation, and NDOW environmental personnel immediately. VPC would implement those appropriate measures requested by the BLM, Reclamation, and/or NDOW to protect the resource until it could be adequately evaluated by the permitted archaeologist, and the BLM, Reclamation, and/or NDOW archaeologist, if necessary.

Based on the avoidance of known sites and the established protocol for the discovery of any new site, effects to cultural resources would be minimal.

Effects to cultural resources would be minimal during decommissioning. Only previously disturbed areas would be disturbed during decommissioning. All cultural sites would be avoided.

4.11.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to water quality or hydrology would occur.

4.12 Native American Religious Concerns

4.12.1 PROPOSED ACTION

Consultation on the Patua Geothermal project between the BLM and federally recognized Native American tribes is ongoing. Native Americans religious and spiritual concerns could be affected if project construction disturbed Native American artifacts and remains. No TCPs or traditional uses could be impacted by implementation of the project. All archaeological sites can and would be avoided through project design. If human remains are identified during construction of any of the components of the proposed project, work within 300 feet of the discovery would be stopped and the remains would be protected from further exposure or damage. The coroner and Reclamation, NDOW, or SHPO (depending on land ownership) would be contacted. If the remains are determined to be Native American, the agencies would follow the procedures set forth in 43 CFR Part 10, Native American Graves Protection and Repatriation Regulations. Procedures for handling the discovery of human remains would follow Reclamation Manual Directives and Standards LND 07-01 (Inadvertent Discovery of Human Remains on Reclamation Lands) if remains are located on Reclamation-managed lands. If remains are found on private land, NRS 383 would be implemented with SHPO as the lead agency.

Avoidance of any cultural resources found and implementation of protection measures in the unlikely event that human remains are discovered would minimize effects to Native American religious concerns. Decommissioning is not expected to have effects on Native American Religious Concerns as all sites would be avoided.

4.12.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to Native American remains, cultural artifacts, or other resources of Native American religious significance would occur as the project area would remain unchanged.

4.13 Socioeconomics

4.13.1 PROPOSED ACTION

The project is expected to have a positive impact on the economy. Construction of the well field, power plant, transmission line, and associated features could have a beneficial effect on the surrounding economy by employing construction workers. Well pad construction and drilling can employ approximately 20 workers for about three or four months per well. Approximately 12 construction personnel would typically be employed to construct approximately 6 miles of transmission line. Expenditures for equipment, materials, fuel, lodging, food, and other needs would temporarily stimulate the local economy over the duration of development.

Once the well field and power plant are operating, about five permanent employees would be needed for field production, and ten additional employees would be needed for the plant, and would likely be local, having a minor positive effect on the economy and population. Operation of the project would also provide tax and royalty revenues for the State and counties, having a positive impact on the local population. Decommissioning would result in some additional jobs for disassembling the system. The project would have negligible impacts on socioeconomics.

4.13.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to socioeconomics would occur because the project area would remain unchanged.

4.14 Minerals

4.14.1 PROPOSED ACTION

Construction of the proposed project would require the use of fill material for well pads, access roads, laydown areas, etc., which would be obtained from a permitted gravel operation located east of Black Butte, in Section 24, T20N, R26E (assigned serial number N-86320).

The recovery of other mineral resources would not be substantially affected by implementation of the proposed project. The Leete Mining District is located 15 miles to the north of the project area.

Salt and borax are mined from this area. Project construction and operation would have no effects on this mining area.

During the life of the geothermal facilities, all disturbed areas not needed for active support of production operations should undergo “interim” reclamation in order to minimize the environmental impacts of development on other resources and uses. At final abandonment, well location, production facilities, and access roads must undergo “final” reclamation so that the character and productivity of the land is restored. VPC would cease utilization of the geothermal resource during decommissioning or final reclamation. Given the long-term nature of geothermal facility operations and changes in the future site conditions, additional analysis may be necessary prior to final reclamation. For interim reclamation, effects to mineral resources would be minimal.

4.14.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to minerals would occur.

4.15 Soils

4.15.1 PROPOSED ACTION

On-site soils at the proposed well pads and access roads have the highest potential for erosion from wind. Construction of the well field and power plant would disturb a total of 110 acres. The removal of ground cover during construction of each pad, the power plant, and access roads would increase the potential for erosion by wind through exposure of denuded surfaces. VPC’s NDEP BAPC SAD permit, documenting the BMPs to be used, would be implemented for the project because the surface disturbed would be greater than 5 acres. Erosion and loss of soil productivity would be minimized by implementing BMPs during construction of the project components. BMPs include covering exposed top soil, watering unpaved access roads, and limiting vehicle speeds on access roads to 10 to 30 mph.

Soil erosion could also occur from exposure of denuded soils during rain events. Low levels of precipitation and the lack of year-round surface water in the project area minimize run-off erosion potential. A site drainage and runoff management plan would be prepared and implemented prior to construction. Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or rip rap, would be installed where necessary immediately after completion of construction activities to avoid erosion and runoff. Only certified weed-free BMPs would be used.

All new access roads would comply with the site drainage and runoff management plan in order to minimize erosion and off-site sedimentation. Access roads would follow existing contours to the maximum extent possible. In areas where new access roads must be constructed across slopes, erosion control measures would be installed as necessary, in accordance with Gold Book standards (BLM 2007). Additional gravel would be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation and severe compaction. Effects from erosion during construction of the well field and power plant would be minimal.

The estimated permanent soil disturbance associated with the transmission line is 13 acres and temporary soil disturbance is 7 acres, with a total maximum not-to-exceed disturbance of 27 acres. The transmission line would cross existing wetland areas in three locations along the western portion of the FWMA. The transmission line would be designed to span the wetlands, avoiding construction activities within the marsh soils. Construction would occur during the dry season to further minimize effects to soils. Existing two-track access roads would be used along the transmission route to minimize the amount of new surface disturbance and potential for erosion during construction of the transmission line.

Operation of the proposed facilities would include routine inspections and minor repairs. Access to the transmission line for inspection and maintenance would be via existing access roads and overland traverses where roads are not available or practical. Maintenance and inspection activities are not anticipated to require any ground disturbance, vegetation removal (with the exception of routine trimming), or soil stockpiling. Accordingly, an increase in soil erosion or the loss of topsoil would be minimized during operation or maintenance activities associated with the project.

Decommissioning and restoration would involve removal of the project elements. Natural habitat would be restored after the removal of geothermal facilities. Restoration would involve recontouring and recreating, to the extent feasible, natural forms similar to the original landscape. Any soils that could be contaminated from exposure to geothermal fluid or other operational fluids would be tested and properly disposed. Impacts would be minimal.

4.15.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to soils would occur.

4.16 Wastes, Hazardous or Solid

4.16.1 PROPOSED ACTION

Project construction and operation would involve hazardous material use and waste generation. These materials would include, but would not be limited to, drilling additives and mud, diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, geothermal water.

The transport, use, or disposal of hazardous materials could affect workers, the public, and the environment through accidental spills or emissions. VPC would adhere to general geothermal lease stipulations for geothermal developers to address the potential impacts involved with transport, use, and disposal of hazardous materials, including the development and implementation of an emergency response plan. VPC would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes. VPC would prepare and implement a hazardous material spill prevention plan to prevent impacts to the environment from hazardous materials. Fueling and routine maintenance of equipment and vehicles would be performed off site or within designated areas with appropriate spill controls to minimize effects. Wastes considered hazardous by the State of Nevada would be transported and disposed of according to applicable federal, state, and local regulations.

Hazardous wastes in the area are processed at the US Ecology Beatty Resource Conservation and Recovery Act (RCRA)/Toxic Substances Control Act (TSCA) Treatment, Storage, and Disposal Facility, located in Beatty, NV.

Drilling mud and fluid would be directed to reserve pits. At the conclusion of drilling and testing, the liquid portions of the containment basin contents would be evaporated, pumped back down the well, or removed and disposed of off-site in a facility authorized to receive such wastes. Both Russell Pass Landfill and Lockwood Regional Landfill are permitted to accept solid waste. These landfills are located approximately 35 miles southeast and 35 miles west of the project area. The remaining contents, typically consisting of non-toxic drilling mud and cuttings, would be tested as required by the Nevada BWQP. If non-toxic and as authorized by the BWQP, these materials would be spread and dried on the well site, mixed with soil and buried in the on-site reserve pit in conformance with the applicable requirements of the BWQP and the BLM. Testing results and location of buried waste would be provided to Reclamation and BLM. Impacts are expected to be minimal. Toxic materials would be disposed of at an appropriate facility.

Well blowouts and pipeline failures are rare occurrences during well drilling and can result in the release of toxic drilling additives and fluids, as well as hydrogen sulfide gas (see section 4.17 Air Quality for more information on hydrogen sulfide) from the geothermal resource. Blowouts may also result in the surface release of geothermal fluids and steam containing heavy metals, acids, mineral deposits, and other pollutants (see the discussion above in air quality and hydrology). VPC has and would implement a blow-out prevention plan. The implementation of BOPE and the blowout plan would minimize impacts to the environment.

Operation of the project would include periodic use of hazardous materials for maintenance. Quantities would be small as would the likelihood of upset. Solid and hazardous wastes would be disposed of at the Beatty RCRA/TSCA facility (or another permitted facility). Impacts would be minimal. Operation of the geothermal facilities would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes and, therefore, impacts on the environment would be minimized.

Impacts from decommissioning would be similar to construction in terms of transport of materials. Power plant, pipeline, transmission line, and well head parts would be recycled to the greatest extent feasible. Other wastes would be disposed of at an appropriate landfill to accept the particular type of waste (i.e., hazardous vs. non-hazardous). Impacts would be minimal.

4.16.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to or from wastes or other hazardous materials would occur.

4.17 Air Quality

4.17.1 PROPOSED ACTION

Overview

Air emissions from the proposed action would be primarily attributed to the following air pollution sources:

- Fugitive dust from earth moving and grading and drilling
- Combustion emissions, including diesel exhaust emissions, from heavy equipment and the drill rig
- H₂S emissions from well drilling and testing
- GHGs

Fugitive Dust

The primary pollutant of concern during construction activities for the project would be particulates in the form of fugitive dust. Fugitive dust emissions would be generated by ground-disturbing activities related to transport of workers and equipment to the site, access road construction and well pad construction.

Air quality impacts from the construction activities at the well pads and access roads would be localized and temporary. Up to six well pads (including access roads) would be constructed on federal land. Particulate concentrations in the vicinity of the project would increase on a short term basis. Construction when winds exceed approximately 9 miles per hour could further increase particulate matter in the air; however, the SAD Air Quality Operating Permit (AP1629-2517) obtained for the project stipulates that a plan for fugitive dust control must be implemented. The fugitive dust control plan includes dust suppression processes (e.g., watering access roads and well pads) to minimize localized increases in particulate matter concentrations. These measures would minimize fugitive dust emissions during construction.

Air drilling could be a source of particulate matter. This particulate matter originates from well bore cuttings removed with the compressed air and steam. Well testing would also be a source of particulate matter originating from the well with the steam. Well drilling would produce condensate, rock and sulfur solids, and particulate matter that would collect in a tank. Particulate matter emissions from venting steam would be reduced by injecting water into the blooie line.

Fugitive dust generation during operation of the proposed project would be limited to periodic vehicle emissions from maintenance work and would not be minimal. Particulate and fugitive dust emissions during decommissioning of the well pads, power plant, and transmission line would result primarily from ground-disturbing activities related to vehicle travel and earthwork. Dust control BMPs utilized for construction would also be utilized during decommissioning activities in order to reduce impacts. Decommissioning of the geothermal and ancillary facilities and restoration of the disturbed areas would result in negligible impacts.

Combustion Emissions

Diesel combustion emissions would be emitted from the construction equipment and any diesel-fueled vehicles used to access the project site as well as from equipment used for drilling. Combustion emissions of criteria air pollutants (nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO) and fine particulate matter (PM₁₀)), criteria air pollutant precursors (volatile organic compounds (VOCs)) and air toxics (small quantities of diesel PM, acetaldehyde, benzene, and formaldehyde) would be released during well pad and road construction from the diesel engines. These short-term fugitive emissions would be below the threshold level that would require a permit from NDEP BAPC.

Combustion emissions from drilling would also be emitted from large bore diesel-powered engine(s) on the drill rig. Table 4.17-1 is a worst-case emissions scenario for large bore, stationary diesel engines based on estimated maximum daily fuel consumption at the well pads. Because of the variables in operating parameters of the engines, emissions are expected to be considerably lower than in the worst-case scenario. Drilling operations and engine use are highly variable over 24-hour periods. It is unlikely that maximum daily fuel consumption would be reached at any given point in time. Additional generators and pumps may be required for the project, but these small sources are not expected to have any sizeable impact on emissions. Diesel engines that meet US EPA Tier II Diesel Standard Emissions for any diesel engines over 37 kilowatts (kW) (50 horse power) in size would be used to reduce emissions.

Table 4.17-1: Estimated Emissions from Large Bore Diesel Engines³

| Air Pollutant | Emission Factor ⁴ (lbs/mmBTU) | Maximum Estimated Emissions | |
|---|---|-----------------------------|----------------------|
| | | Hourly (lbs/hr) | 24-hour (lbs/day) |
| Carbon Monoxide (CO) | 0.085 | 4.83 | 116.47 |
| Carbon Dioxide (CO ₂) | 165.00 | 942.08 | 22,609.95 |
| Total Organic Compounds (as Methane (CH ₄)) | 0.09 | 0.51 | 12.33 |
| Oxides of Nitrogen (NO _x) | 3.20 | 18.27 | 438.49 |
| Particulate Matter ≤ 10 microns (PM ₁₀) | 0.0573 | 0.33 | 7.85 |
| Oxides of Sulfur (as Sulfur Dioxide (SO ₂)) | 0.0202 | 0.12 | 2.77 |

SOURCE: EPA 1996

³ Values based on the assumption that a maximum of 1000 gallons of low sulfur (0.02%) diesel oil fuel would be used, and that the average heating value of the fuel is 19,300 BTU per pound of fuel with a density of 7.1 pounds per gallon.

⁴ Source: U.S. EPA 1996.

Combustion emissions would be localized and temporary, with particulate and gaseous criteria pollutant concentrations in the vicinity of the proposed project increasing on a short-term basis. Because of the low background criteria pollutant concentrations in the area and the limited nature of the drilling activities, none of the activities would exceed either federal or state ambient air quality standards. Combustion emissions associated with project construction would cause a negligible effect on air quality.

Hydrogen Sulfide and Other Emissions

Hydrogen sulfide emissions may be an issue during well testing, depending on the chemical composition of the geothermal resource. H₂S can be released from a well during drilling, and would be vented with the steam and non-condensable gases during flow-testing (if the well encounters a producible resource). H₂S is a colorless, non-condensable gas with a characteristic “rotten egg” odor. H₂S can pose a threat to human health at high concentrations. Nuisance odor is of primary public concern, since this distinctive odor can be easily detected at concentrations far below levels of health concern. The closest residences are within approximately 1,742 feet from the project site; a distance over which odors would dissipate.

H₂S is typically encountered during the production zone drilling phase. There is no federal air quality standard for H₂S. Nevada has adopted an hourly ambient air quality standard of 112 µg/m³ for H₂S (0.08 ppm) (BAPQ 2007). Emissions would be minimized through the use of properly weighted drilling mud which is expected to keep the well from flowing during drilling. H₂S gas that may be entrained in the drilling mud and return with the drilling cuttings to the solid separation process is expected to be neutralized by the high pH of the mud system. Data collection devices would be installed and operated during all phases of drilling and testing. An H₂S abatement plan would be developed and implemented during long-term flow-testing if it becomes apparent during drilling operations that H₂S abatement is necessary to minimize potential nuisance odors. With monitoring and abatement, H₂S emissions would be minimal.

H₂S emissions would be minimal during the operations phase of the project. The power plant would be a binary system and the geothermal fluid would be injected back into the reservoir without coming into contact with air (unless some of the fluid is used for cooling). No H₂S emissions would occur as a result of decommissioning, as the wells would be shut-in and plugged.

Other potential emissions during drilling could be caused by releases of NCGs during a loss of well control. Blow-out protection equipment would be installed on well heads during drilling operations to prevent such events from happening and drill rigs would be equipped with alarms to detect unsafe levels of NCGs. Anticipated geothermal fluid chemistry is such that temporary releases should not cause violations of Nevada air quality standards.

GHG Emissions

There are no federal regulations governing the emissions of GHGs during project construction. The Final Mandatory Reporting of Greenhouse Gases Rule issued by the EPA, as signed on September 22, 2009, requires suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions to submit annual reports to the EPA. The NDEP also requires GHG emissions reporting; however, NDEP has exempted geothermal projects from GHG reporting.

The diesel engines used to power construction equipment and drill rigs would generate CO₂ and small amounts of methane. Emissions of steam during well testing would also include GHGs, mostly in the form of CO₂. However, the amount of fossil fuel powered GHG emissions that would be off-set by the proposed facility would more than compensate for the CO₂ emissions from the proposed project construction. A comparison between geothermal and fossil fuel CO₂ emissions from electrical generation is shown in Table 4.17-2. Emissions reported in the table are weighted average values for all geothermal capacity.

Decommissioning would result in minor emissions associated with construction equipment. These emissions would be minimal.

| Table 4.17-2: Geothermal vs. Fossil Fuel CO₂ Emissions for Electrical Generation | | | | |
|--|-------------------|-------------|------------------|--------------------|
| | Geothermal | Coal | Petroleum | Natural Gas |
| Emissions (pounds CO ₂ per kilowatt hour) | 0.20 | 2.095 | 1.969 | 1.321 |

SOURCE: Bloomfield et al. 2003

4.17.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no geothermal exploration or development in the project area. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the proposed action would occur. No impacts to air quality would occur.

5.1 Introduction

Cumulative impacts are defined by the CEQ in 40 CFR 1508.7 as “impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.”

The following discussion evaluates the potential impacts of the Proposed Action when taken in combination with the potential impacts of known past, present, and reasonably foreseeable future actions in the analysis area. Unless otherwise identified below, the analysis area for cumulative impact consideration is the same as the analysis area for the resource in Section 4.

5.2 Past, Present, and Reasonably Foreseeable Future Actions

5.2.1 PAST AND PRESENT ACTIONS

Current land use activities in the vicinity of the project include existing geothermal exploration activities by VPC and grazing. The existing, LADWPs PDCI 500 kV transmission line corridor abuts the western edge of the project area in T20N, R25E, Section 15. The FWMA is also managed in the area. Portions of private land are also located around the project area.

Other existing activities in the project area include:

- The FEWWTF, which discharges effluent into the FWMA
- Dispersed recreation
- Off-highway vehicle (OHV) use (currently illegal use)
- Other illegal uses

5.2.2 REASONABLY FORESEEABLE FUTURE ACTIONS

Reasonably foreseeable future actions constitute those actions that are known or could reasonably be anticipated to occur within the study area, within a time frame appropriate to the expected impacts from the Proposed Action. For the Proposed Action, the time frame for potential future actions is assumed to be the duration of the lease, or approximately 35 years. Future activities are anticipated to include all current land use activities (i.e., grazing, current geothermal energy exploration, recreation, OHV use, and drainage for Newlands Irrigation Project), as well as geothermal development. The project is located near the Hazen Lease Area (although not a part of these leases). The Hazen leases are located approximately 2 miles to the southwest of the proposed well field. The Hazen area includes 6 leases encompassing 5,585 acres (BLM 2006). No exploration or development has occurred to date on these leases although exploration and development could occur in the future. Several other leases within the Patua Unit could also be developed in the future.

A new transmission line and substation is being constructed by NV Energy and/or a private developer on private land in T20N, R25E, Sections 8 and 9, where VPC will interconnect.

5.3 Cumulative Impacts for the Proposed Action

5.3.1 LANDS

The Proposed Action is consistent with BLM land use planning for the area and would not interfere with other ongoing or reasonably foreseeable future activities, and therefore would not contribute to cumulative impacts on land use.

5.3.2 LIVESTOCK

The Proposed Action would potentially remove some grazing land in the area. The proposed project's contribution of a permanent loss of 2 AUMs (0.5 percent) is negligible. No other proposed projects that could also remove AUMs would occur in the same area as the lease.

Weed propagation from increased OHV use could indirectly reduce grazing efficiency and human disturbance could also impact livestock grazing. Implementation of the Noxious Weed Abatement Plan would reduce and improve the existing weed propagation issues, minimizing effects. Human disturbance after construction is mostly associated with maintenance of the transmission line, which would occur on a periodic basis. OHV use may increase in the area; which can propagate weeds; however, the access road along the transmission route already exists and it is at the edge of the grazing lease boundary, so it does not increase access to the majority of the lease area. Implementation of the Noxious Weed Abatement Plan may offset impacts of improved access by reducing the number of weeds that OHVs encounter along the improved roads.

5.3.3 WATER RESOURCES

When combined with other current and potential future area activities, such as other geothermal development, there would be an increased potential for impacts to surface water and groundwater quality. Potential impacts to groundwater quality during project construction would be minimized through the use of BMPs. Wells would be cased to minimize the potential for localized impacts. Other geothermal projects would likely implement the same measures, but would be located at enough distance not to impact the same areas as the proposed project.

Effects to wetlands and hot springs from the proposed project are expected to be minimal, as the geothermal reservoir is very deep and likely separated from the groundwater, which is greatly influenced by shallow water from the Truckee Canal. Potential impacts to surface water would be temporary and local, and also would be minimized through the use of BMPs.

Other geothermal projects that could be developed in the area (i.e., on the Hazen leases) would also use pumping and injection techniques to manage the reservoir. These projects would be expected to have minimal effects on surface waters for the same reasons as stated for VPC's project. If VPC were to use groundwater as cooling water, effects to the wetland are also anticipated to be minimal because of separation of the aquifer and distance from withdrawal. Some groundwater drawdown would occur in the area of withdrawal; however, this area would be nearer to the well field. The permit from the State Engineer would require a review of effects to other groundwater users. If other groundwater users arise after VPC is developed, their proposed use would be subject approval of a permit by the State Engineer to minimize effects to existing groundwater users.

5.3.4 WETLANDS AND FLOODPLAINS

The proposed project would not result in the fill or loss of any federally jurisdictional wetlands. The project could have some minor impacts to wetland and riparian habitat; however, the effects would be minimal and would be further minimized through measures to prevent contamination of wetlands and to facilitate flows.

Other geothermal projects could be developed in the project area, such as on the Hazen leases. These projects would have similar negligible impacts on wetlands from groundwater drawdown as VPC's project because the geothermal aquifer is separated from the groundwater aquifer. Because VPC's project is expected to have negligible effects to the wetlands because of separation of the aquifers, cumulative effects attributable to the proposed project would be negligible.

5.3.5 VEGETATION AND INVASIVE, NON-NATIVE SPECIES

The proposed project could result in the temporary and permanent removal of up to 137 acres of vegetation. The upland vegetation habitat types are very common in the area. The marsh habitat that would be affected is of lower quality than the surrounding wetlands because it is in a disturbed corridor near the existing railroad tracks where there currently is two track road and invasive species. Higher quality wetlands are located further north into the FWMA. None of the other activities in the area are expected to result in removal of the wetlands in the project area. Other projects, particularly other geothermal development, could result in the loss of desert scrub and similar habitat in the area; however, over 21,000 acres of similar habitat (e.g., scrub, wetland, and salt scrub) are located adjacent to the project area. The project's contribution of a loss of 137 acres would be minimal. Other geothermal projects can be expected to be of a similar size as the proposed project. A cumulative loss of even as many as 300 acres is still minimal compared with the available similar habitat in the overall area (an estimated 1 percent).

The proposed project could increase access by illegal OHV usage by improving existing roads. OHV could in turn increase the spread of invasive and non-native species. Individual projects such as the building of the substation and transmission connection on private lands or additional development on the Hazen leases to the south, could spread invasive species if proper measures are not taken. VPC would implement a Noxious Weed Abatement Plan to help reduce invasive plants in the project construction areas. A reduction in the number of invasive species in the project area could counter the potential for increased illegal OHV use in the area.

5.3.6 WILDLIFE AND MIGRATORY BIRDS

The project would have minimal impacts on wildlife due to the nature of the project and the incorporation of environmental protection measures. However, there could be negligible residual impacts from habitat loss and fragmentation.

The proposed project is generally adjacent to existing linear landscape-dividing features and, as such, is part of the existing edge environment. Other geothermal projects, if to occur, would likely be built on the other side of Alt 50 within the Hazen leases, which would extend the edge environment in the other direction but would overall be minimal or negligible compared with the availability of similar habitat in the area.

Impacts to migratory birds and wildlife from existing uses such as the railroad track, Alt 50, the FEWWTF, and existing transmission lines, would continue into the future. The wildlife that inhabit the project area is acclimated to these features. Additional noise and human presence due to other projects could have some effects. Increased human presence in the area would be minimal as the operation of the plant would only require about 15 additional workers. Noise impacts from other development could generally push wildlife further to the north; however, abundant undeveloped habitat is available to the north.

The project would result in the potential loss of area (larger than just the disturbance footprint) for wildlife during construction due to human presence and noise. Other geothermal development on the Hazen leases would not likely be constructed on the same timeframe as the proposed project. The private development of the substation and transmission line at the terminus of VPCs transmission line could occur at the same time. Construction of the transmission line would remove small amounts of vegetation for general wildlife and avian species. Even with the construction of the approximately 2-mile-long private transmission line, overall effects to habitat and wildlife would be minimal because of the abundant similar habitat in surrounding areas (over 20,000 acres). Operation of the well field, power plant, and transmission line would thereby contribute a negligible effect to the overall cumulative impact to wildlife within the area of analysis.

5.3.7 CULTURAL RESOURCES AND NATIVE AMERICAN RELIGIOUS CONCERNS

The proposed action has the potential to affect cultural resources if a significant site is damaged or destroyed; however, protection measures included in the project would minimize the likelihood of effects (through avoiding all known resources and stopping work if a resource or remains are encountered). Other geothermal development in the region is not expected to aggregate this impact, as the potential impact is localized and physically separate from other possible or current development. Cumulative impacts are not expected.

5.3.8 SOCIOECONOMICS

The proposed action would have negligible effects on socioeconomics. The project would have beneficial effects to the economy and would not damage or degrade the physical environment. The proposed project would not make a contribution to an otherwise cumulative effect. Other geothermal and energy projects would likely also have a positive effect to the local economy.

5.3.9 MINERALS

The project would have no effects to mineral resources. All fill material would be obtained from a permitted gravel operation (N-86320). The proposed action would not inhibit the ability for other leases to be explored or developed. The project would have minimal contributions to cumulative effects.

5.3.10 SOILS

The contribution of the proposed action to soil erosion would be minimized through the use of the BMPs. Compounded levels of erosion to soils would be minimal because erosion prevention practices are common for all development. Increased illegal OHV use could increase dust

generation and cause soil disturbance; however, much of this activity currently exists. Use of the improved roads instead of undisturbed earth would minimize some effects. The use of improved roads could; however, increase access to other undisturbed areas. The overall illegal OHV use on undisturbed lands in the area would probably not change markedly.

5.3.11 WASTES, HAZARDOUS OR SOLID

Solid waste and hazardous materials would be transported, stored, and used as part of the proposed action. When combined with other area activities, the increase in the total volume of wastes handled would result in an increased risk of spill or other release of waste materials to the environment. Implementation of the BMPs described in Section 4.16 would minimize the potential for wastes and hazardous materials to be released to the environment.

5.3.12 AIR QUALITY

Construction of the proposed project would result in fugitive dust emissions, combustion emissions, H₂S emissions, and GHG emissions. With the implementation of protection measures identified in Section 4.17, emissions are expected to comply with federal and state ambient air quality standards.

Other simultaneous geothermal development in the area would also have emissions, but would have to comply with standards as well. Other geothermal development would be at least 2 miles away and compounding of emissions would be negligible. Fugitive dust in the region has raised fine particulate matter (PM₁₀) levels above standards naturally. Dust is generated by existing activities such as traffic on Alt 50 and other roads, and OHV usage in the area. The proposed action includes several dust suppression measures to minimize the proposed project's potential contribution to air quality impacts.

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Consultation and Coordination

6.1 Agencies and Individuals Contacted

| Organization | Contact |
|---|---------------------------------|
| US Army Corps of Engineers | Sacramento District Office |
| Public Utilities Commission of Nevada | Garrett Weir |
| Nevada State Fire Marshall | Ginny Capucci, and Fred Pascual |
| Nevada Division of Water Resources | Hamilton Reed |
| Nevada Division of Minerals | Lowell Price |
| NDEP, Bureau of Air Pollution Control | Randy Phillips |
| NDEP, Bureau of Water Pollution Control UIC Program | Russ Land |
| Bureau of Health Protective Services, Health Division | Judy Newberg |
| Nevada Department of Wildlife | Elmer Bull, Pat Kelly |
| Nevada Bureau of Waste Management | Valerie Kauffman |
| Churchill County | Eleanor Lockwood |
| City of Fernley | Melinda Bauer |

6.2 List of Preparers

6.2.1 LEAD AGENCIES

| Name | Agency | Project Expertise |
|------------------|-------------|--|
| Susan McCabe | BLM | Cultural Resources; Native American Religious Concerns |
| Andrea Minor | Reclamation | Invasive, Nonnative, and Noxious Species; Wildlife; Livestock; Soils |
| John Wilson | BLM | Migratory Birds; Threatened and Endangered Species |
| Peter Neugebauer | Reclamation | Wastes, Hazardous or Solid; Water Quality (Surface/Ground); Wetlands/Riparian Zones; Lands |
| Carla James | BLM | Minerals |
| Desna Young | BLM | NEPA Project Manager |
| Jason Wright | BLM | Cultural Resources; Native American Religious Concerns |
| Amy Barnes | Reclamation | Cultural Resources |

6.2.2 CONSULTANTS

| Name | Company | Role |
|---------------------------|----------------------------------|-------------------------------------|
| Laurie McClenahan Hietter | RMT, Inc. | Project Director |
| Tania Treis | RMT, Inc. | Project Manager; Technical Analysis |
| Stefanie Smith | RMT, Inc. | Technical Analysis |
| Aaron Lui | RMT, Inc. | GIS |
| Corey Fong | RMT, Inc. | GIS |
| Susanne Heim | 7Q10 | Water Resources |
| Sue Fox | Wildlife Resources Consultant | Wildlife and Migration Birds |

6.3 Tribes Contacted

| Organization | Contact |
|------------------------------|---------------------------|
| Fallon Paiute-Shoshone Tribe | Alvin Moyle, Chariman |
| Pyramid Lake Paiute | Mervin Wright, Jr., Chair |

7: References

- American Power Line Interaction Committee (APLIC). 2006. Suggested practices for raptor protection on power lines; the state of the art in 2006. Edison Electric Institute, APLIC and the California Energy Commission Washington, D.C and Sacramento, CA.
- Bureau of Air Quality Planning (BAQP). 2003. Trend Report. Website: <http://ndep.nv.gov/BAQP/monitoring/trend/report.html>. Accessed April 23, 2010.
- Bull, Elmer. 2010. Nevada Department of Wildlife. Personal Communication with Tania Treis and Stefanie Smith of RMT, Inc. April 9, 2010.
- Churchill County. 2010. Personal Communication with Planning Department's Office Staff. April 21, 2010.
- Call, M. 1979. Habitat Management Guides for Birds of Prey. Technical Note, U.S. Department of the Interior- Bureau of Land Management.
- Camp, R.J., D. T. Sinton, and R.L. Knight. 1997. Viewsheds: a complementary management approach to buffer zones. *Wildlife Society Bulletin*, 25(3):612-615.
- Craig, J. 1995. Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptor Nests. Colorado Division of Wildlife. Research Center, 317 West Prospect. Fort Collins, Colorado 80526.
- DeLong, J. P., and K. Steenhof. 2004. Effects of management practices on grassland birds: Prairie Falcon. Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/literatr/grasbird/prfa/prfa.htm>
- Environmental Protection Agency (EPA). 2010. Currently Designated Nonattainment Areas for All Criteria Pollutants. Website. <http://www.epa.gov/oaqps001/greenbk/ancl.html>. Accessed April 23, 2010. Updated January 6, 2010.
- _____. 1977. EXECUTIVE ORDER No. 11988. May 24, 1977, 42 F.R. 26951.
- Garside, L.J. and Schilling, J.H. 1979. Thermal waters of Nevada: Nevada Bureau of Mines and Geology Bulletin 91, 163 p.
- Holmes, T.L., R.L. Knight, L. Henits, and G.R. Craig. 1993. Responses of Wintering Grassland Raptors to Human Disturbance.
- Huffman and Carpenter. 2009. Final Report Baseline Wetland mapping and Vegetation Identification, Lyon and Churchill Counties, Nevada. December.
- Kauffman, Valerie. 2010. Nevada Bureau of Waste Management. Personal Communication with Aimee Epstein of RMT, Inc. April 23, 2010.
- Kelly, Pat. 2010. Nevada Department of Wildlife. Personal Communication with Stefanie Smith of RMT, Inc. April 27, 2010.

- _____. 2010. Personal communication between Stefanie Smith and Pat Kelly regarding grazing leases on NDOW property in the FWMA. September 27, 2010.
- King, Clarence. 1870-1880. Report of the geological exploration of the fortieth parallel: U.S. Army Corps of Engineers Professional Paper 18, 7 vols.
- Kochert, M. N., K. Steenhof, C. L. McIntyre and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/684> on 9/22/10.
- Lehman, R.N., P.L. Kennedy, and J.A.Savidge. 2007. The state of the art in raptor electrocution research: a global review. *Biological Conservation* 136:159-174.
- Lyon County. 2010a. Personal Communication with Assessor's Office Staff. April 21, 2010.
- Lyon County. 2010b. Personal Communication with Planning Department's Office Staff. April 21, 2010.
- Nevada Department of Wildlife. 2006. Nevada Wildlife Action Plan. June.
- _____. 2010. <http://www.ndow.org/wild/habitat/wma/#fernley>. Accessed April 27, 2010.
- Nevada Division of Environmental Protection. 2006a. Nevada's Final 2006 303(d) Impaired Waters List.
- _____. 2006b. Ambient Air Monitoring Network Plan.
- Peale, A.C. 1886. Lists and analyses of the mineral springs of the United States (a preliminary study): U.S. Geological Survey Bulletin 32, 235 p.
- Raven, Christopher, and R. G. Elston. 1988. Preliminary Investigations in Stillwater Marsh: Human Prehistory and Geoarchaeology, Volume 1. U.S. Department of the Interior, USFWS, Region 1, Cultural Resource Series. Portland, Oregon. 1989 Prehistoric Human Geography in the Carson Desert I: A Predictive Model of Land-Use in the Stillwater Wildlife Management Area. Cultural Resource Series 3. U.S. Department of Interior, U.S. Fish and Wildlife Service (Region 1), Portland, Oregon. 1991 Looking for the Marsh: Past, Present, and Future Archaeological Research in the Carson Desert. Intermountain Research, Silver City, Nevada.
- Richardson, C.T. and C.K. Miller. 1997. Recommendations for protecting raptors from human disturbance: a review. *Wildlife Society Bulletin* 25:634-638.
- Rush, F.E. 1972. Hydrologic reconnaissance of the Big and Little Soda Lakes, Churchill County, Nevada: Department of Conservation and Natural Resources Water Resources Information Series Report 11, 3 sheets.
- Stalmaster, M.V. and J.R. Newman. 1978. Behavioral Responses of Wintering Bald Eagles to Human Activity. *Journal of Wildlife Management* 42(3):506-513.
- Suter, G. W. and J.L. Jones. 1981. Criteria for Golden Eagle, Ferruginous Hawk, and Prairie Falcon Nest Site Protection. *Raptor Research*. 15(1): 12-18
- University of Nevada at Reno. 2010. <http://www.nbmng.unr.edu/geothermal/site.php?sid=Hazen>

-
- US Bureau of Land Management (BLM). 1984. Bureau of Land Management Grazing Management Handbook (BLM Handbook H-4120-1). 1984.
- _____. 2002. Environmental Assessment for Leasing of the Geothermal Resources Managed by the Bureau of Land Management Carson City Field Office. EA-NV-030-02-021. July 2002
- _____. 2006. Carson City Field Office Geothermal Leasing Environmental Assessment. July 2006.
- _____. 2007. The Gold Book: Surface and Operating Standards and Guidelines for Oil and Gas Exploration and Development. Fourth Edition, Revised 2007. Prepared by the BLM and USFS.
- _____. 2008. National Environmental Policy Act Handbook H-1790-1. January.
- _____. 2010. Rangeland Administration System. <http://www.blm.gov/ras/authorized.htm>. April.
- US Census Bureau. 2010. Fact Sheet. Website: factfinder.census.gov. Accessed April 22, 2010.
- US Department of Agriculture (USDA). 2010. National Resources Conservation Service. Custom Soil Resource Report for Fallon-Fernley Area, Nevada, Parts of Churchill, Lyon, Storey, and Washoe County. Accessed April 22, 2010.
- US Fish and Wildlife Service (USFWS). 2006. Intermountain West Waterbird Conservation Plan. Version 1.2. February.
- _____. 2008. Birds of Conservation Concern 2008. United States
- Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. [Online version available at <<http://www.fws.gov/migratorybirds/>>].
- Van Denburgh, A.S. and Arteaga, F.E. 1985. Revised water budget for the Fernley Area, west-central Nevada 1979.
- Western Cultural Resources Management, Inc. (WCRM). 2009. A Class III Cultural Resources Inventory of Approximately 1,761 Acres for the Vulcan Power Company Patua Geothermal Project in Churchill and Lyon Counties near Hazen, Nevada. December.
- Wildlife Resource Consultants (WRC). 2009. Patua Geothermal Project Baseline Wildlife Surveys. November.
- Western Regional Climate Center. 2010. Fernley, Nevada: Period of Record General Climate Summary. Website: <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nv2840>. Accessed April 23, 2010. Updated Apr 15, 2010.

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Appendix A: Typical Pole Designs

Patua Geothermal Project

Typical Wood Pole HF Tangent Structure and Right-of-way

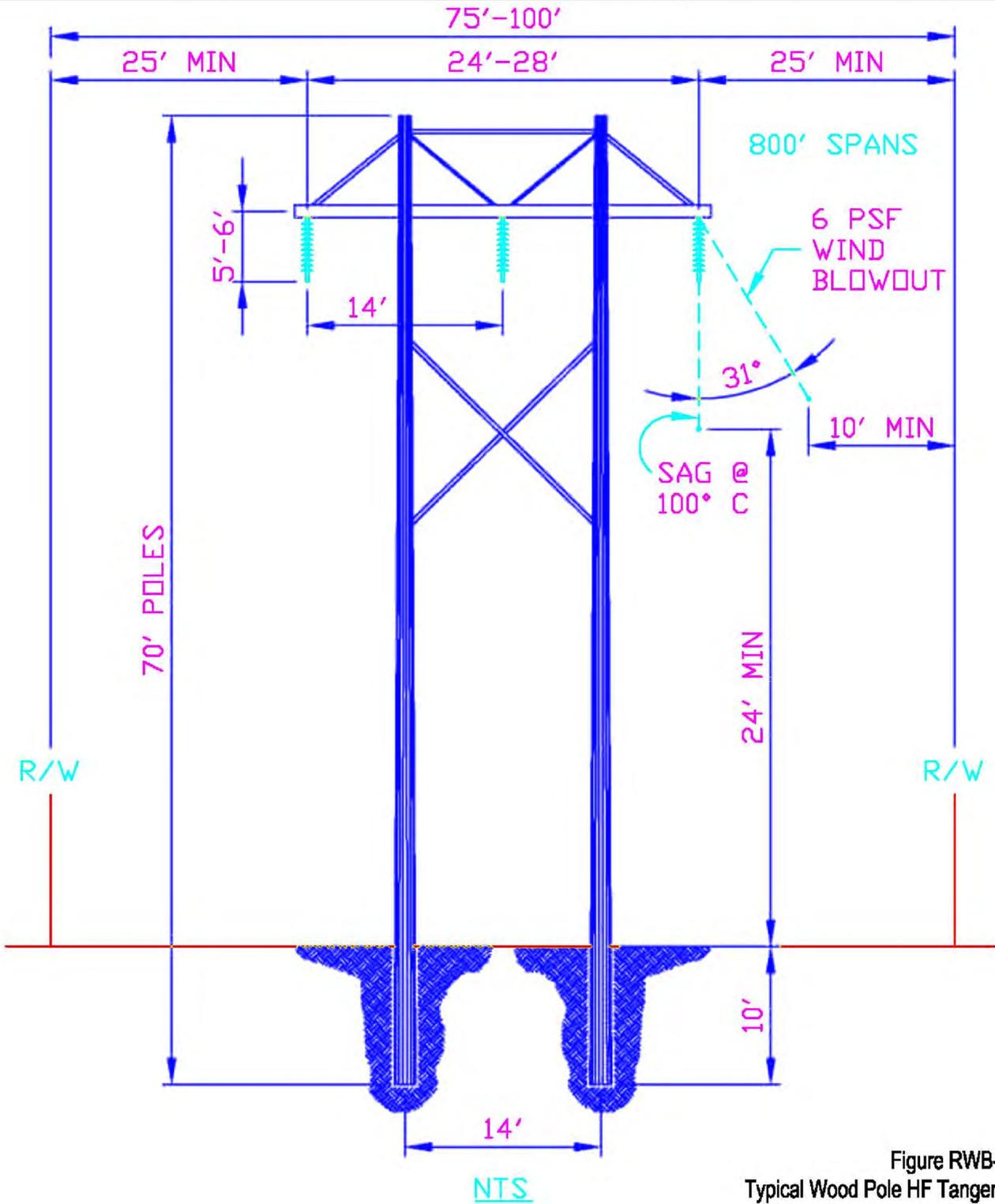
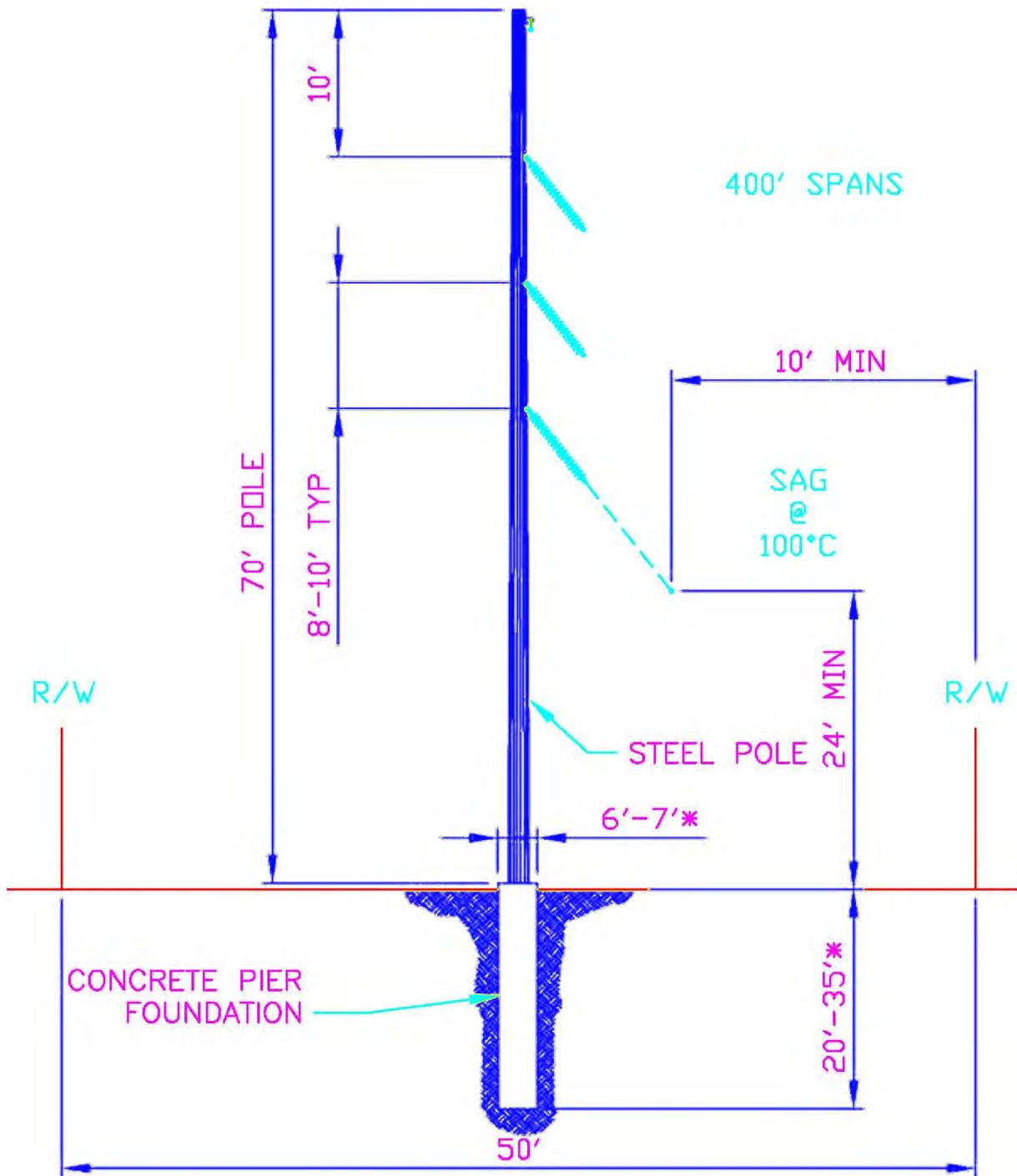


Figure RWB-1
Typical Wood Pole HF Tangent
Structure and Right-of-way
Patua Development Plan
Vulcan Power



Patua Geothermal Project

Single Pole Steel Angle Structure and Right-of-way



*DEPENDS ON LOADS AND SOIL CHARACTERISTICS

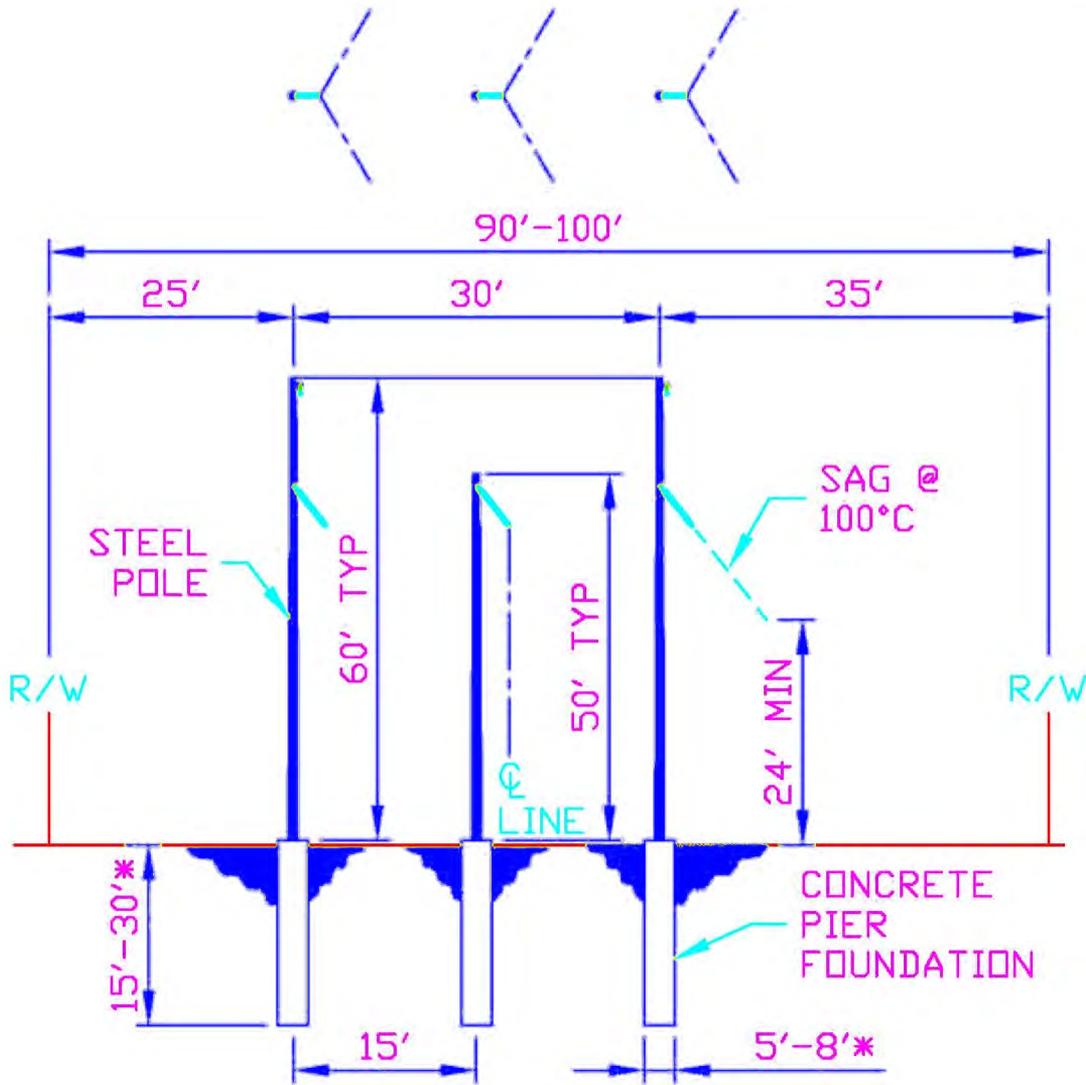
NTS

Figure RWB-3
Single Pole Steel Angle Structure and
Right-of-way
Patua Development Plan
Vulcan Power



Patua Geothermal Project

Typical 3-Pole Self Supporting Steel Structure and Right-of-way



* DEPENDS ON STRUCTURE LOADS
AND SOIL CHARACTERISTICS

NTS

Figure RWB-4
Typical 3-Pole Self Supporting Steel
Structure and Right-of-way
Patua Development Plan
Vulcan Power



Appendix B: Avian Protection Device Specifications

Introduction

Avian protection devices would include both perch deterrents and anti-collision devices. Figure 1 shows the areas of the proposed 6.4 mile long transmission line where anti-collision and perch deterrent devices would be installed. The avian protection devices and their locations were developed in coordination with NDOW and the project's consulting wildlife biologist.

Specifications

BIRD SPIKES

Bird spikes would be used on the cross arms of the transmission poles. The proposed bird spikes are humane with blunt tips that prevent injuries to both birds and maintenance workers. The bird spike bird control product consists of thin, stainless steel rods and a clear U.V. resistant polycarbonate base for long lasting durability while inhibiting the largest birds. A representative spike and adhesion methods are presented in Figure 2. The location of where the spikes would be installed on the cross arms of the transmission line H-frame poles is shown in Figure 3.

ANTI-COLLISION DEVICE

The Firefly Bird Flapper/Flight Diverter #11 would be used for anti-collision. The FireFly Bird Diverter was developed to protect birds from collisions with overhead power lines and communications towers better than past technology.

The FireFly Bird Diverter incorporates motion, reflectivity, and light emissions to deter birds from a protected area. The advantages of the Firefly Bird Diverter include:

- Fast installation
- Fully tested and developed by biologists to be the most effective diverter
- FireFly uses materials that glow at night up to 10 hours
- FireFly Spins in the wind alerting the birds of obstructions

The Firefly Bird Diverter #11 is shown in Figure 4. The spacing of the diverters is shown in Figure 5.

Figure 1: Patua Geothermal Project – Interconnection Avian Protection

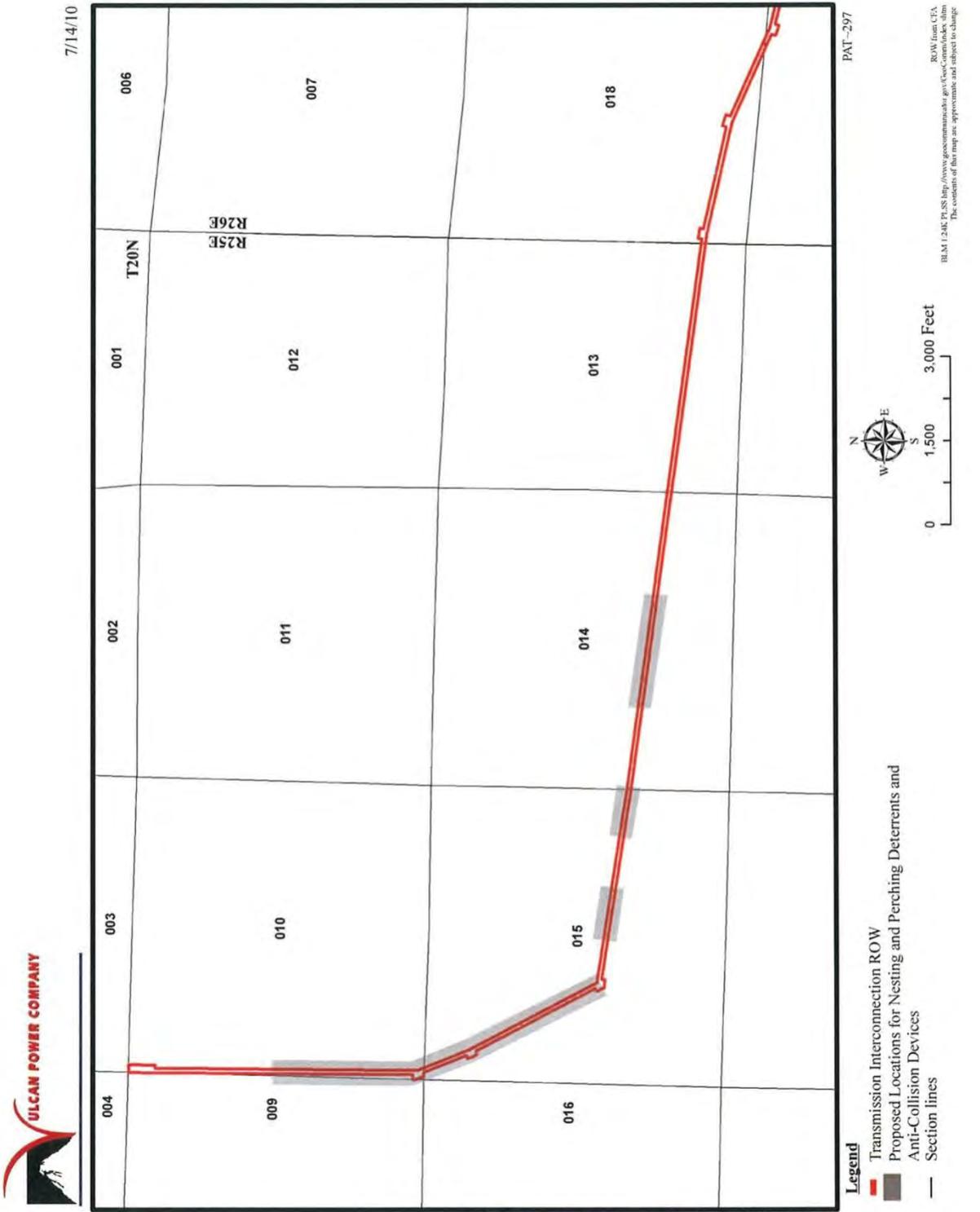


Figure 2: Bird Spike Specifications



Bird Spikes

Bird Spikes clear U.V. resistant polycarbonate base supports blunt-tipped, stainless steel rods that humanely deter problem birds from landing.

| | | |
|--|---------|--------|
| Narrow Bird Spikes: 2-1/2" wide bird spike (1 ft) | BP-F100 | \$3.70 |
| Wide Bird Spikes: 5" wide bird spike (1 ft) | BP-F200 | \$4.10 |
| Extra Wide Bird Spikes: 8" wide bird spike (1 ft) | BP-F300 | \$4.95 |



Special Bird Bond

This is an exceptionally strong, but flexible adhesive, specially formulated to handle dramatic temperature changes without cracking. It adheres our bird spikes to most surfaces. For best results, make sure the mounting surface is dry, completely cleaned and prepped. Full cure is in 24 hours at normal temperatures, but under some circumstances it can be workable in as little as four hours.

| | | |
|--------------------------|---------|----------|
| 10.2 oz. cartridge (ea.) | HA-BB03 | \$ 11.20 |
| 3.75 oz. tube (ea.) | HA-BB02 | \$ 6.25 |
| 1.25 oz. tube (ea.) | HA-BB01 | \$ 2.85 |



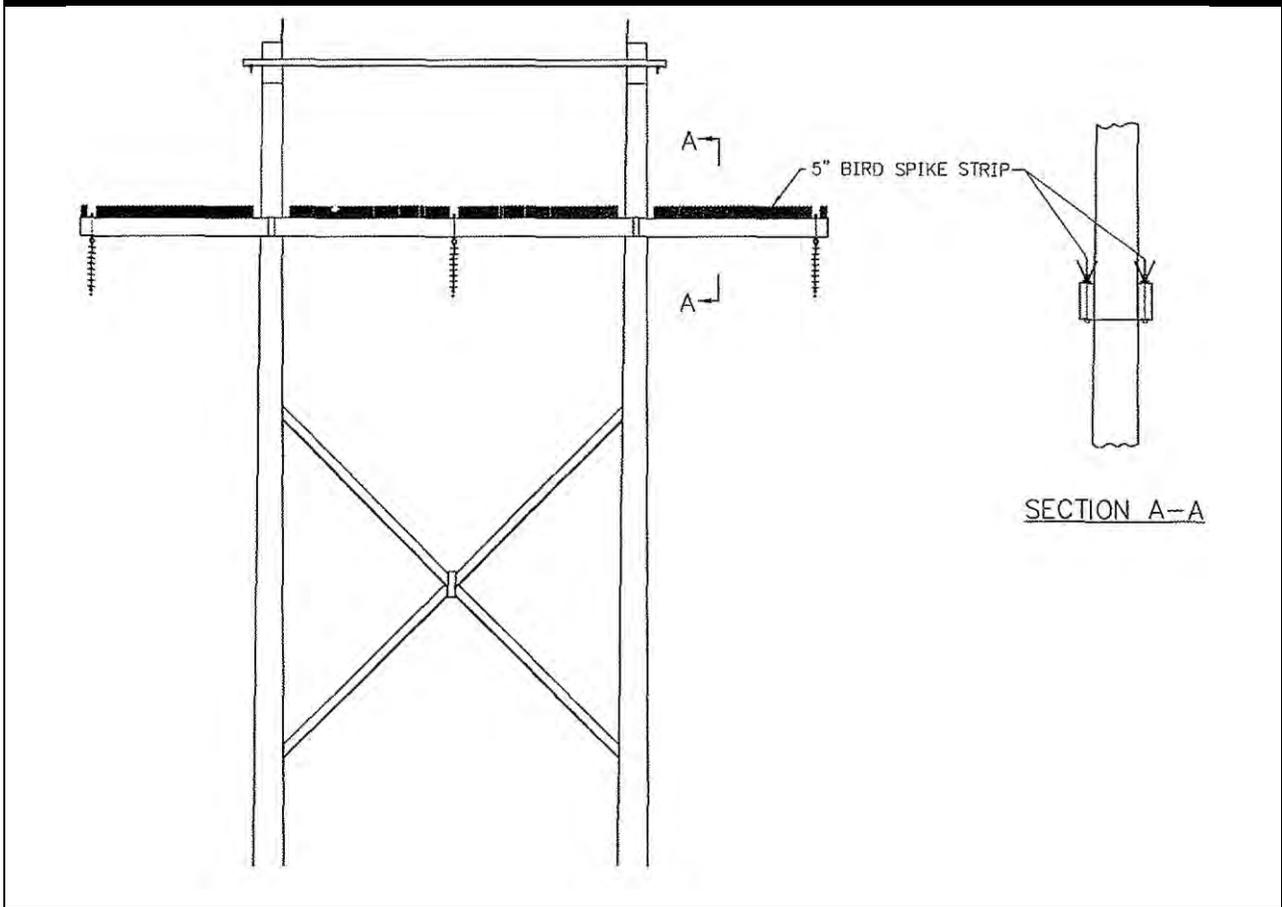
Self Tapping Screws

Fasten bird spikes easily to metal surfaces with these self-tapping screws.

| | | |
|--|---------|---------|
| Self-Tapping Screw Small (100) | HA-S100 | \$9.10 |
| Self-Tapping Screw Small Stainless Steel (100) | HA-S120 | \$33.00 |
| Self-Tapping Screw Heavy Duty (100) | HA-S200 | \$10.95 |

SOURCE: BirdBuster (http://www.birdbusters.com/birdspikcs_hardware.htm)

Figure 3: Bird Spike Strip Mounting Configuration



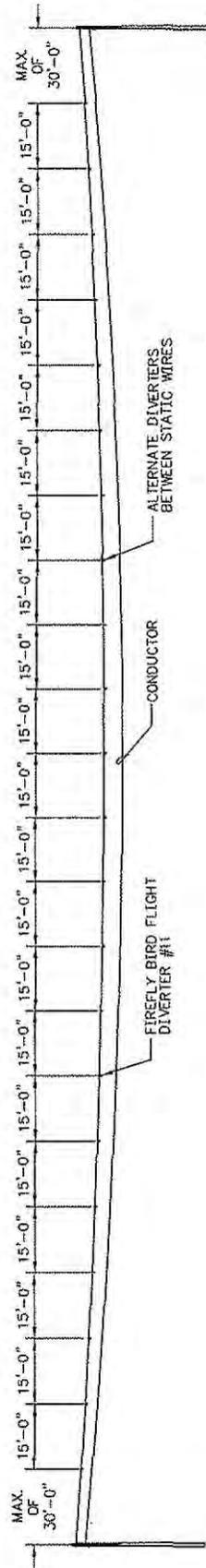
SOURCE: Vulcan Power Company 2010

Figure 4: Firefly Flapper/Flight Diverter



Firefly Bird Flapper/Flight Diverter #11

Figure 5: Flight Diverter Spacing



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Appendix C: Lease Stipulations

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial No.

N-85705

**OFFER TO LEASE AND LEASE FOR GEOTHERMAL RESOURCES
(For New Leases Issued Under the Energy Policy Act of 2005 [August 5, 2005])**

The undersigned (see page 2) offers to lease all or any of the lands in item 2 that are available for lease pursuant to the Geothermal Steam Act of 1970, as amended (30 U.S.C. 1001-1025).

READ INSTRUCTIONS BEFORE COMPLETING

| | | | |
|---------------------------------|-----------------|---|-----------------------|
| 1. Name Vulcan Power Company | | 1a. Street 345 SW Cyber Drive, Suite 103 | |
| 1b. City Bend | 1c. State OR | | 1d. Zip Code 97702 |

2. Surface managing agency if other than BLM: _____ Unit/Project: _____

Legal description of land requested (segregate by public domain and acquired lands): Enter T., R., Meridian, State and County

Total Acres Applied for _____

Percent U.S. interest _____

Amount remitted: Processing Fee \$ _____ Rental Fee \$ _____ Total \$ _____

DO NOT WRITE BELOW THIS LINE

3. Land included in lease: Enter T., R., Meridian, State and County

T. 20 N., R. 26 E., MDM, Nevada
 sec. 04, lots 5-12; sec. 20, N2;
 sec. 04, S2; sec. 22, all;
 sec. 08, all; sec. 28, all.
 sec. 10, all;
 sec. 16, all;
 sec. 20, lots 1-8;

Total Acres in Lease 4535.51

Rental Retained \$ 9072.00

In accordance with the above offer, or the previously submitted competitive bid, this lease is issued granting the exclusive right to drill for, extract, produce, remove, utilize, sell, and dispose of all the geothermal resources in the lands described in Item 3 together with the right to build and maintain necessary improvements thereupon, for a primary term of 10 years and subsequent extensions thereof in accordance with 43 CFR subpart 3207. Rights granted are subject to applicable laws, the terms, conditions, and attached stipulations of this lease, the Secretary of the Interior's regulations and formal orders in effect as of lease issuance, and, when not inconsistent with the provisions of this lease, regulations and formal orders hereafter promulgated.

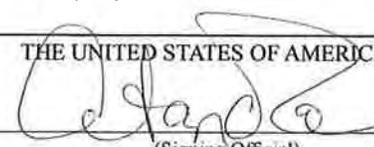
Type of Lease:

Competitive

Noncompetitive

Noncompetitive direct use (43 CFR subpart 3205)

THE UNITED STATES OF AMERICA

BY 

ATANDA CLARK (Signing Official)

Comments:

(Printed Name)
 Chief, Branch of Minerals Adjudication
 (Title)

OCT 27 2008
 (Date)

EFFECTIVE DATE OF LEASE NOV 01 2008

Check if this is a converted lease

EFFECTIVE DATE OF LEASE CONVERSION _____

4. (a) The undersigned certifies that:
 (1) The offeror is a citizen of the United States; an association of such citizens; a municipality; or a corporation organized under the laws of the United States, any State or the District of Columbia; (2) All parties holding an interest in the offer are in compliance with 43 CFR part 3200 and the authorizing Act; (3) The offeror's chargeable interests, direct and indirect, do not exceed those allowed under the Act; and (4) The offeror is not considered a minor under the laws of the State in which the lands covered by this offer are located.
- (b) The undersigned agrees that signing this offer constitutes acceptance of this lease, including all terms, conditions and stipulations of which the offeror has been given notice, and any amendment or separate lease that may cover any land described in this offer open to lease application at the time this offer was filed but omitted for any reason from this lease. The offeror further agrees that this offer cannot be withdrawn, either in whole or part, unless the withdrawal is received by the proper BLM State Office before this lease, an amendment to this lease, or a separate lease, whichever covers the land described in the withdrawal, has been signed on behalf of the United States.

This offer will be rejected and will afford the offeror no priority if it is not properly completed and executed in accordance with the regulations or if it is not accompanied by the required payments. Title 18 U.S.C. § 1001 makes 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.

Duly executed this _____ day of _____, 20____, _____
 (Printed Name of Lessee or Attorney-in-fact) (Signature of Lessee or Attorney-in-fact)

LEASE TERMS

Sec. 1. Rentals—Rentals must be paid to the proper office of the lessor in advance of each lease year. Annual rental rates per acre or fraction thereof, as applicable, are:

- (a) Noncompetitive lease (includes post-sale parcels not receiving bids, a direct use lease or a lease issued to a mining claimant): \$1.00 for the first 10 years; thereafter \$5.00; or
 (b) Competitive lease: \$2.00 for the first year; \$3.00 for the second through tenth year; thereafter \$5.00.
 Annual rental is always due by the anniversary date of this lease (43 CFR 3211.13), regardless of whether the lease is in a unit or outside of a unit, the lease is in production or not, or royalties or direct use fees apply to the production.
 Rental may only be credited toward royalty under 43 CFR 3211.15 and 30 CFR 218.303. Rental may not be credited against direct use fees. Failure to pay annual rental timely will result in late fees and will make the lease subject to termination in accordance with 43 CFR 3213.14.

Sec. 2. (a) Royalties—Royalties must be paid to the proper office of the lessor. Royalties are due on the last day of the month following the month of production. Royalties will be computed in accordance with applicable regulations and orders. Royalty rates for geothermal resources produced for the commercial generation of electricity but not sold in an arm's length transaction are: 1.75 percent for the first 10 years of production and 3.5 percent after the first 10 years. The royalty rate is to be applied to the gross proceeds derived from the sale of electricity in accordance with 30 CFR part 206 subpart H.

The royalty rate for byproducts derived from geothermal resource production that are minerals specified in section 1 of the Mineral Leasing Act (MLA), as amended (30 U.S.C. 181), is 5 percent, except for sodium compounds, for which the royalty rate is 2 percent for sodium produced between September 29, 2006 and September 29, 2011 (Pub. L. No. 109-338, § 102; note to 30 U.S.C. 262). No royalty is due on byproducts that are not specified in 30 U.S.C. § 181. (43 CFR 3211.19.)

If this lease or a portion thereof is committed to an approved communitization or unit agreement and the agreement contains a provision for allocation of production, royalties must be paid on the production allocated to this lease.

- (b) Arm's length transactions—The royalty rate for geothermal resources sold by you or your affiliate at arm's length to a purchaser is 10 percent of the gross proceeds derived from the arm's-length sale (43 CFR 3211.17, 3211.18).
 (c) Advanced royalties—In the absence of a suspension, if you cease production for more than one calendar month on a lease that is subject to royalties and that has achieved commercial production, your lease will remain in effect only if you make advanced royalty payments in accordance with 43 CFR 3212.15(a) and 30 CFR 218.305.
 (d) Direct use fees—Direct use fees must be paid in lieu of royalties for geothermal resources that are utilized for commercial, residential, agricultural, or other energy needs other than the commercial production or generation of electricity, but not sold in an arm's length transaction (43 CFR 3211.18; 30 CFR 206.356). This requirement applies to any direct use of federal geothermal resources (unless the resource is exempted as described in 30 CFR 202.351(b) or the lessee is covered by paragraph (e), below) and is not limited to direct use leases. Direct use fees are due on the last day of the month following the month of production.
 (e) If the lessee is a State, tribal, or local government covered by 43 CFR 3211.18(a)(3) and 30 CFR 206.366, check here: . A lessee under this paragraph is not subject to paragraph (d), above. In lieu of royalties, the lessee under this paragraph must pay a nominal fee of \$ _____.

Sec. 3. Bonds—A bond must be filed and maintained for lease operations as required by applicable regulations.

Sec. 4. Work requirements, rate of development, unitization, and drainage—Lessee must perform work requirements in accordance with applicable regulations (43 CFR 3207.11, 3207.12), and must prevent unnecessary damage to, loss of, or waste of leased resources. Lessor reserves the right to specify rates of development and production and to require lessee to commit to a communitization or unit agreement, within 30 days of notice, if in the public interest. Lessee must drill and produce wells necessary to protect leased lands from drainage or pay compensatory royalty for drainage in the amount determined by lessor. Lessor will exempt lessee from work requirements only where the lease overlies a mining claim that has an approved plan of operations and where BLM determines that the development of the geothermal resource on the lease would interfere with the mining operation (43 CFR 3207.13).

Sec. 5. Documents, evidence, and inspection—Lessee must file with the proper office of the lessor, not later than (30) days after the effective date thereof, any contract or evidence of other arrangement for the sale, use, or disposal of geothermal resources, byproducts produced, or for the sale of electricity generated using geothermal resources produced from the lease. At such times and in such form as lessor may prescribe, lessee must furnish detailed statements and all documents showing (a) amounts and quality of all geothermal resources produced and used (either for commercial production or generation of electricity, or in a direct use operation) or sold; (b) proceeds derived therefrom or from the sale of electricity generated using such resources; (c) amounts that are unavoidably lost or rejected before use, used to generate plant parasitic electricity (as defined in 30 CFR 206.351) or electricity for lease operations, or otherwise used for lease operations related to the commercial production or generation of electricity; and (d) amounts and quality of all byproducts produced and proceeds derived from the sale or disposition thereof. Lessee may be required to provide plats and schematic diagrams showing development work and improvements, and reports with respect to parties in interest.

In a format and manner approved by lessor, lessee must keep a daily drilling record, a log, and complete information on well surveys and tests; keep a record of subsurface investigations; and furnish copies to lessor when required.

Lessee must keep open at all reasonable times for inspection by any authorized officer of lessor, the leased premises and all wells, improvements, machinery, and fixtures thereon, and all books, accounts, maps, and records relative to operations, surveys, or investigations on or in the leased lands. Lessee must maintain copies of all contracts, sales agreements, accounting records, billing records, invoices, gross proceeds and payment data regarding the sale, disposition, or use of geothermal resources, byproducts produced, and the sale of electricity generated using resources produced from the lease, and all other information relevant to determining royalties or direct use fees. All such records must be maintained in lessee's accounting offices for future audit by lessor and produced upon request by lessor or lessor's authorized representative or agent. Lessee must maintain required records for 6 years after they are generated or, if an audit or investigation is underway, until released of the obligation to maintain such records by lessor.

Sec. 6. Conduct of operations—Lessee must conduct operations in a manner that minimizes adverse impacts to the land, air, and water, to cultural, biological, visual, and other resources, and to other land uses or users. Lessee must take reasonable measures deemed necessary by lessor to accomplish the intent of this section. To the extent consistent with leased rights granted, such measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Lessor reserves the right to continue existing uses and to authorize future uses upon or in the leased lands, including the approval of easements or rights-of-way. Such uses will be conditioned so as to prevent unnecessary or unreasonable interference with rights of lessee. Prior to disturbing the surface of the leased lands, lessee must contact lessor to be apprised of procedures to be followed and modifications or reclamation measures that may be necessary. Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessor may require lessee to complete minor inventories or short term special studies under guidelines provided by lessor. If, in the conduct of operations, threatened or endangered species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee must immediately contact lessor. Lessee must cease any operations that are likely to affect or take such species, or result in the modification, damage or destruction of such habitats or objects.

Sec. 7. Production of byproducts—If the production, use, or conversion of geothermal resources from these leased lands is susceptible of producing a valuable byproduct or byproducts, including commercially demineralized water for beneficial uses in accordance with applicable State water laws, lessor may require substantial beneficial production or use thereof by lessee.

Sec. 8. Damages to property—Lessee must pay lessor for damage to lessor's improvements, and must save and hold lessor harmless from all claims for damage or harm to persons or property as a result of lease operations.

Sec. 9. Protection of diverse interests and equal opportunity—Lessee must maintain a safe working environment in accordance with applicable regulations and standard industry practices, and take measures necessary to protect public health and safety. Lessor reserves the right to ensure that production is sold at reasonable prices and to prevent monopoly. Lessee must comply with Executive Order No. 11246 of September 24, 1965, as amended, and regulations and relevant orders of the Secretary of Labor issued pursuant thereto. Neither lessee nor lessee's subcontractor may maintain segregated facilities.

Sec. 10. Transfer of lease interests and relinquishment of lease—As required by regulations, lessee must file with lessor any assignment or other transfer of an interest in this lease. Subject to the requirements of 43 CFR subpart 3213, lessee may relinquish this lease or any legal subdivision by filing in the proper office a written relinquishment, which will be effective as of the date BLM receives it, subject to the continued obligation of the lessee and surety to be responsible for: paying all accrued rentals and royalties; plugging and abandoning all wells on the relinquished land, restoring and reclaiming the surface and other resources; and complying with 43 CFR 3200.4.

Sec. 11. Delivery of premises—At such time as all or portions of this lease are returned to lessor, lessee must place all wells in condition for suspension or abandonment, reclaim the land as specified by lessor, and within a reasonable period of time, remove equipment and improvements not deemed necessary by lessor for preservation of producible wells or continued protection of the environment.

Sec. 12. Proceedings in case of default—If lessee fails to comply with any provisions of this lease or other applicable requirements under 43 CFR 3200.4, and the noncompliance continues for 30 days after written notice thereof, this lease will be subject to termination in accordance with the Act and 43 CFR 3213. This provision will not be construed to prevent the exercise by lessor of any other legal and equitable remedy or action, including waiver of the default. Any such remedy, waiver, or action will not prevent later termination for the same default occurring at any other time. Whenever the lessee fails to comply in a timely manner with any of the provisions of the Act, this lease, the regulations, or other applicable requirements under 43 CFR 3200.4, and immediate action is required, the lessor may enter on the leased lands and take measures deemed necessary to correct the failure at the lessee's expense.

Sec. 13. Heirs and successors-in-interest—Each obligation of this lease will extend to and be binding upon, and every benefit hereof will inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

INSTRUCTIONS

A. General

1. Items 1 and 2 need to be completed only by parties filing for a noncompetitive lease. The BLM will complete the front of the form for other types of leases. The BLM may use the "Comments" space under Item 3 to identify when: the lessee has elected to make all lease terms subject to the Energy Policy Act of 2005 under 43 CFR 3200.7(a)(2) or 43 CFR 3200.8(b) (box labeled "converted lease" must also be checked); the lease is being issued noncompetitively to a party who holds a mining claim on the same lands as is covered by the lease under 43 CFR 3204.12; the lease is a direct use lease issued to a State, local, or tribal government (box at section 2(E) under Lease Terms must also be checked); the lease is a competitive lease with direct-use-only stipulations attached; or other circumstances exist. A lessee who seeks to convert only the royalty rate of a lease under 43 CFR 3212.25 or who qualifies for a case-by-case royalty rate determination under 43 CFR 3211.17(b)(1)(i) should not use this form, but should instead use an addendum to the existing lease.
2. Entries must be typed or printed plainly in ink. The offeror must sign the form (Item 4) in ink.
3. An original and two copies of this offer must be prepared and filed in the proper BLM State Office. See regulations at 43 CFR 1821.10 for office locations.
4. If more space is needed, additional sheets must be attached to each copy of the form submitted.

B. Specific

Item 1—Enter the offeror's name and billing address.

Item 2—Indicate the agency managing the surface use of the land and the name of the unit or project of which the land is a part. The offeror may also provide other information that will assist in establishing status of the lands. The description of land must conform to 43 CFR 3203.10. Total acres applied for must not exceed that allowed by regulations (43 CFR 3203.10; 43 CFR 3206.12).

Payments: For noncompetitive leases, the amount remitted must include the processing fee for noncompetitive lease applications (43 CFR 3204.10; 43 CFR 3000.12) and the first year's rental at the rate of \$1 per acre or fraction thereof. If the United States owns only a fractional interest in the geothermal resources, you must pay a prorated rental under 43 CFR 3211.11(d). The BLM will retain the processing fee even if the offer is completely rejected or withdrawn. To maintain the offeror's priority, the offeror must submit rental sufficient to cover all the land requested. If the land requested includes lots or irregular quarter-quarter sections, the exact acreage of which is not known to the offeror, rental should be submitted on the basis of each such lot or quarter-quarter section containing 40 acres. If the offer is withdrawn or rejected in whole or in part before a lease issues, the BLM will return the rental remitted for the parts withdrawn or rejected.

The BLM will fill in the processing fee for competitive lease applications (43 CFR 3203.17; 43 CFR 3000.12) and the first year's rental at the rate of \$2 per acre or fraction thereof.

Item 3—The BLM will complete this space.

NOTICES

The Privacy Act of 1974 and the regulation at 43 CFR 2.48(d) provide that you be furnished with the following information in connection with information required by this geothermal lease application.

AUTHORITY: 30 U.S.C. 1000 et seq.

PRINCIPAL PURPOSE—The information is to be used to process geothermal lease applications.

ROUTINE USES: (1) The adjudication of the lessee's rights to the land or resources. (2) Documentation for public information in support of notations made on land status records for the management, disposal, and use of public lands and resources. (3) Transfer to appropriate Federal agencies when concurrence is required prior to granting uses or rights in public lands or resources. (4) Transfer to the appropriate Federal, State, local, or foreign agencies, when relevant to civil, criminal, or regulatory investigations or prosecutions.

THREATENED, ENDANGERED OR SENSITIVE SPECIES

Controlled Or Limited Surface Use: (avoidance and/or mitigation measures to be developed)

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 U.S.C. 1531, as amended, including completion of any required procedure for conference or consultation.

Description of Lands

| | |
|---------------------|--|
| PARCEL NV-08-08-001 | T. 20 N., R. 26 E., MDM, Nevada sec. 10, all. |
| PARCEL NV-08-08-002 | ALL LANDS |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-004 | ALL LANDS |
| PARCEL NV-08-08-005 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-013 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | ALL LANDS |
| PARCEL NV-08-08-020 | ALL LANDS |

MIGRATORY BIRDS

Surface disturbing activities during the migratory bird 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 shall 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.

Description of Lands

| | |
|---------------------|---|
| PARCEL NV-08-08-001 | T. 20 N., R 26 E., MDM, Nevada sec. 10, all. |
| PARCEL NV-08-08-002 | ALL LANDS |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-004 | ALL LANDS |
| PARCEL NV-08-08-005 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-013 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | ALL LANDS |
| PARCEL NV-08-08-020 | ALL LANDS |

VEGETATION

Controlled Or Limited Surface Use: (avoidance and/or mitigation measures to be developed).

All areas of exploration and or development disturbance will be reclaimed including re-contouring disturbed areas to blend with the surrounding topography and using appropriate methods to seed with a diverse perennial seed mix.

The seed mix used to reclaim disturbed areas would be "certified" weed free.

Description of Lands

| | |
|---------------------|-------------------------------------|
| PARCEL NV-08-08-001 | T. 20 N., R 26 E., sec. 10, all. |
| PARCEL NV-08-08-002 | ALL LANDS |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-004 | ALL LANDS |
| PARCEL NV-08-08-005 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-013 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | ALL LANDS |
| PARCEL NV-08-08-020 | ALL LANDS |

NOXIOUS WEEDS

During all phases of exploration and development, the lessee shall maintain a noxious weed control program consisting of monitoring and eradication for species listed on the Nevada Designated Noxious Weed List (NRS 555.010).

Description of Lands

| | |
|---------------------|--|
| PARCEL NV-08-08-001 | T. 20 N., R. 26 E., MDM, Nevada sec. 10, all. |
| PARCEL NV-08-08-002 | ALL LANDS |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-004 | ALL LANDS |
| PARCEL NV-08-08-005 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-013 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | ALL LANDS |
| PARCEL NV-08-08-020 | ALL LANDS |

CULTURAL RESOURCES

No surface occupancy: No surface occupancy within the setting of National Register eligible sites where integrity of setting is critical to their eligibility.

| | <u>Description of Lands</u> |
|---------------------|---|
| PARCEL NV-08-08-001 | T. 20 N., R. 26 E., MDM, Nevada sec. 10, all. |
| PARCEL NV-08-08-002 | ALL LANDS |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-004 | ALL LANDS |
| PARCEL NV-08-08-005 | T. 23 N., R. 28 E., MDM, Nevada sec. 32, N2NWNE. |
| PARCEL NV-08-08-012 | T. 25 N., R. 38 E., MDM, Nevada sec. 28, NWSW. |
| PARCEL NV-08-08-013 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | T. 31 N., R. 39 E., MDM, Nevada sec. 33, E2SW. |
| PARCEL NV-08-08-020 | ALL LANDS |

NATIVE AMERICAN

Controlled Or Limited Surface Use: (avoidance and/or mitigation measures to be developed). 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 affected, 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. For development and production phases, surface occupancy may be limited to a specific distance or precluded at hot springs, pending conclusion of the Native American consultation process.

Description of Lands

| | |
|---------------------|---|
| PARCEL NV-08-08-001 | T. 20 N., R 26 E., MDM, Nevada sec. 10, all. |
| PARCEL NV-08-08-002 | ALL LANDS |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-004 | ALL LANDS |
| PARCEL NV-08-08-005 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-013 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | ALL LANDS |
| PARCEL NV-08-08-020 | ALL LANDS |

CULTURAL RESOURCES AND NATIVE AMERICAN CONSULTATION

No Surface Occupancy: No surface occupancy within the setting of National Register eligible sites where integrity of setting is critical to their eligibility. No surface occupancy within the setting of National Register eligible Traditional Cultural Properties (TCPs) where integrity of the setting is critical to their eligibility.

Native American Consultation and investigation of ethnographic records determined that certain lands within the parcel contain a Native American Sacred Site and Traditional Cultural Property (TCP).

Description of Lands

Parcel NV-08-08-001

T. 20 N., R 26 E., MDM, Nevada
sec. 22, all.

WATER RESOURCES

As exploration and development activities commence, the operator shall institute a hydrologic monitoring program. The details of the monitoring programs will be site specific and the intensity shall be commensurate with the level of exploration. For example, if the proponent will be conducting seismic studies the monitoring would be limited to the identification of 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 will be submitted to the Bureau of Land Management and will be used to support future NEPA documentation as development progresses. Adverse impacts to 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 whenever they are conducting activities which have the potential to impact those resources. If adverse impacts do occur, BLM will require the lessee to take corrective action to mitigate the impact. Corrective action may include shutting down the operation. These are in addition to the other stipulations. These are LEASE stipulations, not operational, the information gathered under the monitoring stipulation will be used to identify future impacts at the operational stage.

Description of Lands

| | |
|---------------------|---|
| PARCEL NV-08-08-001 | T. 20 N., R 26 E., MDM, Nevada sec. 10, all. |
| PARCEL NV-08-08-002 | ALL LANDS |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-004 | ALL LANDS |
| PARCEL NV-08-08-005 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-013 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | ALL LANDS |
| PARCEL NV-08-08-020 | ALL LANDS |

HAZARDOUS MATERIALS

Prior to exploration and development, an emergency response plan will be developed to include contingencies for hazardous material spills and disposal.

Description of Lands

| | |
|---------------------|---|
| PARCEL NV-08-08-001 | T. 20 N., R 26 E., MDM, Nevada sec. 10, all. |
| PARCEL NV-08-08-002 | ALL LANDS |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-004 | ALL LANDS |
| PARCEL NV-08-08-005 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-013 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | ALL LANDS |
| PARCEL NV-08-08-020 | ALL LANDS |

CONTROLLED OR LIMITED SURFACE USE

(avoidance and/or mitigation measures to be developed). All surface disturbing activities proposed after issuance of the lease are subject to compliance with Section 106 of the National Historic Preservation Act (NHPA) and its implementation through the protocol between the BLM Nevada State Director and the Nevada State Historic Preservation Officer.

| | <u>Description of Lands</u> |
|---------------------|--|
| PARCEL NV-08-08-001 | T. 20 N., R. 26 E., MDM, Nevada sec. 10, all. |
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-005 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-018 | T. 31 N., R. 39 E., MDM, Nevada sec. 16, SW; sec. 16, PROT N2, SE; sec. 17, all; sec. 21, NE, E2NW, SWNW, S2; sec. 22, NE, E2NW, SWNW, S2; sec. 22, PROT N2, W2SW, SESW, SE; sec. 27, N2, W2SW, SESW, SE. |
| PARCEL NV-08-08-019 | T. 31 N., R. 39 E., MDM, Nevada sec. 30, lots 1-4, E2, E2W2; sec. 31, lots 1-4, E2, E2W2; sec. 33, N2, E2SW, SE; sec. 34, N2N2, SENE, S2NW, S2; sec. 35, N2, N2S2, SWSW; sec. 36, N2, N2SW, NWSE, SESE. |
| PARCEL NV-08-08-020 | ALL LANDS |

WILD HORSE AND BURROS

Controlled or Limited Surface Use: (avoidance and/or mitigation measures to be developed.) If wild horse or burro populations are located on sites proposed for development, it may be necessary to avoid or develop mitigation measures to reduce adverse impacts to horses. These measures may include providing alternative water sources for horses of equal quality and quantity.

| | <u>Description of Lands</u> |
|---------------------|-----------------------------|
| PARCEL NV-08-08-003 | ALL LANDS |
| PARCEL NV-08-08-012 | ALL LANDS |
| PARCEL NV-08-08-017 | ALL LANDS |
| PARCEL NV-08-08-018 | ALL LANDS |
| PARCEL NV-08-08-019 | ALL LANDS |
| PARCEL NV-08-08-020 | ALL LANDS |

RIPARIAN AREAS STIPULATION

The lessee shall comply with the following special conditions and stipulations unless they are modified by mutual agreement of the Lessee and the Authorized Officer (AO):

No surface occupancy or 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). 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.

Description of Lands

| | |
|---------------------|--|
| PARCEL NV-08-08-001 | T. 20 N., R. 26 E., MDM, Nevada sec. 04, lots 5-12, S2; sec. 08, all; sec. 16, all; sec. 20, lots 1-8, N2; sec. 28, all. |
| PARCEL NV-08-08-006 | ALL LANDS |
| PARCEL NV-08-08-007 | ALL LANDS. |
| PARCEL NV-08-08-008 | ALL LANDS |
| PARCEL NV-08-08-010 | ALL LANDS |
| PARCEL NV-08-08-011 | ALL LANDS |
| PARCEL NV-08-08-016 | ALL LANDS |
| PARCEL NV-08-08-021 | T. 22 N., R. 40 E., MDM, Nevada sec. 04, portion within Carson City; sec. 05, lots 1-4, S2N2, S2; T. 23 N., R. 40 E., MDM, Nevada sec. 28, portion within Carson City; sec. 29, all; sec. 31, lots 1-4, E2, E2W2; sec. 32, all. |
| PARCEL NV-08-08-022 | ALL LANDS |
| PARCEL NV-08-08-023 | ALL LANDS |

ENDANGERED SPECIES ACT
SECTION 7 CONSULTATION STIPULATION

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.

CULTURAL RESOURCE PROTECTION
LEASE STIPULATION

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.

NATIVE AMERICAN CONSULTATION STIPULATION

The lessee shall comply with the following special conditions and stipulations unless they are modified by mutual agreement of the Lessee and the Authorized Officer (AO):

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.

Description of Lands

| | |
|---------------------|--|
| PARCEL NV-08-08-001 | T. 20 N., R. 26 E., MDM, Nevada sec. 04, lots 5-12, S2; sec. 08, all; sec. 16, all; sec. 20, lots 1-8, N2; sec. 28, all. |
| PARCEL NV-08-08-006 | ALL LANDS |
| PARCEL NV-08-08-007 | ALL LANDS. |
| PARCEL NV-08-08-008 | ALL LANDS |
| PARCEL NV-08-08-010 | ALL LANDS |
| PARCEL NV-08-08-011 | ALL LANDS |
| PARCEL NV-08-08-016 | ALL LANDS |
| PARCEL NV-08-08-021 | T. 22 N., R. 40 E., MDM, Nevada sec. 04, portion within Carson City; sec. 05, lots 1-4, S2N2, S2; T. 23 N., R. 40 E., MDM, Nevada sec. 28, portion within Carson City; sec. 29, all; sec. 31, lots 1-4, E2, E2W2; sec. 32, all. |
| PARCEL NV-08-08-022 | ALL LANDS |
| PARCEL NV-08-08-023 | ALL LANDS |

UNIT JOINDER REQUIREMENT

The successful applicant for the lands listed below shall file with this office, proof of having joined in the Patua Unit Agreement, or submit satisfactory reasons for not participating in this unit.

Description of Lands

T. 20 N., R. 26 E., MDM, Nevada
sec. 04, lots 5-12, S2;
sec. 08, all;
sec. 10, all;
sec. 16, all;
sec. 20, lots 1-8, N2;
sec. 22, all;
sec. 28, all.

LEASE STIPULATIONS
BUREAU OF RECLAMATION

The Lessee agrees to maintain, if required by the lessor during the period of this lease, including any extension thereof, an additional bond with qualified sureties in such sum as the lessor, if it considers that the bond required under Section 2(a) is insufficient, may at any time require:

(a) to pay for damages sustained by any reclamation homestead entryman to his crops or improvements caused by drilling or other operations of the lessee, such damages to include the reimbursement of the entryman by the lessee, when he uses or occupies the land of any homestead entryman, for all construction and operation and maintenance charges becoming due during such use or occupation upon any portion of the land so used and occupied;

(b) to pay any damage caused to any reclamation project or water supply thereof by the lessee's failure to comply fully with the requirements of this lease; and

(c) to recompense any non-mineral applicant, entryman purchaser under the Act of May 16, 1930 (46 Stat. 367), or patentee for all damages to crops or to tangible improvements caused by drilling or other prospecting operations, where any of the lands covered by this lease are embraced in any nonmineral application, entry, or patent under rights initiated prior to the date of this lease, with a reservation of the oil deposits, to the United States pursuant to the Act of July 17, 1914 (38 Stat. 509).

As to any lands covered by this lease within the area of any Government reclamation project, or in proximity thereto, the lessee shall take such precautions as required by the Secretary to prevent any injury to the lands susceptible to irrigation under such project or to the water supply thereof; *provided* that drilling is prohibited on any constructed works or right-of-way of the Bureau of Reclamation, and *provided, further*, that there is reserved to the lessor, its successors and assigns, the superior and prior right at all times to construct, operate, and maintain dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, appurtenant irrigation structures, and reclamation works, in which construction, operation, and maintenance, the lessor, its successors and assigns, shall have the right to use any or all of the lands herein described without making compensation therefore, and shall not be responsible for any damage from the presence of water thereon or on account of ordinary, extraordinary, unexpected, or unprecedented floods. That nothing shall be done under this lease to increase the cost of, or interfere in any manner with, the construction, operation, and maintenance of such works. It is agreed by the lessee that, if the construction of any or all of said dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone or telegraph lines electric transmission lines, roadways, appurtenant irrigation structures or reclamation works across, over, or upon said lands should be made more expensive by reason of the existence of the improvements and workings of the lessee thereon, said additional expense is to be estimated by the Secretary of the Interior, whose estimate is to be final and binding upon the parties hereto, and that within thirty (30) days after demand is made upon the lessee for payment of any such sums, the lessee will make payment thereof to the United States, or its successors, constructing such dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, appurtenant irrigation structures, or reclamation works, across, over, or upon said lands; *provided, however*, that subject to advance written approval by the United States the location and course of any improvements or works and appurtenances may be changed by the lessee; *provided further*, that the reservations, agreements, and conditions contained in the within lease shall be and remain applicable notwithstanding any change in the location or course of said improvements or works of lessee. 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 improvements or workings of the lessee resulting from the construction, operation, and maintenance of any of the works herein above enumerated. Nothing in this paragraph shall be construed as in any manner limiting other reservations in favor of the United States contained in this lease.

THE LESSEE FURTHER AGREES That there is reserved to the lessor, its successors and assigns, the prior right to use any of the lands herein leased, to construct, operate, and maintain dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, or appurtenant irrigation structures, and also the right to remove construction materials therefrom, without any payment made by the lessor or its successors for such right, with the agreement on the part of the lessee that if the construction of any or all of such dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, or appurtenant irrigation structures across, over, or upon said lands or the removal of construction materials therefrom, should be made more expensive by reason of the existence of improvements or workings of the

lessee thereon, such additional expense is to be estimated by the Secretary of the Interior, whose estimate is to be final and binding upon the parties hereto, and that within thirty (30) days after demand is made upon the lessee for payment of any such sums, the lessee will make payment thereof to the United States or its successors constructing such dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, or appurtenant irrigation structures across, over, or upon said lands or removing construction materials therefrom. The lessee further agrees that the lessor, its officers, agents, and employees and its successors and assigns shall not be held liable for any damage to the improvements or workings of the lessee resulting from the construction, operation, and maintenance of any of the works herein above enumerated. Nothing contained in this paragraph shall be construed as in any manner limiting other reservations in favor of the lessor contained in this lease.

SPECIAL STIPULATION - BUREAU OF RECLAMATION

To assist in preventing damage to any Bureau of Reclamation dams, reservoirs, canals, ditches, laterals, tunnels, and related facilities, and contamination of the water supply therein, and to avoid interference with recreation development and/or impacts to fish and wildlife habitat, the lessee agrees that the following conditions shall apply to all exploration and developmental activities and other operation of the works thereafter on lands covered by this lease:

1. Prior to commencement of any surface-disturbing work including drilling, access road work, and well location construction, a surface use and operations plan will be filed with the appropriate officials. A copy of this plan will be furnished to the Resource Division Manager, Lahontan Basin Area Office, Bureau of Reclamation, 705 North Plaza Street, Room 320, Carson City, Nevada 89701, for review and consent prior to approval of the plan. Such approval will be conditioned on reasonable requirements needed to prevent soil erosion, water pollution, and unnecessary damages to the surface vegetation and other resources, including cultural resources, of the United States, its lessees, permittees, or licensees, and to provide for the restoration of the land surface and vegetation. The plan shall contain provisions as the Bureau of Reclamation may deem necessary to maintain proper management of the water, recreation, lands, structures, and resources, including cultural resources, within the prospecting drilling, or construction area.

Drilling sites for all wells and associated investigations such as seismograph work shall be included in the above-mentioned surface use and operation plan.

If later explorations require departure from or additions to the approved plan, these revisions or amendments, together with a justification statement for proposed revisions, will be submitted for approval to the Resource Division Manager, Lahontan Basin Area Office, Bureau of Reclamation, or their authorized representative.

Any operations conducted in advance of approval of an original, revised, or amended prospecting plan, or which are not in accordance with an approved plan constitute a violation of the terms of this lease. The Bureau of Reclamation reserves the right to close down operations until such corrective action, as is deemed necessary, is taken by the lessee.

2. No occupancy of the surface of the following areas is authorized by this lease. It is understood and agreed that the use of these areas for Bureau of Reclamation purposes is superior to any other use. The following restrictions apply only to mineral tracts located within the boundary of a Bureau of Reclamation project where the United States owns 100 percent of the fee mineral interest.

- a. Within 500 feet on either side of the centerline of any and all roads or highways within the leased area.
- b. Within 200 feet on either side of the centerline of any and all trails within the leased area.
- c. Within 500 feet of the normal high-water line of any and all live streams in the leased area.
- d. Within 400 feet of any and all recreation developments within the leased area.

- e. Within 400 feet of any improvements either owned, permitted, leased, or otherwise authorized by the Bureau of Reclamation within the leased area.
- f. Within 200 feet of established crop fields, food plots, and tree/shrub plantings within the leased area.
- g. Within 200 feet of slopes steeper than a 2:1 gradient within the leased area.
- h. Within established rights-of-way of canals, laterals, and drainage ditches within the leased area.
- i. Within a minimum of 500 feet horizontal from the centerline of the facility or 50 feet from the outside toe of the canal, lateral, or drain embankment, whichever distance is greater, for irrigation facilities without clearly marked rights-of-way within the leased area.
- j. Providing that appropriate environmental compliance measures can be ensured, and providing further that Reclamation project works and other public interests can be protected, Reclamation may consider, on a case-by-case basis, waiving the requirement specified in Section 2 hereof. **HOWEVER, LESSEES ARE ADVISED THAT OBTAINING SUCH A WAIVER CAN BE A DIFFICULT, TIME CONSUMING, AND COSTLY PROCESS WITH NO GUARANTEE THAT RECLAMATION WILL GRANT THE REQUESTED WAIVER.**

3. No occupancy of the surface or surface drilling will be allowed in the following areas. In addition to, no directional drilling will be allowed that would intersect the subsurface zones delineated by a vertical plane in these areas. The following restrictions apply only to mineral tracts located within the boundary of a Bureau of Reclamation project where the United States owns 100 percent of the fee mineral interest.

- a. Within 1,000 feet of the maximum water surface, as defined in the Standard Operating Procedures (SOP), of any reservoirs and related facilities located within the leased area.
- b. Within 2,000 feet of dam embankments and appurtenance structures such as spillway structures, outlet works, etc.
- c. Within one-half (1/2) mile horizontal from the centerline of any tunnel within the leased area.
- d. Providing that appropriate environmental compliance measures can be ensured, and providing further that Reclamation project works and other public interests can be protected. Reclamation may consider, on a case-by-case basis, waiving the requirements specified in Section 3 hereof. **HOWEVER, LESSEES ARE ADVISED THAT OBTAINING SUCH A WAIVER CAN BE A DIFFICULT, TIME CONSUMING, AND COSTLY PROCESS WITH NO GUARANTEE THAT RECLAMATION WILL GRANT THE REQUESTED WAIVER.**

4. The distances stated in items 2 and 3 above are intended to be general indicators only. The Bureau of Reclamation reserves the right to revise these distances as needed to protect Bureau of Reclamation facilities.

5. There will be no discharges into any Bureau of Reclamation water delivery or drainage facilities.

6. Lessee shall not use Bureau of Reclamation operation and maintenance roads for lease related access without prior written approval of the Bureau of Reclamation.

7. The use of explosives in any manner shall be so controlled that the works and facilities of the United States, its successors and assigns, will in no way be endangered or damaged. In this connection, an explosives use plan shall be submitted to and approved by the Resource Division Manager, Lahontan Basin Area Office, Bureau of Reclamation, or their authorized representative.

8. 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.

9. 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 no obligation on the part of the Lessor to exercise its reserved rights. The Lessor shall not be liable in any manner if those rights are not exercised, and, in that event, the Lessee shall dispose of the brines and condensates in accordance with applicable laws, rules and regulations. The Lessor reserves the right to conduct on the leased lands, testing and evaluation of geothermal resources which the Lessor determines are required for its desalinization research programs for utilization of geothermal fluids. These programs may include shallow temperature gradient hole underground exploration, if they are conducted in a manner compatible with lease operations and the production by Lessee of geothermal steam and associated geothermal resources.

Lessor reserves the right to erect, maintain, and operate any and all facilities, pipelines, transmission lines, access roads, and appurtenances necessary for desalinization on the leased premises. Any desalting plants, piping, wells, or other equipment installed by the Lessor on the leased premises shall remain the property of the Lessor; and the Lessee shall conduct his operations in a manner compatible with the operation and maintenance of any desalting plants, piping, wells, or other equipment installed by the Lessor. Any brines and condensates removed by the Lessor shall be replaced without cost to the Lessee with fluids as compatible with reservoir fluids as the brines or condensates that the Lessor removed and where the Lessor and Lessee determine that they are needed by the Lessee for his operation or for reinjection into the geothermal anomalies.

The Lessor and the Lessee, if authorized by law, may enter into cooperative agreements for joint development and production of geothermal resources from the leased premises consistent with applicable laws and regulations. Any geophysical, geological, geochemical, and reservoir hydraulic data collected by either the Bureau of Reclamation or the Lessee will be made available upon request to the other party, and the data furnished to Reclamation by the Lessee shall be considered confidential so long as the following conditions prevail:

a. Until the Lessee notifies Reclamation that there is no requirement to retain the submitted data in confidential status or until Lessee relinquishes all interest in the leased area from where the information was obtained.

b. Reclamation shall not incorporate data received from the Lessee in its publications or reports during the period that confidential data are being retained without written authorization from the Lessee.

c. Information obtained by Reclamation, and upon request submitted to the Lessee, shall not be used in publications or reports issued by Lessee without written consent of Reclamation until the data have been published or otherwise given distribution by Reclamation.

10. Bureau of Reclamation will review all road or bridge crossings, piping or closure of any reclamation project feature, and review NEPA and Cultural clearances on an individual basis.

11. The lessee shall be liable for all damage to the property of the United States, its successors and assigns, resulting from the exploration, development, or operation of the works contemplated by this lease, and shall further hold the United States, its successors and assigns, and its officers, agents, and employees, harmless from all claims of third parties for injury or damage sustained or in any way resulting from the exercise of the rights and privileges conferred by this lease.

12. The lessee shall be liable for all damage to crops or improvements of any entryman, nonmineral applicant, or patentee, their successors and assigns, caused by or resulting from the drilling or other operations of the lessee, including reimbursement of any entryman or patentee, their successors and assigns, for all construction, operation,

and maintenance charges becoming due on any portion of their said lands damaged as a result of the drilling or other operations of the lessee.

13. In addition to any other bond required under the provisions of this lease, the lessee shall provide such bond as the United States may at any time require for damages which may arise under the liability provisions of sections eleven (11) and twelve (12) above.

Description of Lands

PARCEL NV-08-08-002

ALL LANDS

LEASE STIPULATIONS
BUREAU OF RECLAMATION

The Lessee agrees to maintain, if required by the lessor during the period of this lease, including any extension thereof, an additional bond with qualified sureties in such sum as the lessor, if it considers that the bond required under Section 2(a) is insufficient, may at any time require:

(a) to pay for damages sustained by any reclamation homestead entryman to his crops or improvements caused by drilling or other operations of the lessee, such damages to include the reimbursement of the entryman by the lessee, when he uses or occupies the land of any homestead entryman, for all construction and operation and maintenance charges becoming due during such use or occupation upon any portion of the land so used and occupied;

(b) to pay any damage caused to any reclamation project or water supply thereof by the lessee's failure to comply fully with the requirements of this lease; and

(c) to recompense any non-mineral applicant, entryman purchaser under the Act of May 16, 1930 (46 Stat. 367), or patentee for all damages to crops or to tangible improvements caused by drilling or other prospecting operations, where any of the lands covered by this lease are embraced in any nonmineral application, entry, or patent under rights initiated prior to the date of this lease, with a reservation of the oil deposits, to the United States pursuant to the Act of July 17, 1914 (38 Stat. 509).

As to any lands covered by this lease within the area of any Government reclamation project, or in proximity thereto, the lessee shall take such precautions as required by the Secretary to prevent any injury to the lands susceptible to irrigation under such project or to the water supply thereof; *provided* that drilling is prohibited on any constructed works or right-of-way of the Bureau of Reclamation, and *provided, further*, that there is reserved to the lessor, its successors and assigns, the superior and prior right at all times to construct, operate, and maintain dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, appurtenant irrigation structures, and reclamation works, in which construction, operation, and maintenance, the lessor, its successors and assigns, shall have the right to use any or all of the lands herein described without making compensation therefore, and shall not be responsible for any damage from the presence of water thereon or on account of ordinary, extraordinary, unexpected, or unprecedented floods. That nothing shall be done under this lease to increase the cost of, or interfere in any manner with, the construction, operation, and maintenance of such works. It is agreed by the lessee that, if the construction of any or all of said dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone or telegraph lines electric transmission lines, roadways, appurtenant irrigation structures or reclamation works across, over, or upon said lands should be made more expensive by reason of the existence of the improvements and workings of the lessee thereon, said additional expense is to be estimated by the Secretary of the Interior, whose estimate is to be final and binding upon the parties hereto, and that within thirty (30) days after demand is made upon the lessee for payment of any such sums, the lessee will make payment thereof to the United States, or its successors, constructing such dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, appurtenant irrigation structures, or reclamation works, across, over, or upon said lands; *provided, however*, that subject to advance written approval by the United States the location and course of any improvements or works and appurtenances may be changed by the lessee; *provided further*, that the reservations, agreements, and conditions contained in the within lease shall be and remain applicable notwithstanding any change in the location or course of said improvements or works of lessee. 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 improvements or workings of the lessee resulting from the construction, operation, and maintenance of any of the works herein above enumerated. Nothing in this paragraph shall be construed as in any manner limiting other reservations in favor of the United States contained in this lease.

THE LESSEE FURTHER AGREES That there is reserved to the lessor, its successors and assigns, the prior right to use any of the lands herein leased, to construct, operate, and maintain dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, or appurtenant irrigation structures, and also the right to remove construction materials therefrom, without any payment made by the lessor or its successors for such right, with the agreement on the part of the lessee that if the construction of any or all of such dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, or appurtenant irrigation structures across, over, or upon said lands or the removal of construction materials therefrom, should be made more expensive by reason of the existence of improvements or workings of the

lessee thereon, such additional expense is to be estimated by the Secretary of the Interior, whose estimate is to be final and binding upon the parties hereto, and that within thirty (30) days after demand is made upon the lessee for payment of any such sums, the lessee will make payment thereof to the United States or its successors constructing such dams, dikes, reservoirs, canals, wasteways, laterals, ditches, telephone and telegraph lines, electric transmission lines, roadways, or appurtenant irrigation structures across, over, or upon said lands or removing construction materials therefrom. The lessee further agrees that the lessor, its officers, agents, and employees and its successors and assigns shall not be held liable for any damage to the improvements or workings of the lessee resulting from the construction, operation, and maintenance of any of the works herein above enumerated. Nothing contained in this paragraph shall be construed as in any manner limiting other reservations in favor of the lessor contained in this lease.

SPECIAL STIPULATION - BUREAU OF RECLAMATION

To assist in preventing damage to any Bureau of Reclamation dams, reservoirs, canals, ditches, laterals, tunnels, and related facilities, and contamination of the water supply therein, and to avoid interference with recreation development and/or impacts to fish and wildlife habitat, the lessee agrees that the following conditions shall apply to all exploration and developmental activities and other operation of the works thereafter on lands covered by this lease:

1. Prior to commencement of any surface-disturbing work including drilling, access road work, and well location construction, a surface use and operations plan will be filed with the appropriate officials. A copy of this plan will be furnished to the Resource Division Manager, Lahontan Basin Area Office, Bureau of Reclamation, 705 North Plaza Street, Room 320, Carson City, Nevada 89701, for review and consent prior to approval of the plan. Such approval will be conditioned on reasonable requirements needed to prevent soil erosion, water pollution, and unnecessary damages to the surface vegetation and other resources, including cultural resources, of the United States, its lessees, permittees, or licensees, and to provide for the restoration of the land surface and vegetation. The plan shall contain provisions as the Bureau of Reclamation may deem necessary to maintain proper management of the water, recreation, lands, structures, and resources, including cultural resources, within the prospecting drilling, or construction area.

Drilling sites for all wells and associated investigations such as seismograph work shall be included in the above- mentioned surface use and operation plan.

If later explorations require departure from or additions to the approved plan, these revisions or amendments, together with a justification statement for proposed revisions, will be submitted for approval to the Resource Division Manager, Lahontan Basin Area Office, Bureau of Reclamation, or their authorized representative.

Any operations conducted in advance of approval of an original, revised, or amended prospecting plan, or which are not in accordance with an approved plan constitute a violation of the terms of this lease. The Bureau of Reclamation reserves the right to close down operations until such corrective action, as is deemed necessary, is taken by the lessee.

2. No occupancy of the surface of the following areas is authorized by this lease. It is understood and agreed that the use of these areas for Bureau of Reclamation purposes is superior to any other use. The following restrictions apply only to mineral tracts located within the boundary of a Bureau of Reclamation project where the United States owns 100 percent of the fee mineral interest.

- a. Within 500 feet on either side of the centerline of any and all roads or highways within the leased area.
- b. Within 200 feet on either side of the centerline of any and all trails within the leased area.
- c. Within 500 feet of the normal high-water line of any and all live streams in the leased area.
- d. Within 400 feet of any and all recreation developments within the leased area.

- e. Within 400 feet of any improvements either owned, permitted, leased, or otherwise authorized by the Bureau of Reclamation within the leased area.
- f. Within 200 feet of established crop fields, food plots, and tree/shrub plantings within the leased area.
- g. Within 200 feet of slopes steeper than a 2:1 gradient within the leased area.
- h. Within established rights-of-way of canals, laterals, and drainage ditches within the leased area.
- i. Within a minimum of 500 feet horizontal from the centerline of the facility or 50 feet from the outside toe of the canal, lateral, or drain embankment, whichever distance is greater, for irrigation facilities without clearly marked rights-of-way within the leased area.
- j. Providing that appropriate environmental compliance measures can be ensured, and providing further that Reclamation project works and other public interests can be protected, Reclamation may consider, on a case-by-case basis, waiving the requirement specified in Section 2 hereof. **HOWEVER, LESSEES ARE ADVISED THAT OBTAINING SUCH A WAIVER CAN BE A DIFFICULT, TIME CONSUMING, AND COSTLY PROCESS WITH NO GUARANTEE THAT RECLAMATION WILL GRANT THE REQUESTED WAIVER.**

3. No occupancy of the surface or surface drilling will be allowed in the following areas. In addition to, no directional drilling will be allowed that would intersect the subsurface zones delineated by a vertical plane in these areas. The following restrictions apply only to mineral tracts located within the boundary of a Bureau of Reclamation project where the United States owns 100 percent of the fee mineral interest.

- a. Within 1,000 feet of the maximum water surface, as defined in the Standard Operating Procedures (SOP), of any reservoirs and related facilities located within the leased area.
- b. Within 2,000 feet of dam embankments and appurtenance structures such as spillway structures, outlet works, etc.
- c. Within one-half (1/2) mile horizontal from the centerline of any tunnel within the leased area.
- d. Providing that appropriate environmental compliance measures can be ensured, and providing further that Reclamation project works and other public interests can be protected. Reclamation may consider, on a case-by-case basis, waiving the requirements specified in Section 3 hereof. **HOWEVER, LESSEES ARE ADVISED THAT OBTAINING SUCH A WAIVER CAN BE A DIFFICULT, TIME CONSUMING, AND COSTLY PROCESS WITH NO GUARANTEE THAT RECLAMATION WILL GRANT THE REQUESTED WAIVER.**

4. The distances stated in items 2 and 3 above are intended to be general indicators only. The Bureau of Reclamation reserves the right to revise these distances as needed to protect Bureau of Reclamation facilities.

5. There will be no discharges into any Bureau of Reclamation water delivery or drainage facilities.

6. Lessee shall not use Bureau of Reclamation operation and maintenance roads for lease related access without prior written approval of the Bureau of Reclamation.

7. The use of explosives in any manner shall be so controlled that the works and facilities of the United States, its successors and assigns, will in no way be endangered or damaged. In this connection, an explosives use plan shall be submitted to and approved by the Resource Division Manager, Lahontan Basin Area Office, Bureau of Reclamation, or their authorized representative.

8. 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.

9. 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 no 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 desalination 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 desalination on the leased premises. Any desalting plants, piping, wells, or other equipment installed by the Lessor on the leased premises shall remain the property of the Lessor; and the Lessee shall conduct his operations in a manner compatible with the operation and maintenance of any desalting plants, piping, wells, or other equipment installed by the Lessor. Any brines and condensates removed by the Lessor shall be replaced without cost to the Lessee with fluids as compatible with reservoir fluids as the brines or condensates that the Lessor removed and where the Lessor and Lessee determine that they are needed by the Lessee for his operation or for reinjection into the geothermal anomalies.

The Lessor and the Lessee, if authorized by law, may enter into cooperative agreements for joint development and production of geothermal resources from the leased premises consistent with applicable laws and regulations. Any geophysical, geological, geochemical, and reservoir hydraulic data collected by either the Bureau of Reclamation or the Lessee will be made available upon request to the other party, and the data furnished to Reclamation by the Lessee shall be considered confidential so long as the following conditions prevail:

a. Until the Lessee notifies Reclamation that there is no requirement to retain the submitted data in confidential status or until Lessee relinquishes all interest in the leased area from where the information was obtained.

b. Reclamation shall not incorporate data received from the Lessee in its publications or reports during the period that confidential data are being retained without written authorization from the Lessee.

c. Information obtained by Reclamation, and upon request submitted to the Lessee, shall not be used in publications or reports issued by Lessee without written consent of Reclamation until the data have been published or otherwise given distribution by Reclamation.

10. Bureau of Reclamation will review all road or bridge crossings, piping or closure of any reclamation project feature, and review NEPA and Cultural clearances on an individual basis.

11. The lessee shall be liable for all damage to the property of the United States, its successors and assigns, resulting from the exploration, development, or operation of the works contemplated by this lease, and shall further hold the United States, its successors and assigns, and its officers, agents, and employees, harmless from all claims of third parties for injury or damage sustained or in any way resulting from the exercise of the rights and privileges conferred by this lease.

12. The lessee shall be liable for all damage to crops or improvements of any entryman, nonmineral applicant, or patentee, their successors and assigns, caused by or resulting from the drilling or other operations of the lessee, including reimbursement of any entryman or patentee, their successors and assigns, for all construction, operation,

and maintenance charges becoming due on any portion of their said lands damaged as a result of the drilling or other operations of the lessee.

13. In addition to any other bond required under the provisions of this lease, the lessee shall provide such bond as the United States may at any time require for damages which may arise under the liability provisions of sections eleven (11) and twelve (12) above.

Description of Lands

PARCEL NV-08-08-002

ALL LANDS

**Appendix D:
Written Confirmation of
Protection Measures**



October 8, 2010

Ms. Desna Young
Bureau of Land Management
5665 Morgan Mill Road
Carson City, NV 89701

RE: Environmental Commitments for the Patua Geothermal Project

Dear Ms. Young,

Attached is a list of environmental protection measures that have been incorporated into the project description of the Patua Geothermal Project Environmental Assessment (EA). Vulcan Power Company (VPC) agrees to implement all of these measures during implementation of the project. The measures have been incorporated into the project description of the EA prepared by RMT as part of the proposed action.

This letter serves to document the concurrence of VPC to conduct the attached environmental protection measures as part of the project. If you have any questions, please contact me at (775) 284-8842.

Sincerely,

A handwritten signature in blue ink, appearing to read "Kenneth Bonin, Sr.", is written over a light blue horizontal line.

Kenneth Bonin, Sr.
Director of Permitting
Vulcan Power Company

Enclosure

Environmental Protection Measures for the Patua Geothermal Project

Water Resources

1. The reserve pit would be lined to prevent seepage of testing fluids into the underlying groundwater.
2. Containment berms would be constructed around all hazardous material or potentially hazardous material storage areas. Off-pad stormwater is directed away from the well pads.
3. BOPE would be maintained at the wellhead to allow well shutdown if an uncontrolled flow of fluid or gas occurs.
4. A cement and casing program for construction of any wells would be implemented to prevent water quality effects on groundwater during or after well installation. Borehole geophysics analyses (cement bond logs) would be conducted to document that well-casing grouting activities provide an effective seal, isolating the geothermal aquifer from shallow alluvial aquifers.
5. No ground disturbance would be conducted within 650 feet of a canal or water feature on federal leased land prior to Reclamation's consent.
6. VPC would obtain necessary permits for work in waters and/or groundwater discharge permits and would provide a Notice of Intent to NDEP prior to well pad construction.
7. A hydrologic evaluation program will be implemented, which will be site specific and its intensity will be commensurate with the level of development drilling.

Wetlands/Riparian Zones

8. Transmission lines would span wetlands to the extent feasible.
9. Dips or culverts would be installed for access roads so as not to impact flows.
10. Construction of the transmission line would occur in the dry season
11. Existing two-track roads would be used to the greatest extent feasible
12. BMPs to prevent release of fuels or other construction materials would be implemented, including VPC's SWPPP and Spill Prevention, Control, and Countermeasure (SPCC) Plan, which would be prepared and submitted to the BLM and Reclamation prior to construction.
13. When permanent new access roads must cross ephemeral washes, rolling dips would be installed. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. Culverts may be used wherever rolling dips are not feasible

Floodplains

14. Roads would be constructed with culverts properly sized to convey at least a 25-year storm event.

15. Existing two-track would be used as access roads to the greatest extent feasible along the roads to minimize the amount of additional base material and construction necessary.

Vegetation

16. Reclamation of well pads and access roads would occur when it is determined that they would no longer be used for exploration, utilization, or any other purposes. During operations, interim reclamation would be conducted for the well pad areas no longer needed for operation or maintenance. All reclamation would be performed in accordance with the Gold Book (2007).
17. Reclamation would be performed in accordance with lease stipulations. Reclamation would include re-contouring of disturbed areas to blend in with the surrounding topography and use of appropriate methods to seed with a diverse perennial seed mix. The seed mix used to reclaim disturbed areas would be certified weed free. The seed mix would be developed by an experienced botanist in coordination with the BLM, Reclamation, and/or NDOW and would be based on seed availability and quality. Reseeding would not be undertaken in areas where soil conditions are inappropriate or where the adjacent undisturbed land surface has little or no vegetation, as determined in coordination with a qualified biologist. Native soil material and organic matter (topsoil) salvaged from the site preparation operations would be reused as a top-dressing on berms and other areas requiring revegetation to the extent practical.
18. A qualified botanist would perform vegetation surveys in the blooming period prior to construction of the transmission line and access roads in T20N R25E, Section 10 for Nevada dune beardtongue (*Penstemon arenarius*) and Lahontan indigo bush (*Psoralea kingii*). If any individuals of these two plants are found they would be avoided or a replanting and restoration plan would be prepared and implemented.

Invasive and Non-native Species

19. The potential to increase the spread of invasive, non-native species would be minimized through the implementation of the Noxious Weed Abatement Plan, included in Appendix E to this EA for project construction, operation, and decommissioning.

Wildlife

20. Vehicles would not travel off designated access roads or out of approved right-of-ways or easements.
21. Willows or roosting habitat would be avoided to the greatest extent feasible. If willows have to be removed, the vegetation would be inspected by a qualified biologist for bats and Nevada viceroy (*Limenitis archippus*) just prior to removal. If a bat or viceroy is found, the habitat would not be removed until the bat or butterfly has left the area.

Migratory Birds

22. The transmission line would be designed to minimize effects to migratory birds and waterfowl within the FWMA, including incorporation of appropriate spacing between lines to make it improbable that the wing span of a large migratory bird can connect two phases.
23. Anti-perch spikes would be installed on the top of cross-arms.
24. Anti-collision devices approved by NDOW would be used on the shield wires and phase conductors along the transmission line segments that are oriented north/northwest at the west end of the line, within the boundaries of the FWMA.
25. Habitat for migratory birds would be eliminated within areas of proposed disturbance prior to the nesting season. In the event this elimination measure is not implemented, if ground disturbing activities do take place during the migratory bird nesting season, migratory bird nest surveys would be conducted early in the nesting season by a qualified biologist acceptable to BLM/Reclamation and/or NDOW. The survey would be conducted to identify either breeding adult birds or nest sites within the specific areas to be disturbed. If active nests are present within these areas to be disturbed, VPC would coordinate with BLM/Reclamation and/or NDOW to develop appropriate protection measures for these sites, which may include avoidance, construction constraints, and/or the establishment of buffers.
26. To minimize impacts to migratory birds and other wildlife through habitat alteration well pads and roads would be recontoured and reseeded following completion of construction. Reseeding would not be undertaken in areas where soil conditions are inappropriate or where the adjacent undisturbed land surface has little or no vegetation, as determined in coordination with a qualified biologist.
27. Topsoil would be salvaged and reused whenever possible and in a timely manner.
28. During drilling, if the reserve pit contains oil-based contaminants (such as from runoff or drilling muds) the pits would be fitted with exclusion devices such as netting or floating balls, in accordance with lease stipulations.

Cultural Resources

29. If any construction or operations activities require disturbance beyond the existing survey boundaries, additional surveys would be completed and any resources found would be avoided or properly mitigated.
30. A thirty meter buffer would be placed around historic properties identified and an archaeological monitor would be on site during the construction of any areas within the 30 meter buffer.
31. If subsurface cultural resources are found during construction, all work in the vicinity of the resource would cease and the BLM, Reclamation, and/or

NDOW environmental personnel would be notified immediately. The appropriate measures as requested by the BLM, Reclamation, NDOW, and/or SHPO to protect the resource would be implemented until it could be adequately evaluated by the permitted archaeologist, and the BLM, Reclamation, and/or NDOW archaeologist, if necessary.

Native American Religious Concerns

32. If human remains are identified during construction of any of the components of the proposed project, work within 300 feet of the discovery would be stopped and the remains would be protected from further exposure or damage. The coroner and Reclamation, NDOW, or SHPO (depending on land ownership) would be contacted. If the remains are determined to be Native American, the agencies would follow the procedures set forth in 43 CFR Part 10, Native American Graves Protection and Repatriation Regulations. Procedures for handling the discovery of human remains would follow Reclamation Manual Directives and Standards LND 07-01 (Inadvertent Discovery of Human Remains on Reclamation Lands) if remains are located on Reclamation-managed lands. If remains are found on private land, NRS 383 would be implemented with SHPO as the lead agency.

Minerals Resources

33. Fill materials would be obtained from the permitted mine located east of Black Butte, in Section 24, T20N, R26E (assigned serial number N-86320) or purchased from commercial sources.

Soils

34. Any suitable topsoil will be stockpiled onsite for later use during restoration. Access roads would follow existing routes to the extent possible. In areas where new access roads must be constructed across slopes, erosion control measures would be installed as necessary, in accordance with Gold Book standards (BLM 2007a).
35. . Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or rip rap, would be installed where necessary immediately after completion of construction activities to avoid erosion and runoff. Only certified weed-free BMPs would be used.
36. Additional gravel would be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation and severe compaction.
37. The NDEP Bureau of Air Pollution Control SAD permit documenting the BMPs to be used would be implemented for the project because the surface disturbed would be greater than 5 acres.
38. Vehicle travel on unpaved roads would be limited to 30 mph.

39. Existing two-track access roads would be used along the transmission route to minimize the amount of new surface disturbance and potential for erosion during construction of the transmission line.
40. Any topsoil stockpiles will be located on previously disturbed areas, such as portions of well pads, and will be situated so that wind and water erosion of the piles are minimized and the reclamation potential of the soil is maintained. Other erosion control measures may include surface seeding and moisture conditioning.

Wastes, Hazardous or Solid

41. Containment berms would be constructed around all hazardous material or potentially hazardous material storage. Off-pad stormwater would be directed away from the well pads.
42. An emergency response plan would be implemented that includes contingencies for hazardous materials spills and disposals.
43. VPC would adhere to general geothermal lease stipulations for geothermal developers to address the potential impacts involved with transport, use, and disposal of hazardous materials, including the development and implementation of an emergency response plan.
44. VPC would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes. Wastes considered hazardous by the State of Nevada would be transported and disposed of according to applicable federal, state, and local regulations.
45. VPC would prepare and implement a hazardous material spill prevention plan to minimize impacts to the environment from hazardous materials.
46. Fueling and routine maintenance of equipment and vehicles would be performed off site or within designated areas with appropriate spill controls to minimize effects.
47. Drilling mud and fluid would be directed to reserve pits. At the conclusion of drilling and testing, the liquid portions of the containment basin contents would be evaporated, pumped back down the well, or removed and disposed of off-site in a facility authorized to receive such wastes. The remaining contents, typically consisting of non-toxic drilling mud and cuttings, would be tested as required by the Nevada Bureau of Water Quality Planning (BWQP). If non-toxic and as authorized by the BWQP, these materials would be spread and dried on the well site, mixed with soil and buried in the on-site reserve pit in conformance with the applicable requirements of the BWQP, Reclamation, and the BLM. Testing results and location of buried waste would be provided to Reclamation and BLM.
48. A blow-out prevention plan and BOPE would be implemented.
49. Operation of the geothermal facilities would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of

hazardous materials and wastes and therefore minimize impacts to the environment.

Air Quality

50. The SAD Air Quality Operating Permit (AP1629-2517), obtained for the project, stipulates that a plan for fugitive dust control must be implemented. The fugitive dust control plan would include dust suppression processes (e.g., watering access roads and well pads) to minimize localized increases in particulate matter concentrations.
51. Dust emissions from venting steam would be reduced by injecting water into the blooie line.
52. Vehicle speeds would be minimized on exposed soils to 10 to 30 miles per hour (mph) to reduce fugitive dust generation from vehicle travel.
53. Diesel generators over 37 kW (50 horse power) shall be diesel-fired units that are certified to meet the US Environmental Protection Agency's (EPA) Tier II Emission Standards and are equipped with an exhaust particulate filter system.
54. H₂S emissions would be minimized through the use of properly weighted drilling mud which is expected to keep the well from flowing during drilling. Data collection devices would be installed and operated during all phases of drilling and testing. An H₂S abatement plan would be developed and implemented during long-term flow-testing if it becomes apparent during drilling operations that H₂S abatement is necessary to minimize potential nuisance odors. Measures to reduce H₂S, if necessary, could include but are not limited to:
 - Reducing the number of wells venting simultaneously, as applicable
 - Implementing additional wellhead abatement measures, such as caustic injection between the flash tank and the portable silencer
 - All drill rigs would be equipped with alarms to detect unsafe levels of NCGs.

Appendix E:
Noxious Weed Abatement Plan

PATUA GEOTHERMAL PROJECT NOXIOUS WEED ABATEMENT PLAN

Prepared for:

**Vulcan Power Company
775 SW Bonnett Way, Suite 210
Bend, Oregon 97702**

Prepared by:

**Joan Reynolds
Botanical Consultant
P.O. Box 3476
Lake City, California 96115**

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Patua Geothermal Project Noxious Weed Abatement Plan

PROJECT SUMMARY

The Patua Geothermal Project is proposed on BOR, State of Nevada, and private lands from approximately 1 mile east of Fernley (proposed transmission corridor) along Alternate Highway 50 and north into the Fernley Wildlife Management Area, to approximately 1 mile west of Hazen, north to the Hot Spring Mountains, and east to Black Butte, Nevada. The project location includes sections and/or portions of sections 4, 8, 16-21, and 28-30, Township 20 North, Range 26 East in Churchill County, and sections and/or portions of sections 10 and 13-16 in Lyon County. Vulcan Power Company is proposing to design, construct, and operate geothermal well pads and wells, geothermal fluid pipelines, transmission lines, and their associated access roads, on lands that are managed by the Bureau of Reclamation (BOR), State of Nevada lands, and private lands. These facilities would be connected to a geothermal power generation facility, capable of producing 60 megawatts (MW) net of electricity, to be located on a privately owned section of land (Section 21, T20N, R26E, MDBM).

INTRODUCTION

The primary focus of this noxious weed abatement plan is to eradicate Nevada State listed noxious weeds on lands proposed for ground disturbance and travel routes, and to prevent the establishment and spread of noxious weeds within the project area pre, post, and during construction. Surveys were completed in spring, summer and fall of 2009 which identified, delineated, and mapped noxious weed infestations throughout the proposed project area (Appendix A Botanical Resources Survey Report, Patua Geothermal Project Churchill and Lyon Counties, Nevada, 11/2009). Appendix B presents 12 maps of the noxious weed infestations for the Patua Geothermal Project Area.

Nevada Noxious Weed Revised State (NRS) states:

"The Inspection and Destruction of Noxious Weeds Section of NRS 555 advises that the control of noxious weeds is the responsibility of every landowner or occupant.

- NRS 555.150 - Every landowner or occupier, whether private, city, county, or federal shall cut, destroy, or eradicate all noxious weeds as required by the state quarantine officer.
- NRS 555.160 - The state quarantine officer shall ascertain the name of the owner or occupant of infested lands. The state quarantine officer may serve notice in writing upon the owner or occupant to cut, destroy, or eradicate the weeds within such a time and in such a manner as described in the notice.
- NRS 555.170 "Should the owner/occupant fail, neglect, or refuse to comply, the state quarantine officer may notify the board of county commissioners for the county in which the property is situated".

The Bureau of Land Management (BLM) defines noxious weed as a plant that interferes with management objectives for a given area of land at a given point in time (BLM 1996). The State of Nevada defines noxious weeds as any species of plant which is, or liable to be, detrimental or destructive and difficult to control or eradicate... (Nevada Revised Statute [NRS] 555.005). The Nevada Department of Agriculture and the BLM Nevada State Office maintain a Nevada Noxious Weed List which was used as a reference for the survey (Appendix C – Nevada Noxious Weed List).

An integrated management approach will often prevent the establishment and spread of noxious weeds, and can be environmentally safe. Weed control by integrated management may include the use of cultural, mechanical, and chemical techniques. Biological controls may not be appropriate for the purposes of this project and will not be addressed.

Cultural control prevents weed invasion and increases the effectiveness of other weed control methods. Examples of good cultural practices include seeding areas devoid of vegetation, proper land management, use of weed-free seed and mulches, and use of machinery and equipment that are not contaminated with weed seeds. Interim seeding of growth medium stockpiles, berms, and other disturbed surfaces with aggressive annual species (e.g., rye, barley wheat) can often be an effective means of controlling the spread of weeds.

Mechanical control methods physically damage or destroy the weed. Mechanical control includes hand pulling, cultivation, mowing, and root plowing. All of these methods involve the use of tools to physically cut off, cover, or remove undesirable plants from the soil. The use of fire is another mechanical method of controlling weeds. Burning can be useful in reducing the number of weed seeds which would fall to the ground if burning is conducted while seeds remain on the plant. Burning will not kill most of the seeds that have already fallen to the ground. Flooding is another method which works best on weeds adapted to dry sites. Use of mechanical control is dependent upon knowledge of the reproductive strategies of the target weed species. For some weed species, mechanical actions create conditions favorable to the plant, or spread plant reproductive parts to new areas.

Chemical control is a technique where herbicides are used for killing or inhibiting plant growth. Herbicides are often necessary in order to reduce the weed population to a level where non-herbicidal methods can be effective. When herbicides are necessary, an integrated pest management approach to weed control will reduce the amount of herbicide needed and discourage haphazard and wasteful herbicide use. Important considerations in a chemical control program are safety to the environment and individuals applying the herbicides, cost to apply, and effectiveness of the material used.

Objectives:

The objectives of noxious weed management are to:

- identify and map noxious weed locations
- delineate, and if necessary, flag the boundaries of the infestations
- control the spread through treatment
- eradicate known infestations
- monitor for new infestations
- maintain control through surveys and treatment, as necessary

NOXIOUS WEED MANAGEMENT

Control of existing noxious weeds on site during construction of and upon completion of the Patua Geothermal Project will be the sole responsibility of Vulcan Power Company, or their successors.

A.) Pre Construction Period

Surveys were conducted to document, GPS and map all locations of noxious weeds. Mapping information and reporting complies with statewide mapping database and reporting protocol requirements (Appendix A). Large infestations of tall whitetop (*Lepidium latifolium*) and saltcedar (*Tamarix ramosissima*) were found occurring within the project limits. Four other noxious weed species were documented during the 2009 survey in small infestations, and include purple loosestrife (*Lythrum salicaria*), water hemlock (*Cicuta maculata* var. *angustifolia*), sowthistle (*Sonchus arvensis*) and Russian knapweed (*Centaurea repens*). The phenology of noxious weeds was documented during the survey to provide the appropriate timing for treatments.

Surveys were completed for existing noxious weeds along the access roads where control measures should be implemented prior to project onset. All noxious weed locations need to be mechanically and/or chemically treated prior to flower or seed set, if possible. All equipment should arrive on the construction site pre-washed and weed-free.

Vulcan Power Company will contract with a licensed weed control company to conduct a weed control program consisting of an herbicide spraying, mowing, and/or mechanical removal. It is anticipated that two spray applications and/or mowing per year will be conducted, late spring and late summer. The applications and/or mowing will be timed to target noxious weeds at the appropriate growth stage or prior to seed set.

The movement of existing and introduction of new noxious weeds may be reduced by conducting inspections for noxious and weedy species at any borrow sources prior to construction. All planned disturbance areas and travel routes will be inspected prior to construction activities for noxious weeds. Other weedy plant species such as cheatgrass (*Bromus tectorum*) or halogeton (*Halogeton glomerata*) should also be noted during the inspections to prevent other types of weed infestations.

Removal of the noxious weeds by mechanical means during seed set will likely increase the number of plants that sprout the following spring and is not recommended. During mechanical removal of weeds that are in fruit/seed, all weedy material will be containerized or covered before transporting and disposing of them to prevent distribution along haul routes.

B.) Construction Period

Vulcan Power Company will implement Best Management Practices (BMP's) to prevent erosion of the job site and the potential transport of weedy material on to or off of the job site during rainfall and storm-water events. Only certified fiber rolls (excelsior or rice straw) will be used for sediment containment. In addition, manufactured erosion control products will be utilized (silt fencing, geotextile fabrics, etc.)

Noxious weed-free staging areas will be selected for project construction. Movement of equipment and soils from areas with known noxious occurrences must be washed with power or high-pressure, cleaning off all mud, dirt, and plant parts, on tires and the under carriage in a designated washing station before proceeding to weed-free areas. Washing stations need to be located adjacent to weed infested areas so that equipment does not spread noxious weed seed or plants/roots during movement to the washing station from the work site. When cleaning equipment, sufficient BMP structures (excluding straw bales) must be used to contain the wash water and soils.

Soils from washing stations and other known noxious weed infested areas need to be disposed of at the nearest landfill or designated disposal areas, and the areas tracked to prevent the spread of noxious weeds to other areas. If noxious weed infested soils are used for fill material, it will be placed at a depth as to not allow for germination of the seeds.

Ground disturbance and vegetation removal will be minimized to the extent possible and practical.

The entrances to the job site will be restricted to vehicles or other traffic that may transport weed seeds or plant material.

All workers will inspect and clean their boots, clothing and tools to prevent weed seeds and/or plant parts from spreading to weed-free sites after working in noxious weed infested areas. Washing stations will also serve as the locations for these purposes. Vulcan Power Company will inform and instruct all on-site workers of the washing and cleaning requirements. All equipment must be thoroughly cleaned when operating in weed-infested areas prior to mobilizing to another location. Vulcan Power Company will provide training to management, workers, and equipment operators on the identification of noxious weeds and the importance of noxious weed control and measures to minimize their spread.

Noxious weed infested areas will be avoided to the greatest degree possible. Top soil or fill will not be salvaged from known noxious weed locations.

Documentation, follow-up monitoring and evaluation of the effectiveness of control/treatment measures will be conducted monthly during the growing season of project implementation to provide current information for all noxious weed and weedy species locations. Monthly reports will be submitted to Vulcan Power Company until such time that all noxious weed infested areas have been identified and mapped, and those areas have been treated or stripped. The weed control program will be continued until such time (for approximately 3 years) the re-vegetation species are established, and are self-maintaining. Weed management and vegetation maintenance, success will continue throughout the life of the project.

Post Construction Period

Upon completion of construction related activities, monitoring will be conducted in all treated sites for weed infestations. Vulcan Power Company will assume responsibility for noxious weed management after project completion.

Disturbed areas slated to be re-vegetated will use soil components and mulches obtained from non-weed infested sources. Seed and other plant materials will be checked and certified noxious weed-free and with a weed count in compliance with State and Federal seed laws.

MONITORING

Monitoring is used to determine if treatments have been effective and to identify new occurrences as soon as possible. Early detection of emerging plants is important for effective follow-up treatment. Most noxious weeds produce seed that will remain viable for three or more years. Some species of *Lepidium* will remain viable for more than 40 years. Therefore, treatment areas should be carefully mapped, monitored and treated as necessary, monthly and bi-annually after project completion. Areas adjacent to treated areas should also be examined for emerging plants that may have established from seeds dispersed before treatment achieved complete control.

Management and workers should become familiar with the noxious weeds present on site and others that have been identified in the vicinity. Early detection provides the opportunity for the most effective treatment. Contractors can conduct informal monitoring during their routine field activities if they are aware of the species that already occur, or are likely to occur, on the site, and report/document them for treatment.

PROPOSED TREATMENT PLAN

The following list of invasive weed species and treatment plans were developed for noxious weed species known to occur within the project area. There may be additional noxious weed species identified in the general area that are not included in the following treatment plans that will need to be addressed on an individual basis. The proposed treatment plan represents potential control treatments. Alternative treatments will be considered with state approved herbicide products and methodologies.

Note: The following herbicides are effective in killing broad-leaf (dichotomous) plants. Caution should be taken for treatment applications near water, desirable native vegetation, and/or revegetation treatment areas.

- 1.) Purple loosestrife (*Lythrum salicaria*)
 - a.) Mechanical Control
In areas where there are few plants and easy access, manually removing the plants is recommended. It is important to dispose of the plants away from the water. Allow the plants to dry out, then burn if possible. Pulling purple loosestrife by hand is easiest when plants are young (up to two years) or in sand. Remove as much of the root system as

possible, as broken roots may sprout new plants. Removing flowering spikes will prevent this year's seeds from producing more plants in future years as each mature plant can produce over 2 million seeds per year. Remove last year's dry seed heads, as they may still contain seeds. Cut the stems at the ground to inhibit growth.

b.) Cultural Control

Purple loosestrife is a showy plant and is often introduced as an ornamental plant in home gardens. Maintaining the native vegetation in riparian areas and ephemeral drainages greatly reduces the potential for the species to establish new infestations, but does not eliminate the potential.

c.) Herbicidal Control

A 2,4-D formulation labeled for use near water applied as a 2% solution (2 gallons 2,4-D per 100 gallons of water) or (2.6 fl. oz./gallon of water) will prevent seedling establishment when applied in early fall or spring before the plants can establish perennial characteristics. Garlon 3A (triclopyr) Garlon is a selective broadleaf herbicide that will not kill cattail or other desirable monocot species. Garlon will provide good to excellent purple loosestrife control when applied in the pre to early flower or late flower growth stages. Garlon should be applied as a 1 to 2% solution (1 to 2 gallons Garlon per 100 gallons of water or 1.3 to 2.6 fl. oz./gallon of water) and will provide some residual seedling control. Garlon can be applied in dryland sites but should not be used in landscapes or flower beds because soil residual of the herbicide may prevent establishment of other horticultural plants.

d.) Implementation

It is important to use only Garlon 3A formulation labeled for use in wetland sites. Minimize overspray to open water. See label for precautions for use near potable water intakes. Treatment should be followed by good management of existing desirable vegetation, and establishing vegetation on denuded areas to reduce the spread. It is recommended to use herbicides at least once annually until the infestation is eliminated.

2.) Saltcedar (*Tamarix ramosissima*)

a.) Mechanical Control

Successful saltcedar control requires killing the root system. Methods include ripping large plants out by the roots with equipment, pulling small plants by the roots using hand labor. Salt cedar produces an extensive root system, including a deep tap root and lateral roots. Cutting the stem results in profuse sprouting of new shoots from the lateral roots, which are supplied with water and nutrients by the taproot. Disking or plowing generally does not prevent the taproot from generating new sprouts. Mechanical control of salt cedar is generally not an accepted practice, unless combined with application of herbicide to the cut stems. When existing saltcedar plants are removed from an area, seedlings must be controlled for at least one year to prevent re-infestation.

b.) Cultural Control

Maintaining the native vegetation in riparian areas and ephemeral drainages greatly reduces the potential for the species to establish new infestations, but does not eliminate the potential. Where the species already exists, it spreads easily into established native vegetation. The pollen-sized seeds are readily transported by wind and water, and grow rapidly in moist soil.

c.) Herbicidal Control

Herbicides or herbicides combined with mechanical treatment have been the most effective methods to control saltcedar. Treatment of newly established or young plants can be accomplished with foliar application of Arsenal (imazapyr) and a surfactant or a combination of Arsenal, Roundup (glyphosate), and a surfactant. Arsenal is registered for use only on non-cropland with restrictions when treated areas are to be grazed. Roundup

is registered for rangelands and Rodeo is a similar product (i.e., active ingredient is glyphosate) that is formulated for aquatic/riparian sites. It is also recommended that treated saltcedar be left undisturbed for at least two growing seasons following application for best results.

Caution: Both imazapyr and glyphosate are non-selective herbicides that will also control non-target species. Therefore, foliar application is likely to impact native species present in the understory or vegetation adjacent to saltcedar. Seeding of adapted perennial species is recommended following eradication of the salt cedar to prevent other noxious weeds from establishing on the site.

Treatment of large shrubs and tree-sized plants is most effective using the stump cut and spray method. The stem of the plant is completely severed near ground level and herbicide is applied immediately (within minutes). Saltcedar is able to begin sealing cut surfaces within one hour. This response prevents movement of the herbicide into the roots and reduces mortality. Triclopyr ester is the most effective herbicide available for the cut stump and spray method. Pathfinder II contains 14 percent triclopyr ester and is designed to be used from the container with no additional mixing required. Garlon also contains triclopyr and can be used at a rate of five percent total spray volume (1.5 pints/gallon). Some sprouting will occur following treatment with the cut stump and spray method. A spring foliar application to young shoots, as described above, should be included as part of the saltcedar treatment, with application conducted during the growing season after treating with the cut stump and spray method.

d.) Implementation

The appropriate herbicidal treatment should be applied to the different age classes of saltcedar. Close proximity to watercourses should employ a mixture of Rodeo and surfactant for young plants. Where salt cedar occurs in a riparian/moist soil area, consideration should be given to seeding with creeping wildrye (*Elymus triticoides*), alkali grass (*Puccinellia distans*), alkali sacaton (*Sporobolus airoides*), or desert saltgrass (*Distichlis spicata*) following control or substantial reduction in population of salt cedar. The species listed are all saline tolerant, a characteristic of saltcedar sites.

3.) Tall whitetop, Perennial pepperweed, (*Lepidium latifolium*)

a.) Mechanical Control

Deep-seated rootstocks make this weed difficult to control. The extensive creeping root system produces an infinite number of new plants when disturbed. Clean cultivation every several weeks until root stocks fail to grow and continual top mowing to reduce plant food storage and to stop seed scatter are mechanical control options. These control methods may not be practical on all sites, and hand cutting of tops of plants followed by herbicide applications may be necessary.

b.) Cultural Control

Tall whitetop grows best in bright, sunny areas. Soils can be fine or coarse, but must be moist for part of the growing season. The weed reaches its maximum growth where soils are irrigated or roots extend into the water table. Tall whitetop spreads slowly into healthy, competing vegetation. Well-stocked stands of perennial grass and tall-growing brush are good competitors, but they cannot prevent the spread of tall whitetop if proper growing conditions exist.

c.) Herbicidal Control

Several different herbicides will kill the aerial portion of tall whitetop plants, but translocation of herbicides to the roots is very limited. The rapid response of the extensive root system to partial control makes it necessary to attain very close to total control in order to suppress this weed. All herbicide treatments require several years to achieve control. Herbicides providing the most consistent control of tall whitetop are Weedar -64, 2-4D, Telar, Plateau, Rodeo, and Escort. Repeat applications for a minimum of three and up to six years may be needed. Telar is used for non-selective control by soil sterilization. Desirable plants can be damaged. Telar can be applied anytime there is moisture from rainfall to wash it into the ground. Repeat applications may be necessary.

d.) Implementation

Treatment of this weed with herbicides is the only viable option because of the repeat treatments required when using mechanical control. Tall whitetop will readily expand along roads and other disturbed sites and will slowly spread into weed free areas. Treatment should be followed by good management of existing desirable vegetation, and establishing vegetation on denuded areas to reduce the spread. It is recommended to use herbicides at least once annually.

4.) Russian knapweed (*Centaurea repens*)

a.) Mechanical Control

Mechanical control is not a recommended treatment unless it is combined with an herbicide treatment and cultural control. Intensive cultivation, followed by planting a competitive crop and a fall application of herbicide may achieve an 85 percent reduction in plant density. Indiscriminate plowing and cultivation will rapidly spread Russian knapweed because the plant has the ability to reproduce from broken root pieces.

b.) Cultural Control

This species is capable of invading landscapes where the precipitation is greater than 15 inches annually. In drier sites, Russian knapweed requires bare ground or disturbance to become established. Therefore, maintaining competitive vegetation within the drier landscapes is recommended.

c.) Herbicidal Control

Several herbicides are available for the control of Russian knapweed, but all require several years of application before eradication can be achieved. Herbicide treatment should be followed by seeding to establish perennial grasses in the void left by the knapweed. Roundup (glyphosate) is effective on monotypic stands of Russian knapweed, but will kill established grasses in non-monotypic stands. Tordon (picloram) is a restricted-use herbicide and requires a licensed applicator. Tordon herbicide will eradicate Russian knapweed applied at the rate one to one and one-half pounds active ingredient per acre. Repeat applications of Tordon are needed to control new growth after initial application. An application of 2,4-D applied at four pounds of active material per acre, repeated spring and fall for several seasons, will reduce Russian knapweed by 85 percent. The usual 2,4-D application rates of up to 2 pounds per acre will have very little effect. Spike can be used on non-crop areas for complete vegetation control.

d.) Implementation

Russian knapweed control depends on: (1) spot eradication with chemicals that will destroy the extensive root system; or (2) reducing stand density by using combinations of cultivation, competing plants, and herbicides. Cultivation may not be applicable or practical for the project area.

5.) Sow thistle (*Sonchus arvensis*)

a.) Mechanical Control

Hand pulling of individuals prior to seed set is suitable for small infestations. Depending on the timing and type, tillage can reduce perennial sowthistle stands. Tillage at the seven to nine leaf rosette stage seems to work best for reducing the reproductive capacity of the roots. Depth of burial and amount of root breakage determine the effectiveness of tillage. Root fragments left on the soil surface die from desiccation, and those buried 30 cm or more are unlikely to resprout. However, roots buried at intermediate depths will produce new shoots.

b.) Cultural Control

Seeding after control with herbicides can prevent re-establishment. Maintaining competitive vegetation within the landscape is recommended.

c.) Herbicidal Control

Herbicide control of perennial sowthistle is better when combined with other control methods because the species is relatively resistant to many common broadleaf herbicides. Most chemical control recommendations for perennial sowthistle are for auxin-type herbicides. Amitrole, dicamba, MCPA amine, and 2,4-D amine have all been recommended for control at various growth stages. Pre-harvest treatments of glyphosate have been successful, but fall applications were generally less effective than auxin-based herbicides. The species has also been shown to be susceptible to atrazine, simazine, bromacil, monuron, and diuron, as well as some sulfonylurea herbicides. Treating sowthistle with herbicides may entail repeated applications for a couple of years.

d.) Implementation

Recommend applying Amitrole or 2,4-D amine during the spring prior to seed set. 2,4-D should not be applied near sensitive crops.

6.) Water hemlock (*Cicuta maculata* var. *angustifolia*)

a.) Mechanical Control

Hand grubbing is a very effective method of removing water hemlock. The roots must be entirely removed because they are attractive to grazing livestock and highly poisonous. This plant is easily removed when the ground is moist. Gather all the plant pieces after removal and burn them. It highly recommended to wear gloves and protective clothing when hand grubbing this toxic plant species.

b.) Cultural Control

Water hemlock grows where water is abundant. Water hemlock is pulled out of the ground very easily in areas where the ground is moist and soft. Controlling the access of grazing animals to habitats where water hemlock grows may reduce the risk of poisoning.

c.) Herbicidal Control

The herbicide tebuthiuron provides pre-emergence control of water hemlock plants, as does chlorsulfuron and a combination of chlorsulfuron and metsulfuron. The pre-emergence photosynthetic inhibitors hexazinone, metribuzin, and terbacil also provide great control of poison hemlock. Post-emergence application of phenoxy herbicides or glyphosate can be effective, with best results when applied in early spring. Treating water hemlock with herbicides may entail repeated applications for a couple of years.

d.) Implementation

For water hemlock, application of chemicals is most effective when done in late spring or early summer. Glyphosate, 2,4-D, and picloram will all provide excellent control of western water hemlock. Apply 2,4-D or MCPA to water hemlock at a rate of 2 lb ae/A in the early bolting stage of growth. Chemical application is an effective means of control, but there is some evidence that the toxicity of the plant increases after spraying until the plant dies. Most animal losses take place in the spring or after the plants were sprayed with chemicals. Therefore, keep animals away from treated plants for 3 weeks after

spraying. Repeat herbicide application until eradication is accomplished.

REFERENCES

Donaldson, Sue. August, 2003. Email Communication. *NWAC Map, Plant Codes, Mapping Data, and Contract Wording*. NWCA, UNR Cooperative Extension.

Environmental Management Association, Report No. 1788-01, 2000. *Noxious Weed Inventory of the Rochester Mine and Access Roads, Pershing County, Nevada*.

Johnson, Stoddard, and Wilson, 2000. *Invasive Plants in Nevada: An Identification Handbook*. University of Nevada Cooperative Extension.

Lym, Rodney. 2004. Identification and Control of Purple Loosestrife. www.ag.ndsu.edu

MN Department of Natural Resources. 2009. Purple Loosestrife Control: What You Can do. www.dnr.state.mn.us/invasives

Pickel, Dave, NRCS. August 27, 2003. Personal Communication. *NRCS Nevada Invasive Plant Geographic Information System*. Natural Resource Conservation Service, Reno, Nevada.

Rafferty, Dawn, August 28, 2002. Email Communication. *Truckee Meadows CWMA Suggested Construction Contract Wording for Weed Prevention*. Nevada Department of Agriculture.

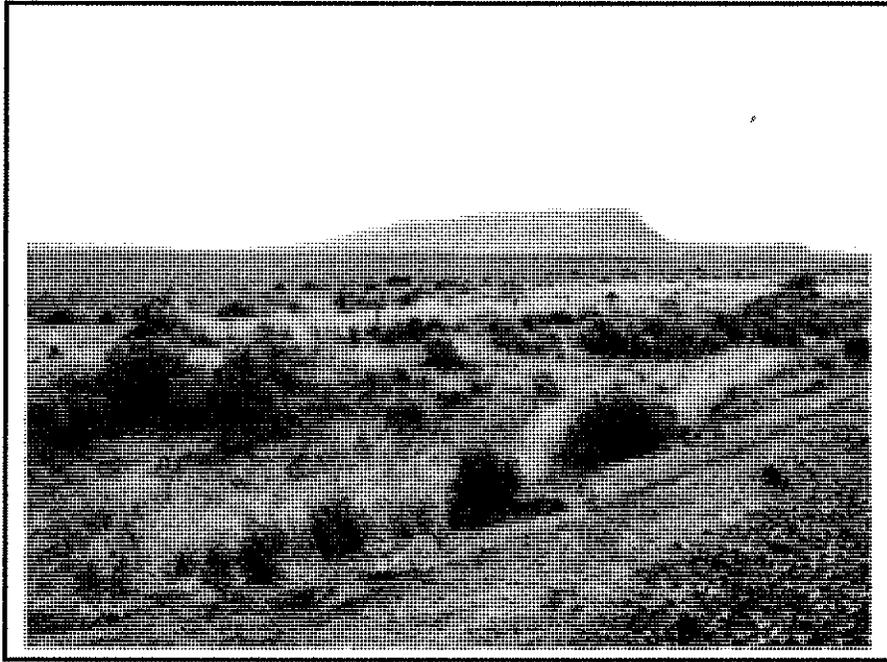
Schmidt, Jane, NRCS, August 27, 2003. Personal Communication. *Weed Prevention BMP 3-03, Prevention of Noxious Weed Population Establishment and Spread*. Natural Resource Conservation Service, Gardnerville, Nevada.

State Noxious Weed Control Board. 2002. Perennial Sowthistle (*Sonchus arvensis*). www.nwcb.wa.gov/weed

UNR Cooperative Extension. 2004. Managing Poison and Western Water Hemlocks. FS-04-09 www.unce.unr.edu

Appendix A

**BOTANICAL RESOURCES SURVEY REPORT
PATUA GEOTHERMAL PROJECT
CHURCHILL AND LYON COUNTIES, NEVADA**



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Figure 3 - Botanical Survey Noxious Weed Occurrences

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Appendix B - USFWS letter

Appendix C - Patua Geothermal Plant Species List

Appendix D - Invasive Plant Survey Forms

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Appendix F - Noxious Weed Occurrence Maps # 1-12

Appendix G - GPS UTM's and Acreages of Noxious Weeds

Appendix H - Photographs - Rare Plants and Noxious Weeds

1. INTRODUCTION

1.1 Project Description

Vulcan Power Company is proposing to design, construct, and operate geothermal well pads and wells, geothermal fluid pipelines, transmission lines, and their associated access roads, on lands that are managed by the Bureau of Reclamation (BOR), State of Nevada lands, and privately owned lands. These facilities would be connected to a geothermal power generation facility, capable of producing 60 megawatts (MW) net of electricity, to be located on a privately owned section of land (Section 21, T20N, R26E, MDBM).

Botanical resources, including threatened, endangered, sensitive and species of concern (TESC) plant species and noxious weed species. Surveys were conducted on approximately 5000 acres of BOR, State of Nevada, and private lands on May 18-22 (Task I), September 12-15 (Task II), and October 23-25 (Task IV), 2009.

The surveys were conducted on the northwestern and western slopes of Hot Springs Mountains to Hazen in Churchill County, in the southern portion of the Fernley Wildlife Management Area, and on lands parallel to State Highway Alt 50 adjacent to the railroad tracks approximately 1.5 miles east of Fernley in Lyon County, Nevada. The surveys were conducted on BOR, State of Nevada, and private lands within the area legally described as sections and/or portions of Sections 4, 8, 16 – 21, 28, 29, and 30, Township 20 North, Range 26 East (T20N, R26E), and portions of Sections 10, 13 - 17, T20N, R25E, Mount Diablo Base and Meridian (Figure 1).

1.2 Environmental Setting

The Patua Geothermal Project Area, located along the western portion of the Hot Spring Mountains and across a southern portion of the Forty Mile Desert, ranges in elevation from approximately 3,600 to 4,800 feet above mean sea level. The Project Area lies within the Lahontan Basin Section of the Great Basin Division of the Intermountain Region. This section of the Great Basin lies in the depression in western Nevada once occupied by Lake Lahontan, with broad, irregular shaped valleys and smaller, less elongated mountain ranges than the typical Basin and Range topography. The mountains are mostly of block-faulted beds of volcanic origin, and the greater part of the area is alluvial flat and playa (Cronquist et al. 1972). Portions of the survey area are in desert lands with little or no vegetation due to the climate and saline conditions. The low altitude and the position in the rain-shadow of the Sierra Nevada created the dry and warm conditions of the area. Within the Project Area, the average temperature in the summer is 91 degrees Fahrenheit and 29 degrees Fahrenheit in the winter. The average annual precipitation for the area in the last 30 years is 5.9 inches. In 2008, the annual precipitation was 3.73 inches, most of which fell from December to May (<http://www.wrcc.dri.edu/summary/Climsmnv.html>).

The vegetation of survey area was comprised of a variety of desert saltshrub plant species in the foothills and playa, with areas of saline playa completely barren and heavily salt-encrusted. Sandy soils and sand dunes were encountered in portions of the survey area on slopes of the uplands and foothills. The wetland habitats, irrigation canals, and

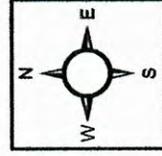
Patua Exploration Project

Botanical Survey

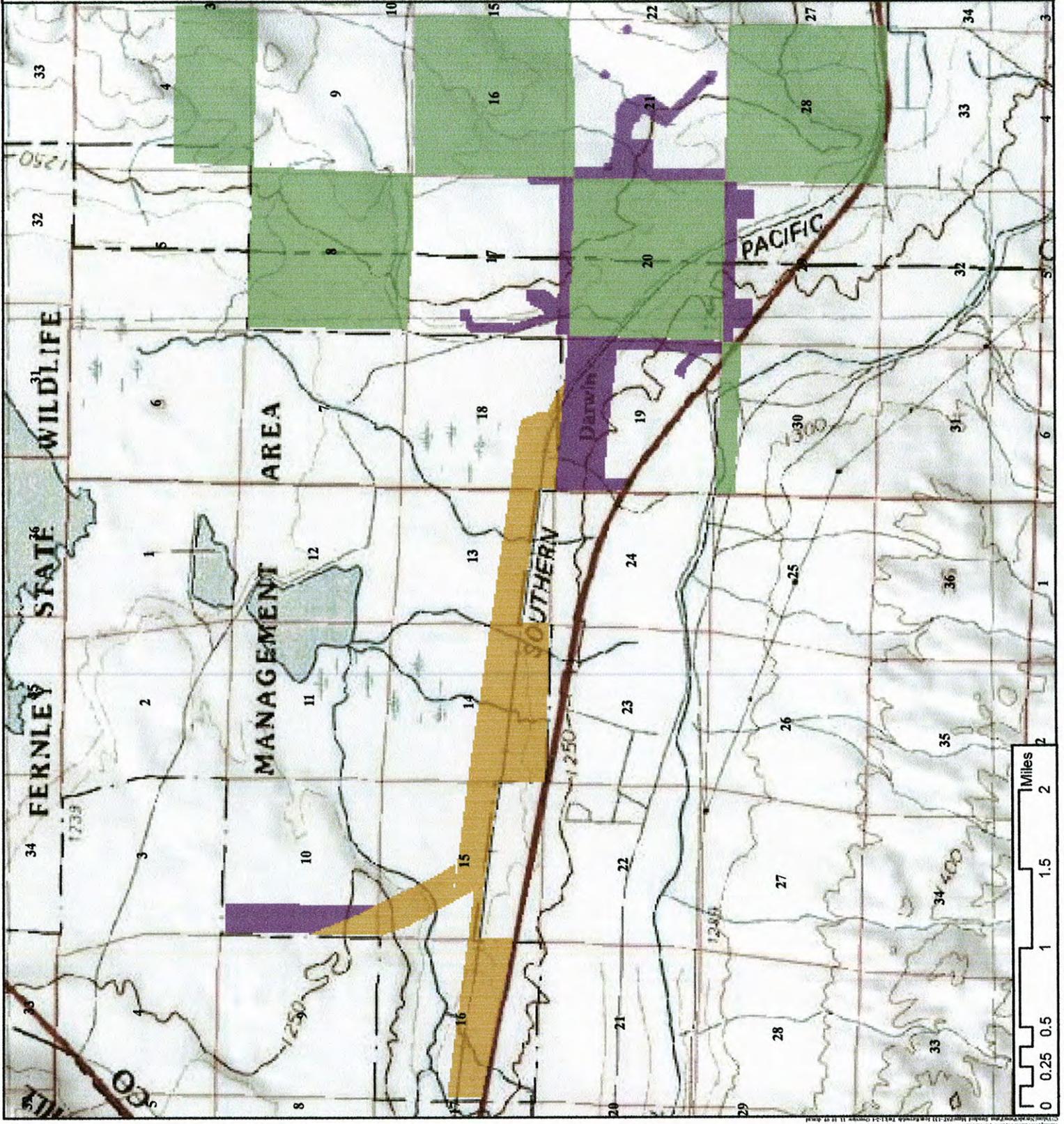
Areas By Task

Figure 1

-  Task I Surveyed 5/18/09 - 5/21/09
-  Task II Surveyed 9/14/09 - 9/16/09
-  Task IV Surveyed 10/23/09 - 10/25/09



1:52,000



Source: USGS 100K Topo:
Two Tips, Eagle Rock
Hazen, Fernley East
11/10/09

drainages were encountered in numerous areas in the northern and western portions of the survey area.

1.3 Purpose and Need

Vulcan Power Company is proposing to conduct geothermal exploration, drilling, and transmission line construction in the Patua Geothermal Project Area. The purpose of the field work was to conduct a botanical resource survey, including TESC plant species and potential habitat, noxious weed species, and other botanical resources that may occur in the area for environmental compliance and permitting requirements under NEPA for the BLM and BOR.

2. BOTANICAL SURVEY METHODS

A database query was conducted with the Nevada Natural Heritage Program (NNHP) prior to performing the field survey. A systematic survey was conducted throughout the Task I portion of the Project Area for two TESC plant species listed by the NNHP database, including Lahontan indigo bush (*Psoralea kingii*) and Nevada dune beardtongue (*Penstemon arenarius*) (Appendix A – NNHP database search results). The US Fish and Wildlife Service (USFWS) database was queried for T&E plant species (Appendix B – USFWS letter). No T&E plant species are known to occur within proximity of the proposed project.

Both of the plant species listed by the NNHP are endemic to sand dune habitats. Areas with sandy soils and sand dunes were encountered during the surveys.

The surveys were conducted by two botanists and two botanical technicians and consisted of walking transects approximately 30 to 50 feet apart in potential habitat areas (intensive survey), and 100 feet apart throughout the remaining areas (intuitive survey). All plant species encountered were identified and compiled into a plant species list (Appendix C).

Locating, identifying and mapping noxious weed species were the primary activities included in the survey methods, with intensive searches conducted in drainages, along roads, and in wetland areas. Numerous and extensive occurrences of two noxious weed species, including tall whitetop (*Lepidium latifolium*) and saltcedar (*Tamarix ramosissima*) were encountered and documented with GPS coordinates for mapping purposes (Figure 3). One occurrence of Russian knapweed (*Centaurea repens*) was encountered on the south side of the Truckee irrigation canal. Scattered individuals of noxious weed species water hemlock (*Cicuta maculata* var. *angustifolia*) and sow thistle (*Sonchus arvensis*) were encountered along wetland and irrigation canals. One occurrence of purple loosestrife (*Lythrum salicaria*) was encountered along the wetland edge of the Fernley Wildlife Management Area. Additionally, other invasive plant species, including scattered individuals of bull thistle (*Cirsium vulgare*), halogeton (*Halogeton glomerata*), cheatgrass (*Bromus tectorum*), and Russian olive (*Elaeagnus angustifolius*), were documented in portions of the survey area. Extensive areas of Russian thistle (*Salsola tragus*) were encountered in loose, sandy soils. All noxious weeds were documented on Invasive Plant Survey Form(s) and mapped, and are included

in Appendix D. As part of the Patua Geothermal Project, a noxious weed abatement plan (Task III) was prepared to reduce the spread of noxious weeds and to treat noxious weeds within the proposed project area.

2.1 TESC Plant Species Habitat Descriptions

Lahontan indigo bush, (*Psoralea kingii*) a state listed species of concern, is known to occur in the lower Humboldt River valley and Carson sink in northwestern Nevada, between Winnemucca and Paradise Valley in Humboldt County, and in the foothills of Hot Spring and Blow Sand Mountains in Churchill County. It is found in sand-flats and hollows in mobile sand dunes. It develops elongating rhizomes, forming populous colonies in extremely localized areas. This shrubby dune plant flowers in June through August, at elevations ranging from 3,800 to 4,800 feet. Although no plant occurrences were noted during the 2009 survey, unoccupied potential habitat was encountered in portions of the project area.

The BLM listed Sensitive plant species, Nevada dune beardtongue (*Penstemon arenarius*), is an endemic to western Nevada. It is known to occur from the vicinity of Tonopah in northwestern Nye and southern Mineral counties, north to the Fallon region in Churchill County, Nevada. It grows in loose, drifting desert sands. It is found in sand dune desert saltshrub plant communities at elevations ranging from 3,600 to 5,500 feet. It flowers from May through June. Although no plant occurrences were noted during the 2009 survey, unoccupied potential habitat was encountered in portions of the project area.

Sandy potential habitat for both plant species was encountered and searched intensively during the May survey (Task I) at the toe of the slopes of the foothills of the Hot Spring Mountains on the east side of sections 8 and the south end of section 4. During the September (Task II) and October (Task IV) surveys, sand dune habitat was encountered along the western portion of section 10. Figure 1 presents a map of the entire project area, and the survey areas by task are highlighted and dated. Due to the late timing of the field surveys for section 10 and other areas surveyed under Tasks II and IV of the Patua Exploration Project, TESC plant species identification was compromised. Field surveys conducted for Tasks II and IV included only mapping potential sand dune habitat for the two TESC plant species identified by the NNHP database (Figure 2 Sand Dune Potential Habitat). If necessary, additional surveys for TESC plant species in areas identified and mapped as potential habitat in section 10 will be conducted in the spring of 2010.

3. BOTANICAL SURVEY RESULTS

3.1 Plant Communities

The vegetation of survey area was comprised of desert saltshrub plant communities in the uplands. The saline playa was comprised of areas completely barren and heavily salt-encrusted. The lowland habitats bordering these barren areas included plant association dominants such as greasewood (*Sarcobates vermiculatus*), Torrey seablite (*Suaeda moquinii*), four-wing saltbush (*Atriplex canescens*) and shadscale *Atriplex confertifolia*). The well drained, dry plains of the Lahontan sediments and residual soils in the foothill elevations were dominated by Bailey's greasewood (*Sarcobates vermiculatus* var.

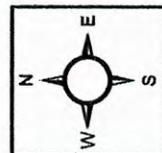
Patua Exploration
Project

Botanical Survey

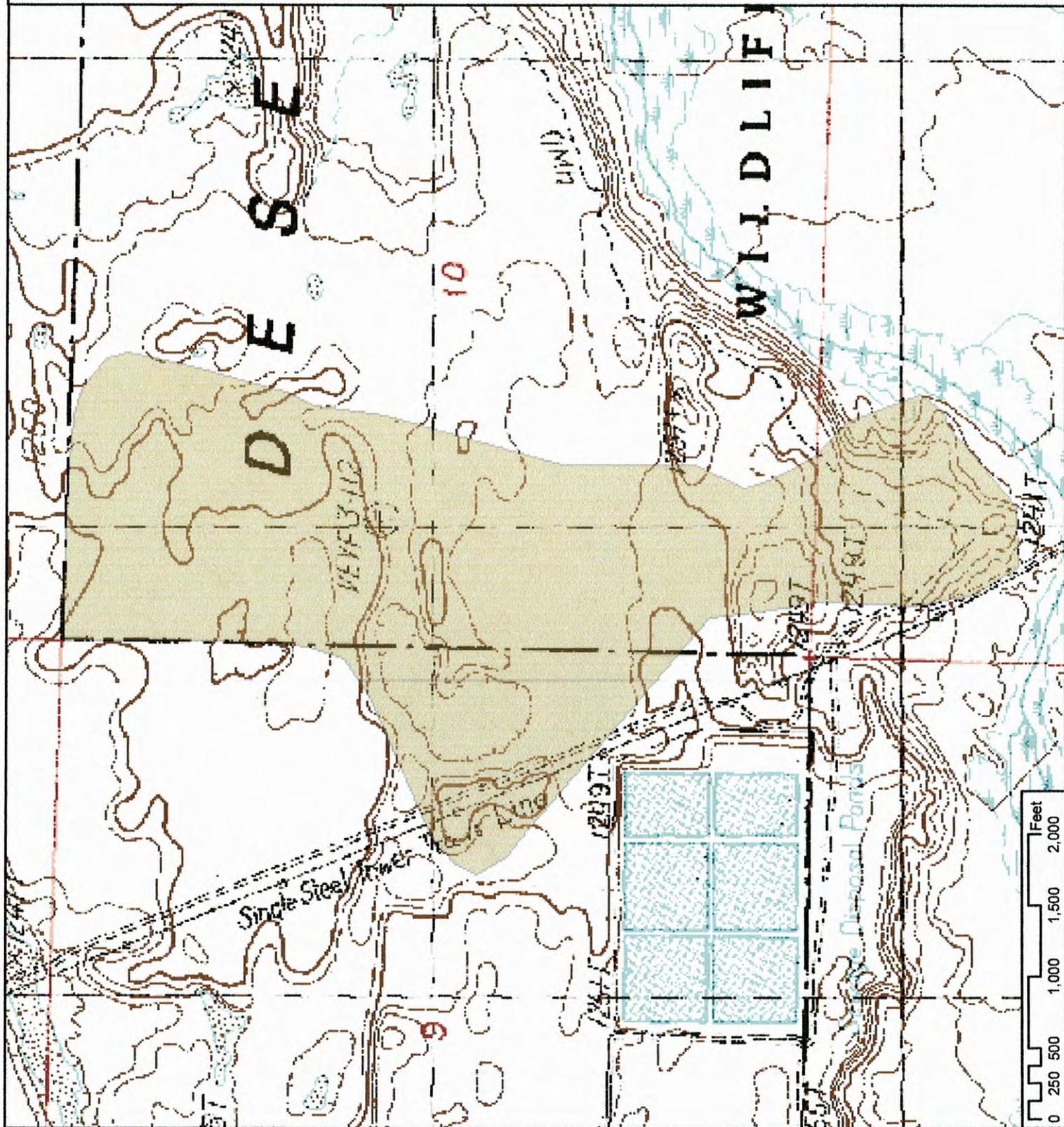
Sand Dune
Potential
Habitat

Figure 2

Sand Dune
Potential
Habitat



1:11,000



Source: USGS 7.5' Quads:
Fernley East
11/10/09

baileyi), shadscale, Nevada ephedra (*Ephedra nevadensis*), budsage (*Artemisia spinescens*), winterfat (*Krascheninnikovia lanata*), and glandular indigo bush (*Psoralea polyadenia*). The sand dunes and sandy soils on the slopes of the foothills were dominated by glandular indigo bush, Bailey's greasewood, four-wing saltbush, spiny horsebrush (*Tetradymia spinosa*), dune horsebrush (*Tetradymia tetrameres*), and green rabbitbrush (*Chrysothamnus viscidiflorus*).

The wetland habitats, irrigation canals, and drainages were comprised of native and weedy plant species, dominated in areas by greasewood, hard stem bullrush (*Scirpus acutus*), common three-square (*Scirpus pungens*), tall whitetop (*Lepidium latifolium*), mugwort (*Artemisia douglasiana*), cattail (*Typha latifolia*, *T. angustifolia*), saltcedar (*Tamarix ramosissima*), saltgrass (*Distichlis spicata*), creeping wildrye (*Leymus triticoides*), and halogeton (*Halogeton glomerata*). Occasional overstory trees encountered in the wet habitats included Fremont cottonwood (*Populus fremontii*), coyote willow (*Salix exigua*), Russian olive (*Elaeagnus angustifolia*), and Chinese elm (*Ulmus parvifolia*).

3.2 TESC Plants

The May survey (Task I) was conducted at the optimum time of year for rare plant species and most native plant species identification in the area. No occurrences of TESC plant species were encountered within the Project Area. Potential habitat for the two rare plant species discussed above was noted and searched for intensively in portions of sections 4 and 8 within the survey area. Potential habitat, including areas of loose sandy soils and mobile dunes for both plant species was encountered during the September and October surveys in the western portion of section 10.

Two plant species no longer tracked by the NNHP were found during the May survey, including Nevada oryctes (*Oryctes nevadensis*) and sand cholla (*Opuntia pulchella*). NNHP Nevada Native Species Site Survey Report forms were filled out for each of these rare plants (Appendix E) and photographs were taken of the plants and sand dune potential habitat (Appendix H). A list of all plant species encountered during the surveys is included in Appendix C.

Very few annual plant species were observed after a year of minimal precipitation in the area for 2008/2009. The average annual precipitation for the area since 1959 was recorded at 5.9 inches. The total precipitation for 2008 was 3.73 inches, and the total recorded precipitation for January through May of 2009 was 0.99 inches (Western Regional Climate Center (WRCC)).

3.3 Noxious Weeds

Six species of Nevada State-listed noxious weeds were encountered within the Patua Geothermal Project Area during the botanical surveys (NRCS website, Nevada Administrative Code, 2003. *Control of insects, pests, and noxious weeds*. State of Nevada.). One of these noxious weed species, tall whitetop, was encountered during the surveys in all of the wetland areas and irrigation canals, frequently found as the dominant ground cover along the fringes of open water and wetland habitats. Scattered individuals

of tall whitetop extended out into the salt flats in numerous areas. The second most commonly encountered noxious weed species, frequently growing as an overstory dominant within the tall white top infestations, was saltcedar. A small (<1/4 acre) occurrence of Russian knapweed, and individual plants of water hemlock and sow thistle were encountered and documented primarily along the Truckee irrigation canal in section 30. Sow thistle was also noted on the southern edge of the wetland within the Fernley Wildlife Management Area in the section 15. One occurrence (~20 plants in a cluster) of purple loosestrife was documented in the northwest portion of the wetland in section 15 of the Fernley Wildlife Management Area.

Approximately 108 acres of tall whitetop were documented and mapped with GPS points (individual plants) and polygons (> 1/4 acre) in the survey area, including portions of areas surveyed for Tasks I, II, and IV. Approximately 70 acres infested with saltcedar were documented and mapped with GPS as clumps of trees (polygons) and as individual trees (points), and included over 4810 trees. Both tall whitetop and saltcedar growing together were documented on approximately 27 acres. Figure 3 presents an overview of all of the noxious weed occurrences documented within the Project Area. Appendix F includes individual Maps #'s 1-12 of the noxious weed occurrences by species and presented by section within the areas surveyed. Russian knapweed, sow thistle, purple loosestrife and water hemlock were documented with GPS as points for small (< 1/4 acre) infestations (Figure 3 Noxious Weed Occurrences). All noxious weed infestations were documented on Invasive Plant Survey Forms (Appendix D) and GPS UTM's were documented (Appendix G).

4. CONCLUSION AND RECOMMENDATIONS

4.1 TESC Plants

Botanical surveys were completed throughout the Patua Geothermal Project Area for Tasks 1, 2, and 4 and no TESC plant occurrences were encountered. Sandy deposits and mobile dune-like potential habitat for Lahontan indigo bush and Nevada dune beardtongue was found and surveyed intensively in portions of sections 4 and 8 of the Hot Spring Mountains. Additional TESC plant surveys are recommended to be conducted in potential habitat areas (Figure 2) documented and mapped in section 10 during the spring of 2010.

4.2 Noxious Weeds

There are extensive areas infested with tall whitetop and saltcedar in the Patua Geothermal Project Area. Additionally, four other noxious weed species were found within the Project Area. All of the noxious weed species identified during the surveys grow in or near wetland and/or riparian habitats.

Tall whitetop is an extremely prolific plant that has spread into thousands of acres of lands in Nevada, especially in habitats adjacent to water sources. It is highly invasive in riparian areas, wetlands, marshes, flood plains, irrigation canals and ditches, roadsides, native hay meadows, alfalfa fields, and rangeland habitats. It vigorously spreads by seed, from perennial roots, and deep-seated underground rhizomes.

Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

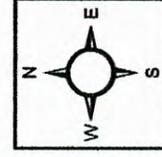
Figure 3

Noxious Species

- Centrep
- Leplat
- Sonary
- Sonary/Cimmac
- Tamram
- Lytsal

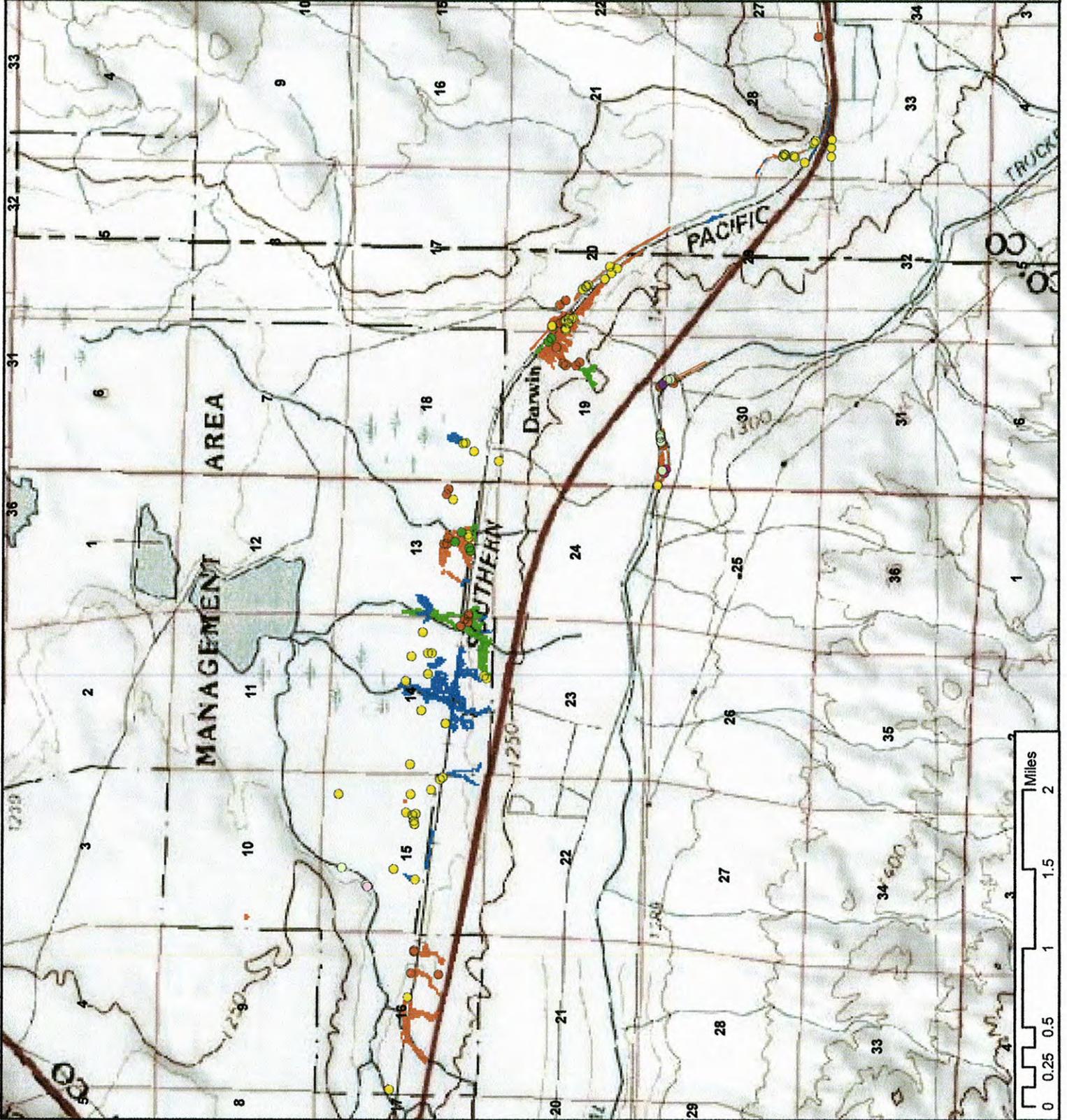
Occurrences

- Leplat
- Leplat/Tamram
- Tamram



1:52,000

Source: USGS 100K Topo:
Two Tips, Eagle Rock
Hazen, Fernley East
11/10/09



Nevada Noxious Weed Law states: “The Inspection and Destruction of Noxious Weeds Section of NRS 555 advises that the control of noxious weeds is the responsibility of every landowner or occupant.”. In order to comply with Nevada Law, it is recommended that all areas infested with noxious weeds (particularly tall whitetop and saltcedar) within existing and proposed travel and transmission routes, well pad sites, and any areas slated for disturbance or vehicular/machinery on and off road travel for the Patua Geothermal Project Area be treated to eradicate the noxious weed species. Additional measures to prevent the spread of noxious weeds onto and off the project site, as well as monitoring for new infestations should be implemented under the direction of the Patua Geothermal Project Noxious Weed Abatement Plan.

5. BOTANY REFERENCES

- Benson, Lyman. 1992. *The Cacti of the United States and Canada*. Stanford University Press. Stanford, California.
- Conquist, A., Holmgren, A., Holmgren, N., Holmgren, P., Reveal, J.L. 1989. *Intermountain Flora, Vascular Plants of the Intermountain West, U.S.A., Volumes I, II part B, III parts A and B, IV, V, and VI*. The New York Botanical Garden, Bronx, New York.
- Hickman, J.C. 1993. *The Jepson Manual*. University of California Press. Berkeley and Los Angeles, California.
- Kartesz, J. T. 1988. *A Flora of Nevada*. UMI Dissertation Service, Ann Arbor, Michigan.
- Morefield, J.D. (ed.).2001. *Nevada Rare Plant Atlas*. Carson City: Nevada Natural Heritage Program.
- Nevada Department of Agriculture. 2009. website <http://agri.nv.gov.nwca/weed> 20% plan. Nevada's Coordinated Invasive Weed Strategy. Nevada Noxious Weed Laws.
- Nevada Natural Heritage Data Base. 2009. Nevada Natural Heritage Program Data Base Search. Carson City, Nevada.
- NRCS website, Nevada Administrative Code. 2003. *Control of insects, pests, and noxious weeds*. State of Nevada.
- Reed C., Rollins. 1993. *The Cruciferae of Continental North America, Systematics of the Mustard Family from the Arctic to Panama*. Stanford University Press. Stanford, California.
- Reveal, J. L. 1997. *A Weekend of Woolly Knees, Jepson Herbarium Workshop*. Polygonaceae subfam. Eriogonoideae north of Mexico. Norton-Brown Herbarium, University of Maryland, College Park, Maryland.
- Reveal, J. L. *Annotated Key to Eriogonum (Polygonaceae) of Nevada*. Department of Botany, University of Maryland, College Park, Maryland.
- USDA Soil Conservation Service. 1984. *Soil Survey of Lyon County Area, Nevada*. *Soil Survey of Churchill County Area, Nevada*.
- Western Regional Climate Center (WRCC). 2009. *Western U.S. Climate Historical Summaries*. <http://www@wrcc@dri.edu>.

INVASIVE PLANT SURVEY

Date: 5/18 - 5/21/09

Recorder's Name: JOAN REYNOLDS

Time:

Phone #: (530) 279-2779

Weed Name (s): Infestation Estimate (area, percent infested, and/or # of plants): PLANTS IN BUD ONLY

LEPIDIUM LATIFOLIUM - ~20 ACRES ALONG DITCHES AND ADJACENT AREAS, >10,000 PLANTS
TAMARIX RAMOSISSIMA - SCATTERED ALONG DITCHES VEGETATIVE - NO FLOWERS

Control Methods (what was used and at what rate):

UNKNOWN - BUREAU OF RECLAMATION & PRIVATE LANDS
NO EVIDENCE OF CONTROL METHODS APPARENT.

Land Use (roadside, pasture, range, crop, facility, residence, landscape, etc.):

RXR ADJACENT TO PORTIONS OF INFESTATION
PASTURE, ROADSIDE, AND RANGELANDS, GEOTHERMAL DEVELOPMENT

Location: HAZEN, NV

Township: 20 N Range: 25 E Section(s): 10, 13, 14, 15, 16

County: CHURCHILL, LYON State: NEVADA

Latitude: Longitude:

UTM: NAD 83 ZONE 11

Check if GPS: [X] SEE MAPS AND EXCEL SPREADSHEET

Other Notes (site flagged or marked, descriptive location, etc...)

PATUA GEOTHERMAL EXPLORATION PROTECT AREA - NO INFESTATIONS WERE FLAGGED EB. EXTENSIVE INFESTATIONS OCCURRED PRIMARILY IN SEASONALLY MOIST AREAS AND/OR ADJACENT TO WETLANDS/WARDS.

INVASIVE PLANT SURVEY

Date: 5/19 - 5/20/09
AND 9/15/09

Recorder's Name: JOAN REYNOLDS

Time:

Phone #: (530) 279-2779

Weed Name (s):

Infestation Estimate (area, percent infested, and/or # of plants):

SONCHUS ARVENSIS - SCATTERED INDIVIDUALS ALONG BANKS OF (PLANTS IN FRUIT)
TRUCKEE IRRIGATION CANAL 750 PLANTS AND ON EDGE OF (PLANTS IN SEED)
WETLAND IN FERNLEY WILDLIFE MANAGEMENT AREA (FWMA) ~ 20 PLANTS

Control Methods (what was used and at what rate):

UNKNOWN - IN SECTIONS 19 & 30, WEEDS UNDER MANAGE OF TRUCKEE CARSON
IRRIGATION DISTRICT. NO KNOWN ABATEMENT FOR SECTION 15 OF FWMA.

Land Use (roadside, pasture, range, crop, facility, residence, landscape, etc.):

AGRICULTURAL IRRIGATION CANAL & WILDLIFE MANAGEMENT AREA

Location: APPROXIMATE: 13.5 MILES (1 OCCURRENCE) AND 5.5 MILES (1 OCCURRENCE)
E OF FERNLEY.

Township: 20 N Range: 25 E Section(s): SW 1/4 OF NW 1/4 SECT 15 AND SOUTHERN 1/2
OF SECTION 19

County: LYON State: NEVADA

Latitude: _____ Longitude: _____

UTM: NAD 83 ZONE 11

Check if GPS: 0314274 4386204, 0314106 4385959 - SECT. 15

Other Notes (site flagged or marked, descriptive location, etc...)

SEE MAP. PLANTS FOUND SCATTERED ALONG BANKS OF TRUCKEE
CANAL, AND WIDELY SCATTERED ALONG SOUTH EDGE OF
WETLAND IN SECT. 15 OF FWMA. NO INFESTATIONS WERE FLAGGED.

INVASIVE PLANT SURVEY

Date: 5/20/09

Recorder's Name: JOAN REYNOLDS

Time:

Phone #: (530) 279-3779

Weed Name (s):

Infestation Estimate (area, percent infested, and/or # of plants):

CENTAUREA REPENS
RUSSIAN KNAPWEED

~ 50 FT X 40 FT AREA, 7500 PLANTS - ALL PLANTS IN
BUD & FLOWER

Control Methods (what was used and at what rate):

UNKNOWN - UNDER MANAGEMENT OF TRUCKEE CARSON IRRIGATION DISTRICT

Land Use (roadside, pasture, range, crop, facility, residence, landscape, etc.):

ROADSIDE AND SOUTH OUTSIDE SLOPE OF TRUCKEE CANAL

Location: IN BETWEEN ROAD AND IRRIGATION DITCH

Township: 20N Range: 26E Section(s): NW1/4 OF NW1/4 SECTION 30

County: LYON State: NEVADA

Latitude: Longitude:

UTM: NAD 83, Zone 11

Check if GPS: [X] 0318323 S / 0318283 S
4382931 E / 4382951 E

Other Notes (site flagged or marked, descriptive location, etc...)

SEE MAP - PLANTS FOUND ON SOUTH SIDE OF TRUCKEE CANAL
BERM - OUTSIDE OF ACTUAL WATER WAY. NO
INFESTATIONS WERE FLAGGED. PLANT OCCURRENCE APPEARS
TO BE INCREASING. IDENTIFIED ALL PLANTS FOUND
ON S. SLOPE.

INVASIVE PLANT SURVEY

Date: 8/13/09

Recorder's Name: Joan Reynolds

Time:

Phone #: (530) 279-2449

Weed Name (s): Cicuta maculata var. angustifolia - widely scattered banks of Truckee Irrigation Canal. Plants in seed - 5 plants noted

Infestation Estimate (area, percent infested, and/or # of plants):

Control Methods (what was used and at what rate): UNKNOWN - UNDER MANAGEMENT OF TRUCKEE CARSON IRRIGATION DISTRICT KNOWN TO USE BOTH HERBICIDES & MECHANICAL METHODS.

Land Use (roadside, pasture, range, crop, facility, residence, landscape, etc.): PLANTS GROWING ON BANKS OF TRUCKEE IRRIGATION CANAL.

Location: APPROXIMATELY 5.5 MILES EAST OF FERNEY ALONG TRUCKEE CANAL

Township: 20N Range: 26E Section(s): SW 1/4 OF SE 1/4 SECT. 19

County: LYON State: NV

Latitude: Longitude:

UTM: NAD 83 ZONE 11

Check if GPS: [X] 0319186 - 4382970

Other Notes (site flagged or marked, descriptive location, etc...)

SEE MAP. NO INFESTATIONS WERE FLAGGED. PLANTS GROWING ALONG BANKS ADJACENT TO THE TRUCKEE CANAL.

INVASIVE PLANT SURVEY

Date: 9/15/09 - 9/15/09

Recorder's Name: JOAN REYNOLDS

Time: 2:30 PM

Phone #: (530) 279-2779

Weed Name(s): **Infestation Estimate (area, percent infested, and/or # of plants):**
LYTHRUM SALICARIA - 5 FT X 3 FT IN 20 PLANTS - GROWING IN WOODS
IN FULL BLOOM ABOUT 6 FT TALL. GROWING WITH TYPH, LEP LAT,
SCIRPUS ACUTUS, CIRSIUM VULGARE

Control Methods (what was used and at what rate):
NONE - IN FERNLEY WILDLIFE MANAGEMENT AREA

Land Use (roadside, pasture, range, crop, facility, residence, landscape, etc.):
WILDLIFE - MIGRATORY BIRD - MANAGEMENT AREA, FERNLEY

Location:

Township: 20N Range: 25E Section(s): SE 1/4 OF NW 1/4 SECTION 15

County: LYON State: NEVADA

Latitude: Longitude:

UTM: NAD 83 ZONE 11

Check if GPS: 0314082 4385946

Other Notes (site flagged or marked, descriptive location, etc...)

DRAW THE BOUNDARIES ENCOUNTERED, APPROXIMATELY 300 FT
EAST TO POWERLINE CROSS ROAD. SEE MAP. NO INFESTIONS
WERE FLAGGED.

INVASIVE PLANT SURVEY

Date: 10/23/09 - 10/25/09

Recorder's Name: JOAN REINHOLD

Time: 11:00 AM

Phone #: 530 279-2779

Weed Name (s):

Infestation Estimate (area, percent infested, and/or # of plants):

1) TAMARIX RAMPIDISSIMA - TARA - SCATTERED INDIVIDUALS - VEGETATIVE.

2) LEPIDIUM LATIFOLIUM - TALL WHITETOP IN DRAINAGES LOW & SPREADING ONTO
BELLA ROAD SIDES AND ADJACENT LANDSCAPE, PLANTS IN SEED.

Control Methods (what was used and at what rate):

NONE KNOWN - BOR & PRIVATE LANDS

Land Use (roadside, pasture, range, crop, facility, residence, landscape, etc.):

RXR LINE, ROADSIDE, ~~SUBDIVISION~~ DEVELOPMENT

Location: DAWSON, NV TO HAZEN

Township: 20N Range: 26E Section(s): 17, 18, 19, 20, 28 & 30

County: WYON/CORCORAN State: NV

Latitude: _____ Longitude: _____

UTM: NAD 83 - SEE ATTACHED EXCEL FILES - MULTIPLE SHEETS

Check if GPS: SEE EXCEL SPREAD SHEET AND MAPS

Other Notes (site flagged or marked, descriptive location, etc...)

INFESTATIONS WERE NOT FLAGGED. THE INFESTATION AREAS WERE FREQUENTLY
IN SEASONAL MOIST AREAS AND/OR ADJACENT TO WATER BODIES.

| Name | Count | Northing | Easting |
|---------------|--------------|------------------|------------------|
| Cenrep | | 4382951 | 318283 |
| Cenrep | | 4382931 | 318323 |
| Tamram | | 4383017.54588052 | 318160.350925859 |
| Sonarv | | 4382970.19758358 | 318310.183996813 |
| Sonarv | | 4382985.22051522 | 318642.8502314 |
| Sonarv | | 4382986.57897195 | 318660.604610471 |
| Sonarv | | 4382988.41984297 | 318673.670383412 |
| Leplat | | 4382961.87306189 | 318564.510490314 |
| Leplat | | 4382973.57968854 | 318590.23609504 |
| Sonarv | | 4382980.14199181 | 318603.702965927 |
| Leplat | | 4382981.79591386 | 318623.011818933 |
| Leplat | 3 | 4382992.37155145 | 319160.158273811 |
| Leplat | 2 | 4382987.0798742 | 319169.154125136 |
| Sonarv/Cicmac | 11, 2 | 4382970.146507 | 319186.616660062 |
| Leplat | 7 | 4382948.979798 | 319205.666698162 |
| Leplat | 10 | 4382936.80894032 | 319214.662549487 |
| Leplat | 3 | 4382926.75475355 | 319219.954226737 |
| Leplat | 5 | 4382921.4630763 | 319223.129233087 |
| Sonarv | 3 | 4382914.05472815 | 319227.362574887 |
| Sonarv | | 4382888.65467735 | 319239.004264837 |
| Leplat | | 4382870.6629747 | 319221.012562187 |
| Leplat | | 4382854.25877522 | 319197.729182287 |
| Tamram | | 4383488.40096002 | 320312.706604011 |
| Tamram | | 4383429.64972957 | 320357.546057776 |
| Tamram | | 4383557.23185362 | 320252.049379027 |
| Tamram | | 4383893.48559676 | 319847.607532813 |
| Tamram | | 4383925.96078471 | 319807.249342586 |
| Tamram | 5 | 4383921.27423072 | 319852.294657956 |
| Tamram | 2 | 4383875.9583143 | 319858.468925083 |
| Tamram | 5 | 4383949.11706983 | 319752.285926458 |
| Tamram | | 4383952.63223248 | 319739.569099293 |
| Tamram | | 4381435.83519326 | 321632.477884034 |
| Tamram | | 4381417.9673303 | 321650.345746993 |
| Tamram | | 4381530.46868967 | 321437.916709593 |
| Tamram | | 4381628.41104959 | 321490.196753065 |
| Tamram | | 4381643.63182174 | 321504.093979811 |
| Tamram | | 4381723.044546 | 321510.711706833 |
| Tamram | | 4381731.64759113 | 321514.020570344 |
| Tamram | | 4381742.23595437 | 321519.976524663 |
| Tamram | | 4381754.80963571 | 321498.138025492 |
| Tamram | 2 | 4381258.5999871 | 321494.528460744 |
| Tamram | | 4381257.96293744 | 321590.722958795 |
| Tamram | | 4381254.14063951 | 321669.398591306 |
| Leplat | | 4381390.50231914 | 322712.535735813 |
| Opupui | 1 clump | 4387092.77903014 | 321262.696865802 |
| Opupui | 4 clumps | 4387084.43368092 | 321156.98910907 |
| Opupui | 2 clumps | 4387076.08833171 | 321123.885890515 |
| Orynev | | 4388251.17515102 | 321836.5766502 |

| | | |
|--------|------------------|------------------|
| Tamram | 4383500.69559011 | 320379.027647136 |
| Tamram | 4383721.26635357 | 320196.054172902 |
| Tamram | 4383745.82991586 | 320174.498393746 |
| Tamram | 4383739.3130524 | 320182.017851591 |
| Tamram | 4383777.41163881 | 320145.924453934 |
| Tamram | 4384092.23532262 | 319776.209739956 |
| Leplat | 4384014 | 319991 |
| Leplat | 4383953 | 320035 |

| Id | Name | Count | Acres |
|-----------|---------------|--------------|--------------|
| 0 | Leplat | | 1.4842 |
| 0 | Leplat | | 0.5531 |
| 0 | Leplat | | 2.5423 |
| 0 | Leplat | | 0.0279 |
| 0 | Leplat | | 10.1550 |
| 0 | Leplat | | 4.4759 |
| 0 | Leplat | | 0.1563 |
| 0 | Tamram | 20 | 0.1666 |
| 0 | Leplat | | 0.1652 |
| 0 | Leplat | | 1.1938 |
| 0 | Tamram | 10 | 0.0845 |
| 0 | Leplat | | 0.1183 |
| 0 | Leplat/Tamram | | 0.1740 |
| 0 | Tamram | 60 | 0.3495 |
| 0 | Leplat | 500 | 0.0804 |
| 0 | Tamram | 300 | 0.6360 |
| 0 | Leplat | 800 | 0.0473 |
| 0 | Tamram | 30 | 0.1696 |
| 0 | Tamram | | 0.0432 |
| 0 | Tamram | | 0.0181 |
| 0 | Tamram | | 0.0243 |
| 0 | Leplat | | 0.3208 |
| 0 | Leplat | | 0.0981 |
| 0 | Leplat | | 17.8844 |
| 0 | Leplat/Tamram | | 4.6974 |
| 0 | Leplat | | 6.6556 |
| 0 | Leplat | | 0.2039 |
| 0 | Leplat | | 0.1541 |
| 0 | Leplat | | 0.2856 |
| 0 | Leplat | | 0.2581 |

| Species | Count | Acres | Task Number | Easting Centroid | Northing Centroid |
|------------------------------|-------|------------------|-------------|------------------|-------------------|
| Leplat | | 0.092285 | 2 | 312026 | 4385752 |
| Leplat | | 9.661045 | 2 | 312629 | 4385450 |
| Leplat | | 2.54613 | 2 | 313131 | 4385362 |
| Leplat | 300 | 3.025856 | 2 | 313372 | 4385294 |
| Leplat | | 2.766109 | 2 | 312744 | 4385574 |
| Tamram | 28 | 0.940795 | 2 | 314436 | 4385324 |
| Tamram | 260 | 2.170561 | 2 | 315213 | 4384959 |
| Tamram | 10 | 0.153097 | 2 | 314721 | 4385496 |
| Leplat | 30 | 0.106929 | 2 | 314935 | 4385577 |
| Tamram | 6 | 0.124397 | 2 | 314157 | 4385536 |
| Tamram | 375 | 7.76197 | 2 | 315832 | 4384997 |
| Tamram | 1250+ | 14.413383 | 2 | 316069 | 4385296 |
| Tamram | | 1.640313 | 2 | 316327 | 4385259 |
| Tamram | 380 | 5.651266 | 2 | 316260 | 4384989 |
| Leplat/Tamram | | 9.812494 | 2 | 316471 | 4384803 |
| Leplat/Tamram | | 7.048112 | 2 | 316811 | 4385267 |
| Leplat/Tamram | | 4.239393 | 2 | 316787 | 4384878 |
| Tamram | 450 | 4.3646 | 2 | 316912 | 4385375 |
| Tamram | 120 | 0.372809 | 2 | 316646 | 4384732 |
| Tamram | | 0.293174 | 2 | 316790 | 4384782 |
| Tamram | | 0.563033 | 2 | 317155 | 4384973 |
| Leplat | | 1.053972 | 2 | 317215 | 4385107 |
| Leplat | | 2.416665 | 2 | 317413 | 4385188 |
| Leplat/Tamram | 11 | 0.766356 | 2 | 317668 | 4384883 |
| Leplat | | 10.154706 | 2 | 317537 | 4384982 |
| Tamram | 30 | 2.228146 | 2 | 318611 | 4385072 |
| Total Task II Acreage | | 94.367596 | | | |

| Species | Count | Acres | Task Number | Easting Centroid | Northing Centroid |
|------------------------------|-------|-----------------|-------------|------------------|-------------------|
| Leplat | | 0.279091 | 4 | 313753 | 4387173 |
| Tamram | 71 | 0.536488 | 4 | 320845 | 4382454 |
| Leplat/Tamram | 100 | 0.346973 | 4 | 319507 | 4384220 |
| Leplat | | 0.749162 | 4 | 319474 | 4384085 |
| Leplat | | 1.500797 | 4 | 319411 | 4384123 |
| Total Task IV Acreage | | 3.412511 | | | |

Appendix B

Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

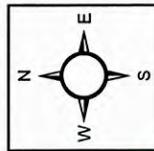
Map 1

Noxious Species

- Centrep
- Leplat
- Sonarv
- Sonarv/Cicmac
- Tamram

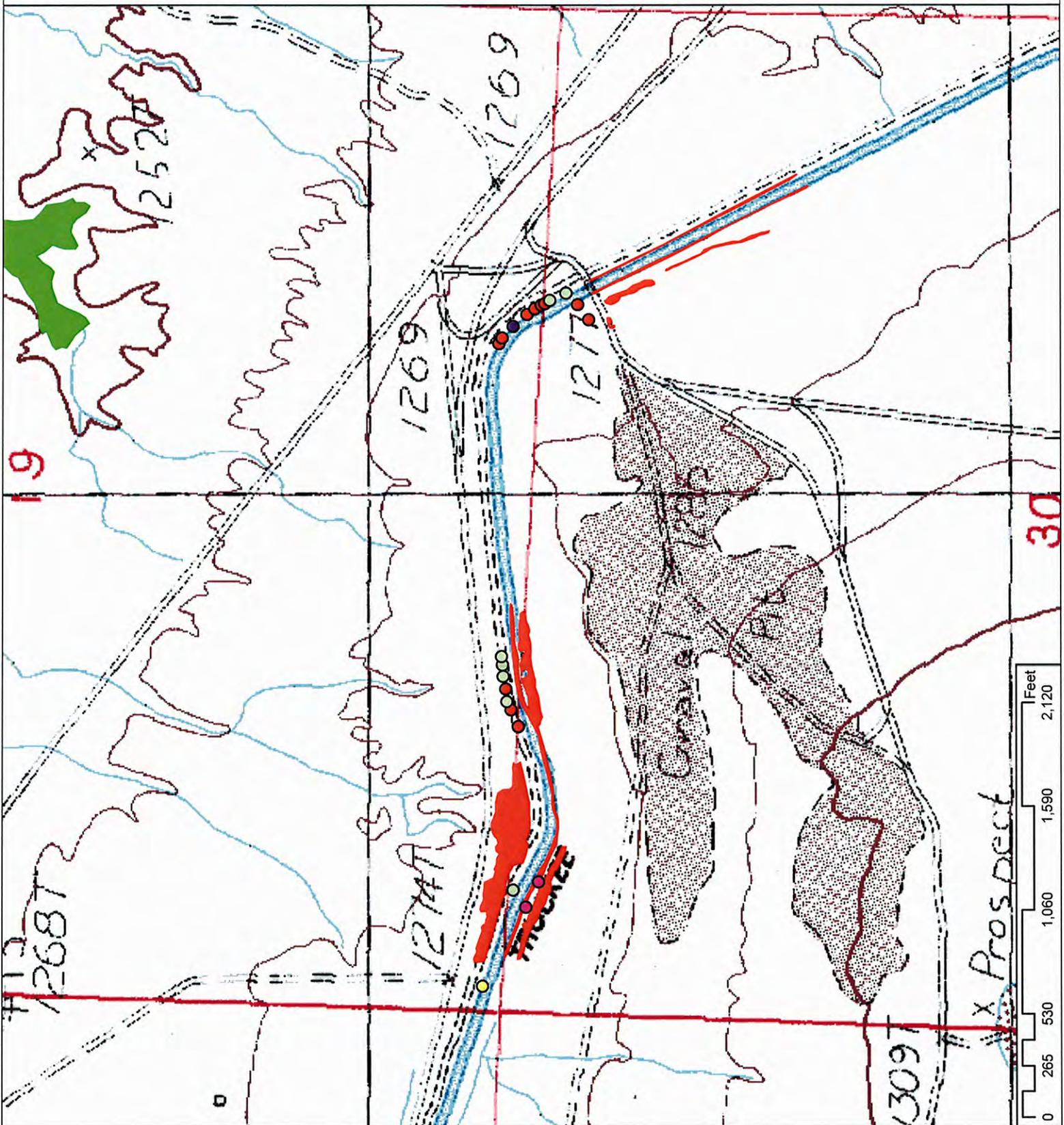
Occurrences

- Leplat
- Leplat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Hazen, Eagle Rock
7/4/2009



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

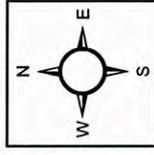
Map 2

Noxious Species

- Cenrep
- Leplat
- Sonarv
- Sonarv/Cicmac
- Tamram

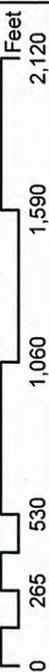
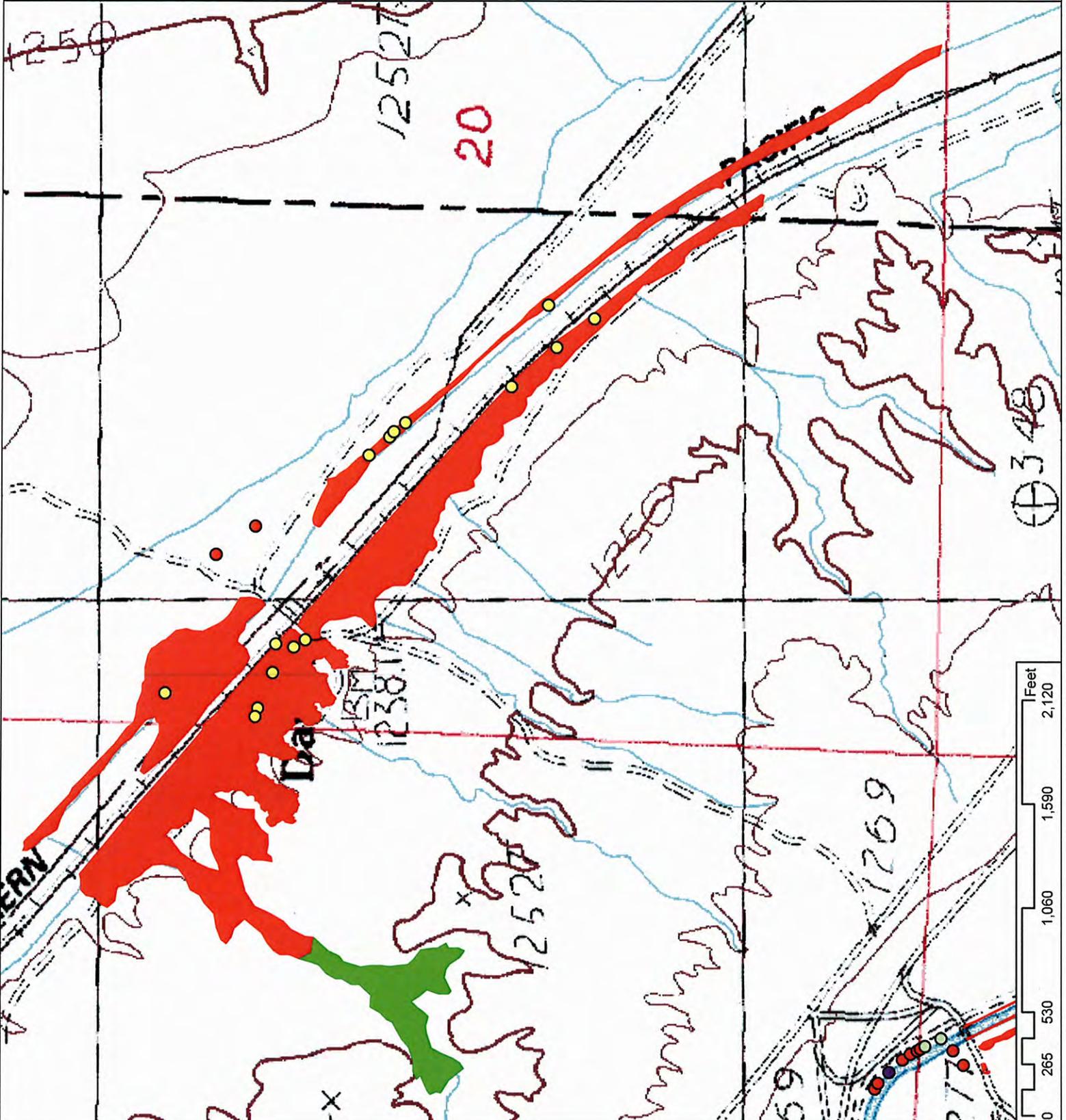
Occurrences

- Leplat
- Leplat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Hazen, Eagle Rock
7/4/2009



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

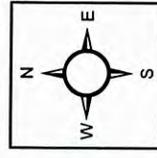
Map 3

Noxious Species

- Centrep
- Leplat
- Sonarv
- Sonarv/Cicmac
- Tamram

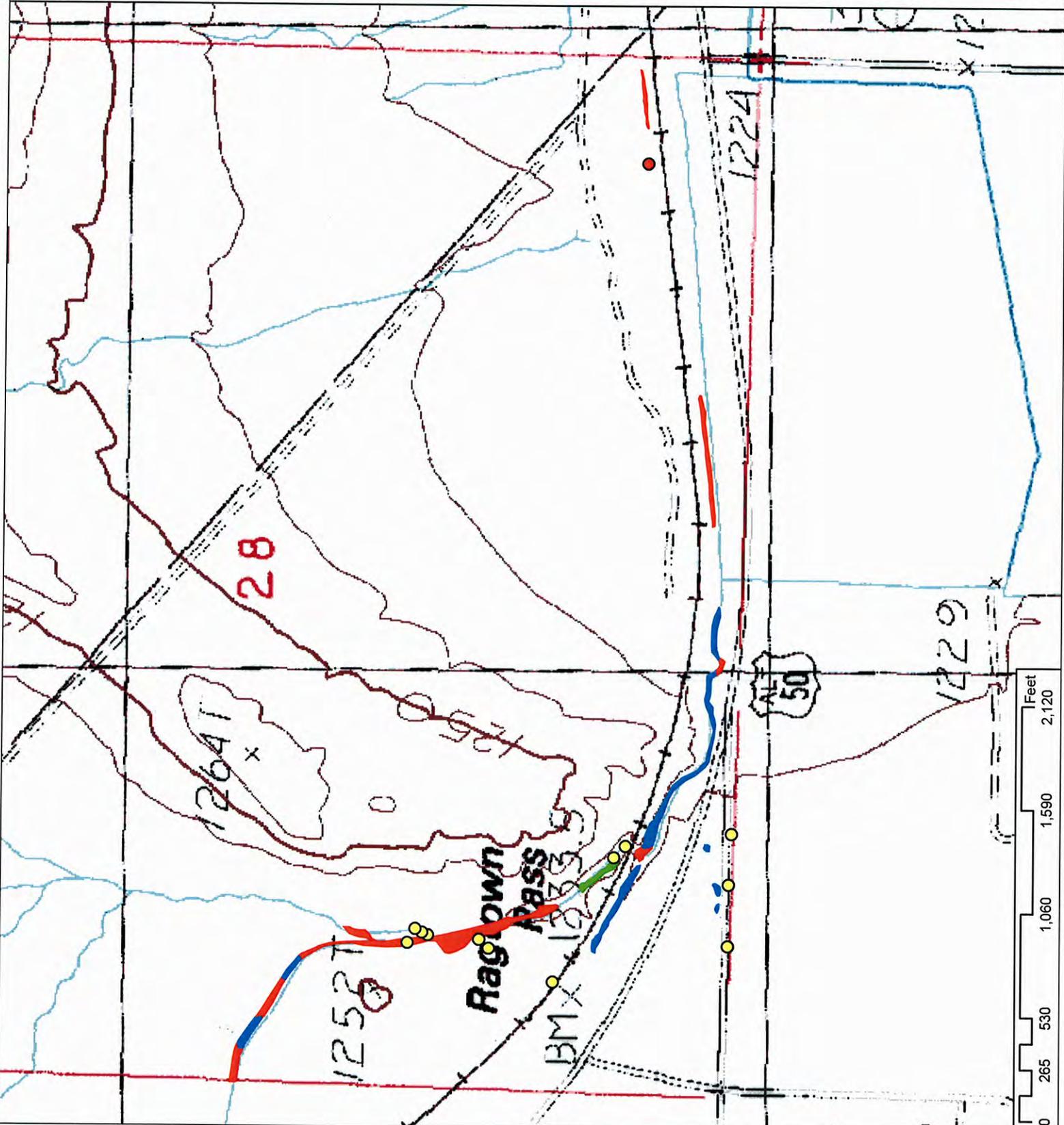
Occurrences

- Leplat
- Leplat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Hazen, Eagle Rock
7/4/2009



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

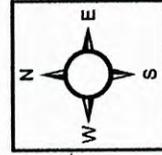
Map 4

Noxious Species

- Leplat
- Sonary
- Tamram
- Lytsal

Occurrences

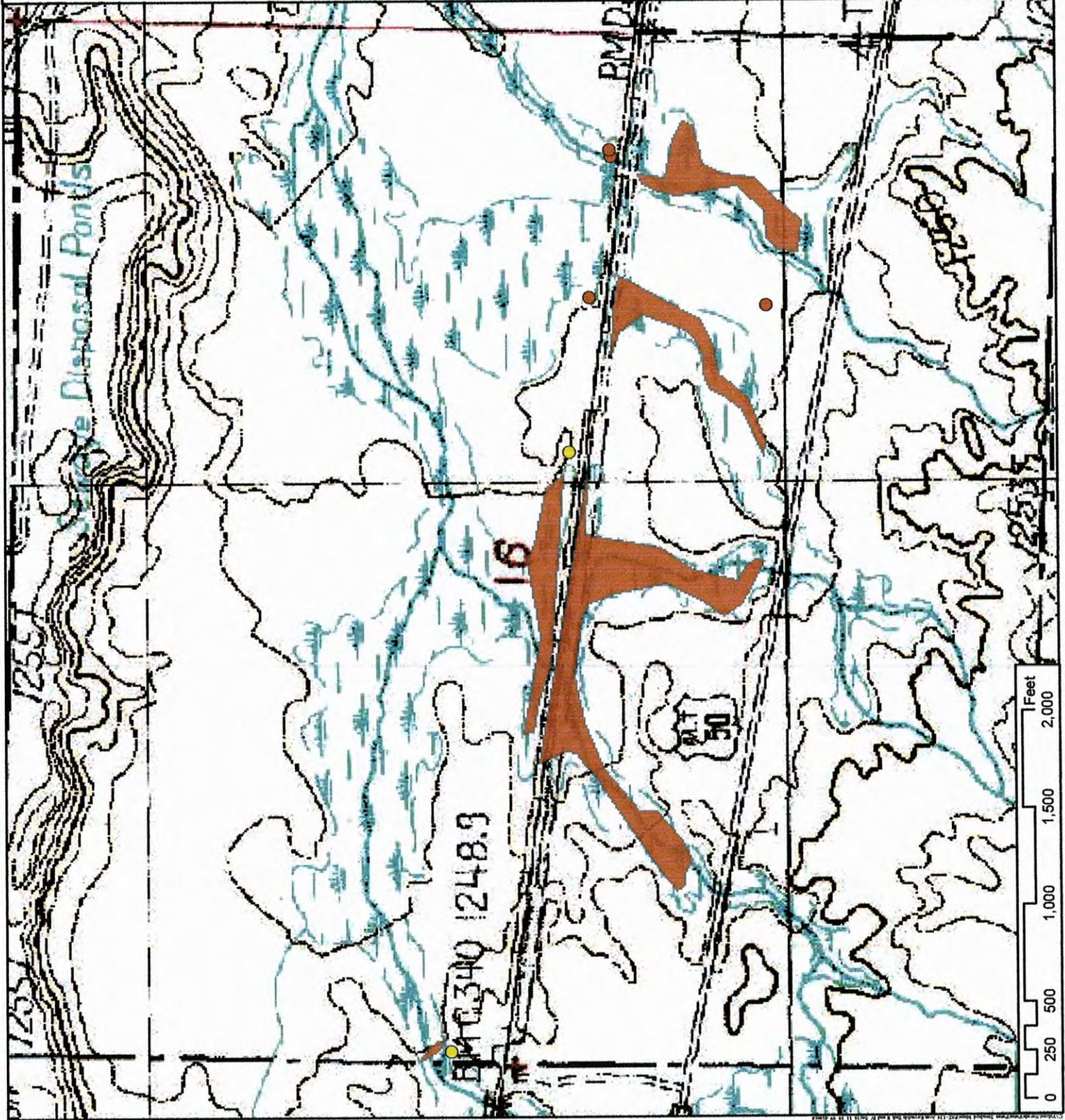
- Leplat
- Leplat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Fernley East
11/10/09

PAT-134



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

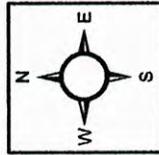
Map 5

Noxious Species

- Leplat
- Sonarv
- Tamram
- Lytsal

Occurrences

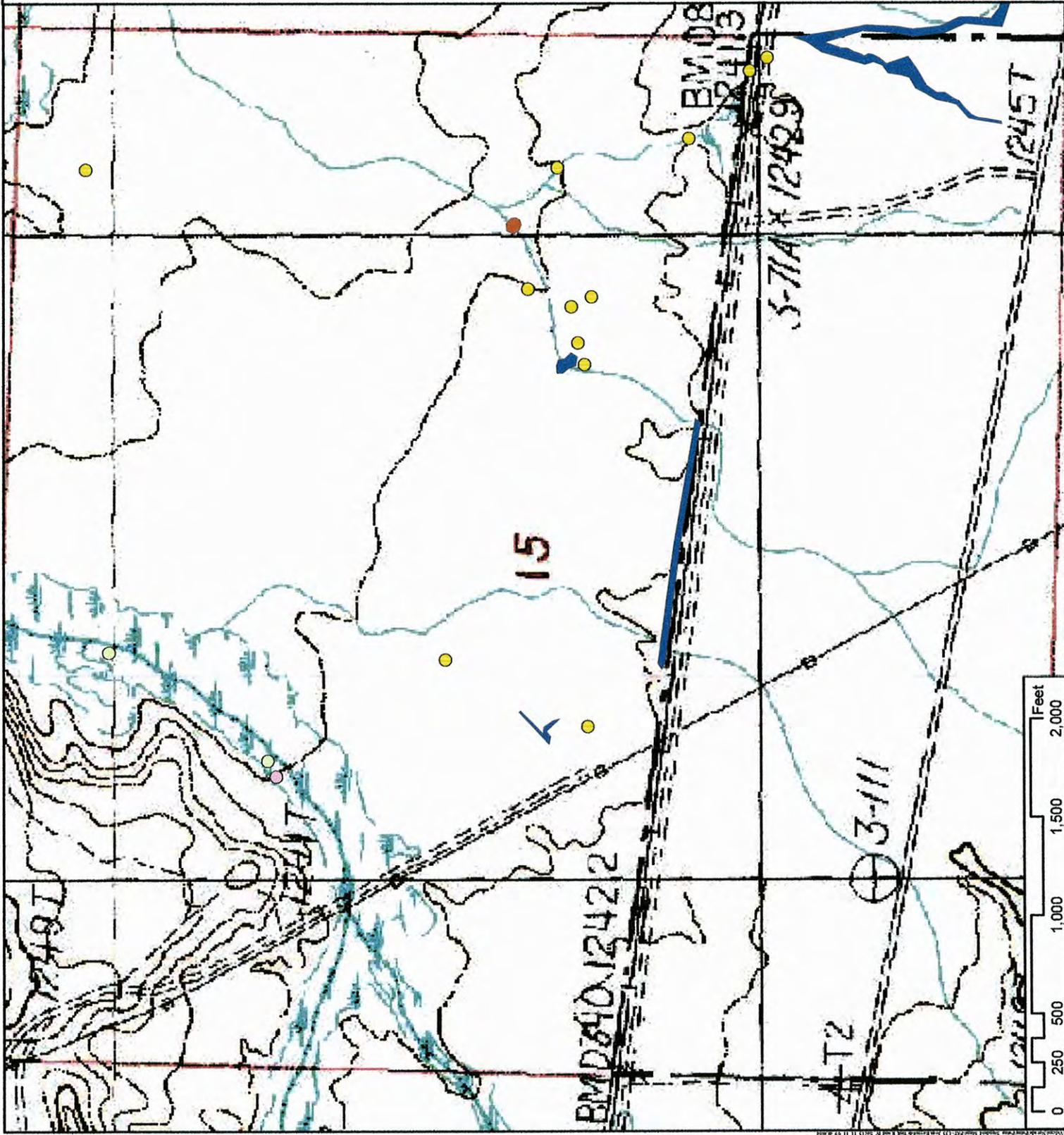
- Leplat
- Leplat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Fernley East
11/1/09

PAT-135



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

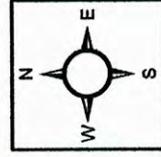
Map 6

Noxious Species

- Leplat
- Sonarv
- Tamram
- Lytsal

Occurrences

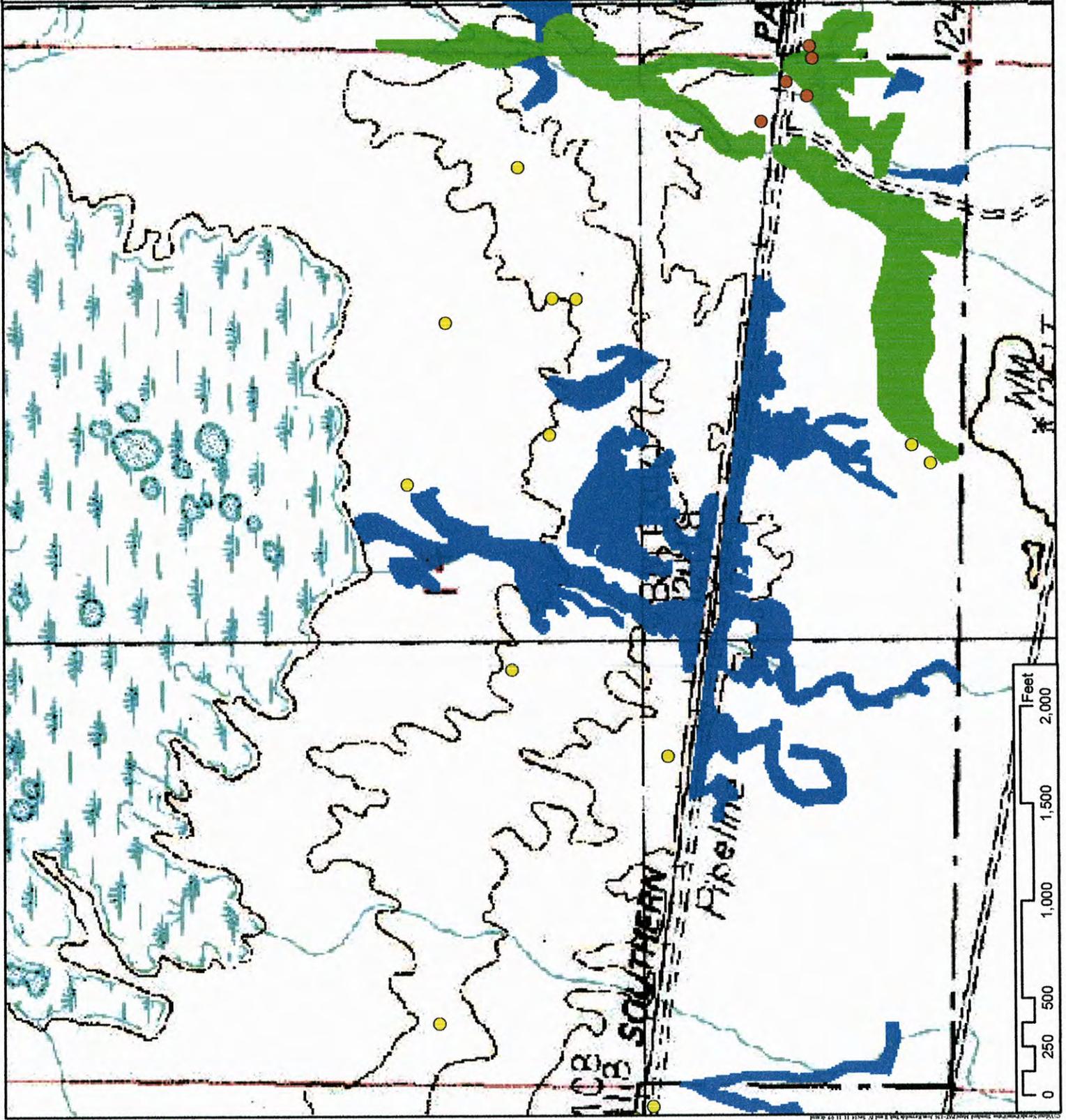
- Leplat
- Lepiat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Fernley East
11/11/09

PAT-136



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

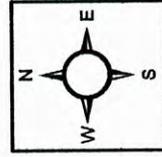
Map 7

Noxious Species

- Lepilat
- Sonary
- Tamram
- Lytsal

Occurrences

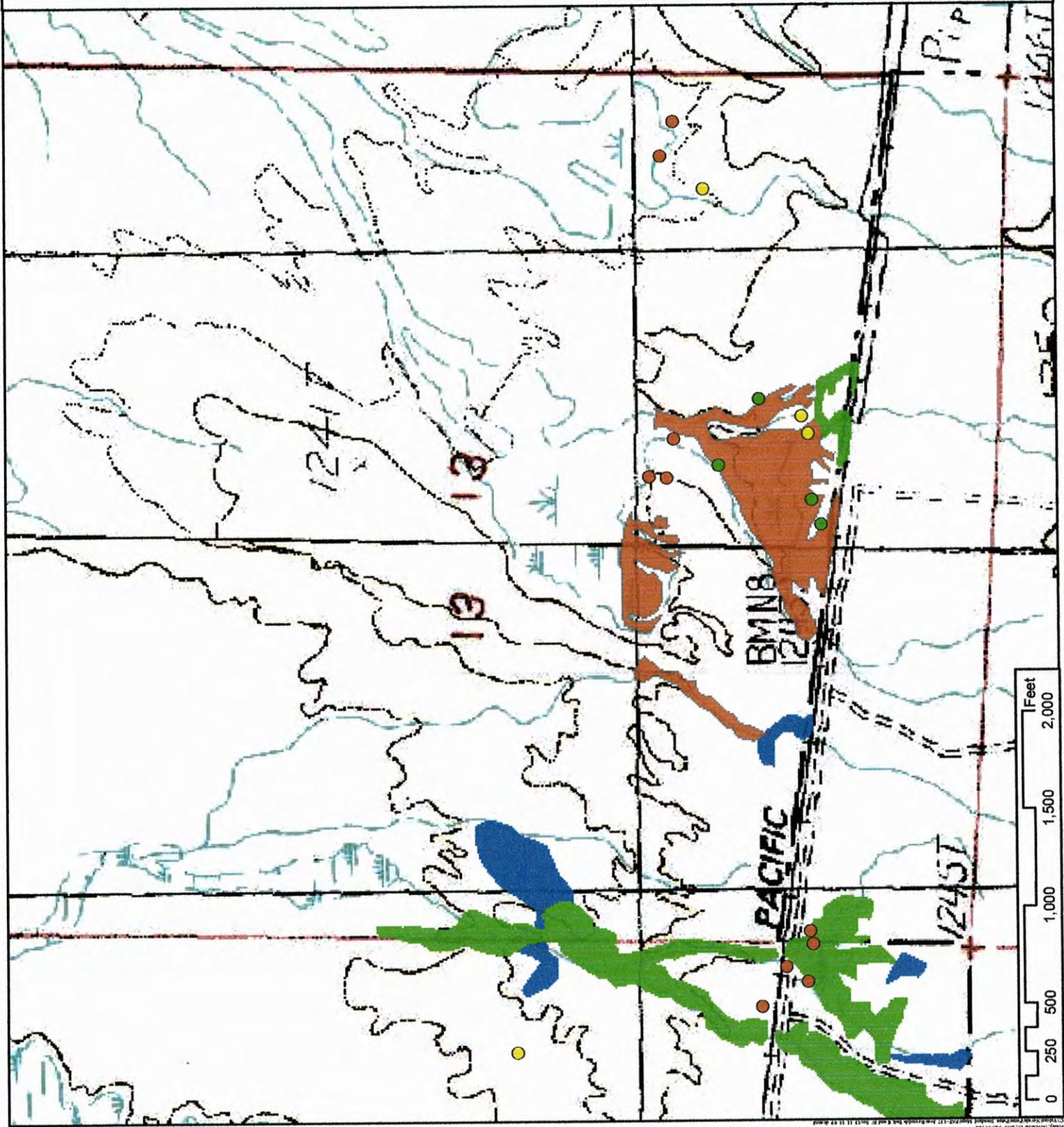
- Lepilat
- Lepilat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Hazen, Fernley East
11/11/09

PAT-137



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

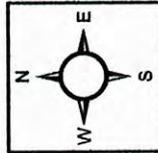
Map 8

Noxious Species

- Lepilat
- Sonary
- Tamram
- Lytsal

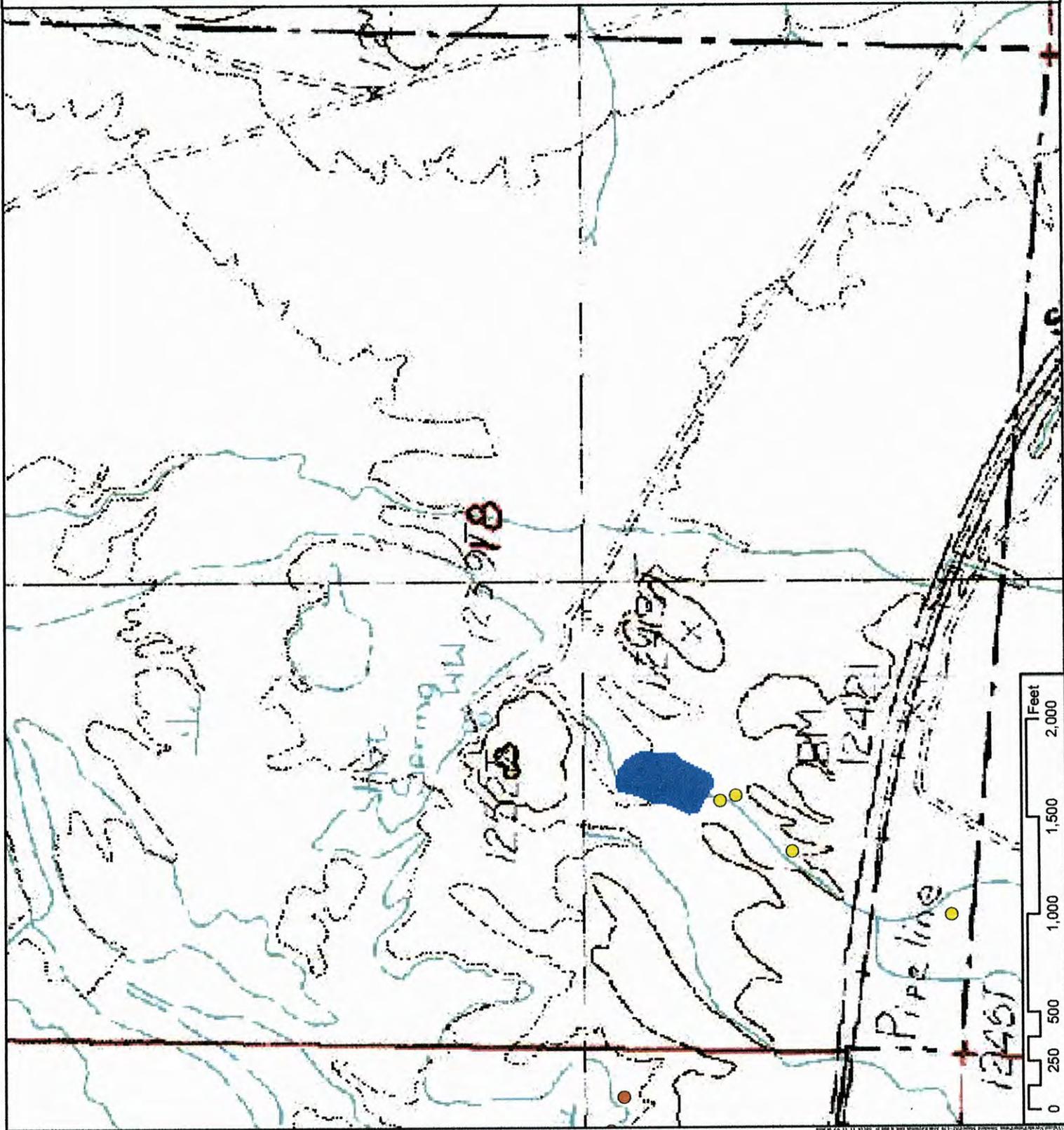
Occurrences

- Lepilat
- Lepilat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Hazen
11/11/09
PAT-338



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

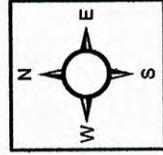
Map 9

Noxious Species

- Lepiat
- Sonarv
- Tamram
- Lytsal

Occurrences

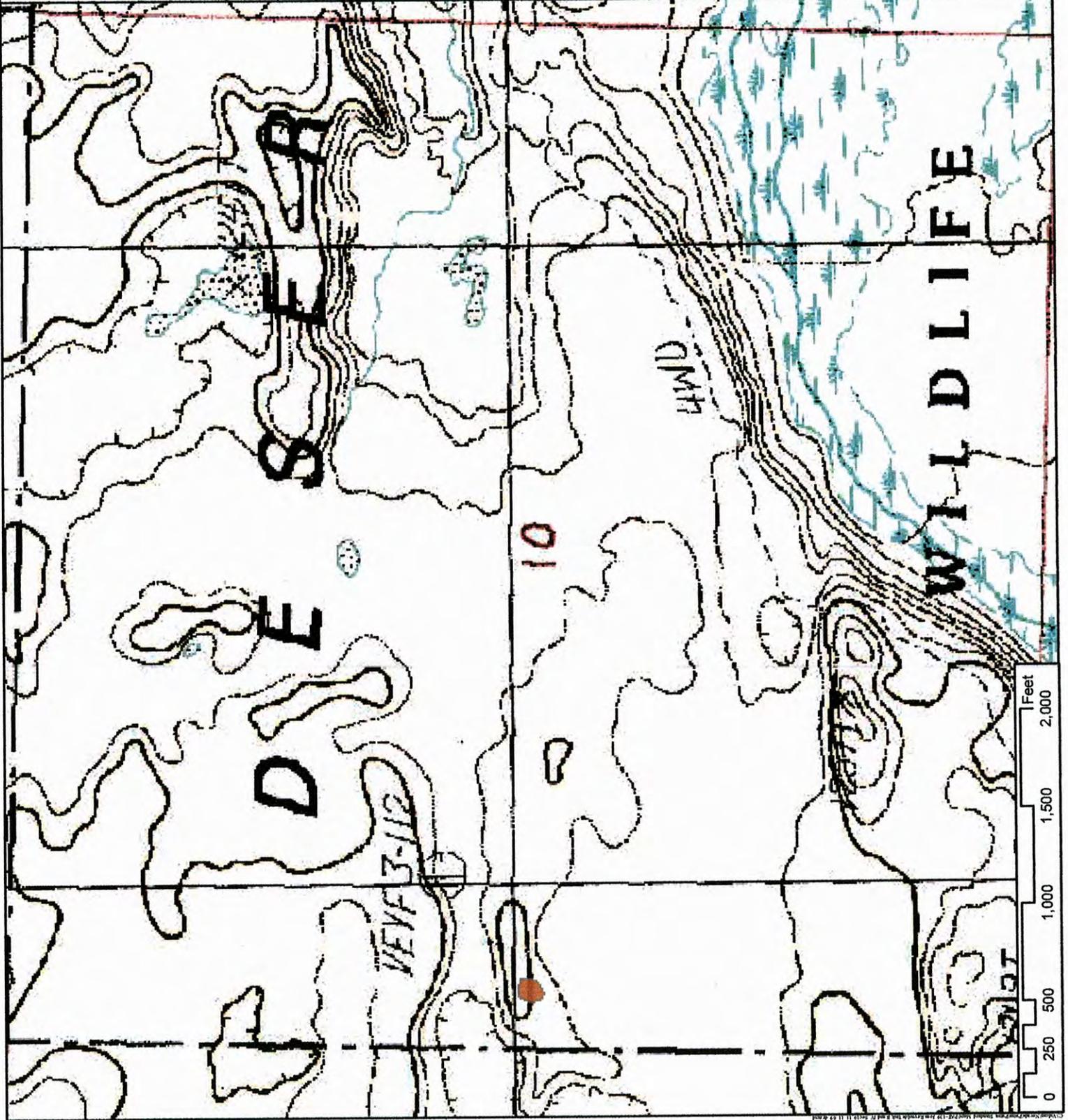
- Lepiat
- Lepiat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quads:
Fertley East
11/11/09

PAT-139



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

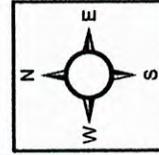
Map 10

Noxious Species

- Leplat
- Sonarv
- Tamram
- Lytsal

Occurrences

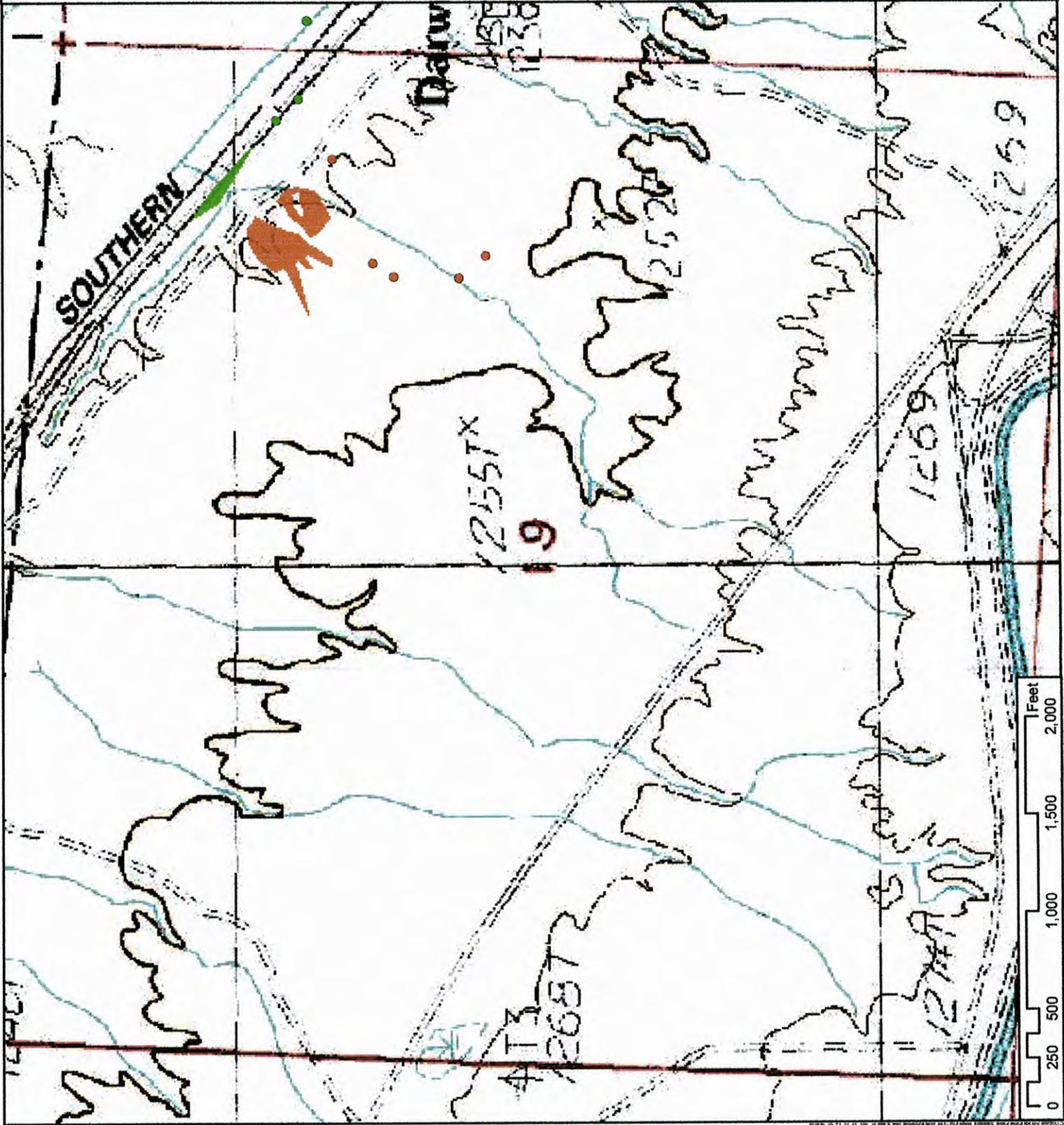
- Leplat
- Lepiat/Tamram
- Tamram



1:8,000

Source: USGS 7.5 Quad:
Hazen
11/12/09

PAT-140



Patua Exploration Project

Botanical Survey

Noxious Weed Occurrences

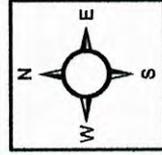
Map 12

Noxious Species

- Leplat
- Sonarv
- Tamram
- Lytsal

Occurrences

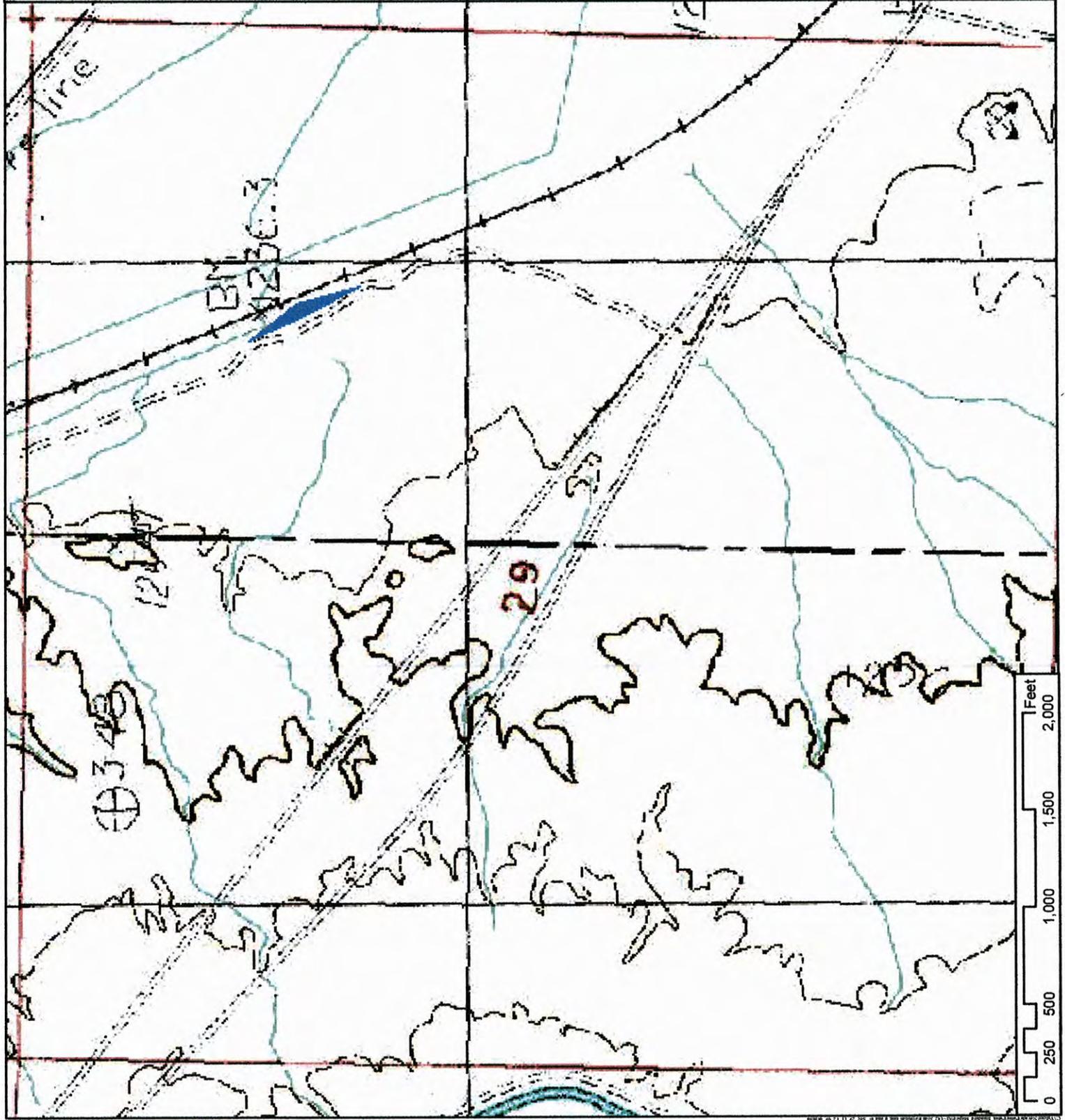
- Leplat
- Leplat/Tamram
- Tamram



1:8,000

Source: USGS 7.5' Quad:
Hazden
11/12/09

PAT-142



Appendix C

Invasive and Noxious Weeds

[NRCS Invasive Species Policy](#)

[Invasive Species Executive Order 13112](#)

Nevada State-listed Noxious Weeds

52 records returned

Click on an accepted name below to view its PLANTS Profile with more information, and web links if available. Noxious weeds that are synonyms retain their noxious status, and are indented beneath the current PLANTS accepted name.

Nevada Administrative Code. 2003. [Control of insects, pests, and noxious weeds](#) (20 October 2003). State of Nevada.

| Symbol | Scientific Name | Noxious Common Name | State Weed Status† | Native Status* |
|------------------------|---|-------------------------------------|------------------------------------|----------------------------------|
| ACRE3 | Acroptilon repens (L.) DC. | | | L48 (I), CAN (I) |
| CERE6 | Centaurea repens L. | Russian knapweed | NW | |
| ALMA12 | Alhagi maurorum Medik. | | | L48 (I) |
| ALCA | Alhagi camelorum Fisch. | camelthorn | NW | |
| ANCO2 | Anthemis cotula L. | mayweed chamomile | NW | L48 (I), AK (I), HI (I), CAN (I) |
| CADR | Cardaria draba (L.) Desv. | whitetop, hoary cress | NW | L48 (I), CAN (I) |
| CANU4 | Carduus nutans L. | musk thistle | NW | L48 (I), CAN (I) |
| CECA2 | Centaurea calcitrapa L. | purple starthistle | NW | L48 (I), CAN (I) |
| CEDI3 | Centaurea diffusa Lam. | diffuse knapweed | NW | L48 (I), CAN (I) |
| CEIB | Centaurea iberica Trevir. ex Spreng. | Iberian starthistle | NW | L48 (I) |
| CEME2 | Centaurea melitensis L. | Malta thistle | NW | L48 (I), HI (I), CAN (I) |
| CESO3 | Centaurea solstitialis L. | yellow starthistle | NW | L48 (I), CAN (I) |
| CESTM | Centaurea stoebe L. ssp. micranthos (Gugler) Hayek | | | L48 (I), HI (I), CAN (I) |
| CEMA4 | Centaurea maculosa auct. non Lam. | spotted knapweed | NW | |
| CEVIS2 | Centaurea virgata Lam. ssp. squarrosa (Willd.) Gugler | | | L48 (I) |
| CEVIS | Centaurea virgata Lam. var. squarrosa (Willd.) Boiss. | squarrose knapweed | NW | |
| CHJU | Chondrilla juncea L. | rush skeletonweed | NW | L48 (I), CAN (I) |
| CIMA2 | Cicuta maculata L. | water hemlock | NW | L48 (N), AK (N), CAN (N) |
| CIAR4 | Cirsium arvense (L.) Scop. | Canada thistle | NW | L48 (I), AK (I), CAN (I), |

| | | | | |
|-------|---|----------------------------|----|--|
| | | | | GL (I), SPM (I) |
| COMA2 | <i>Conium maculatum</i> L. | poison hemlock | NW | L48 (I), CAN (I) |
| CRVU2 | <i>Crupina vulgaris</i> Cass. | Common crupina | NW | L48 (I) |
| CYOF | <i>Cynoglossum officinale</i> L. | houndstongue | NW | L48 (I), CAN (I) |
| EUES | <i>Euphorbia esula</i> L. | leafy spurge | NW | L48 (I), CAN (I) |
| GAOF | <i>Galega officinalis</i> L. | goats rue | NW | L48 (I), CAN (I) |
| HYVE3 | <i>Hydrilla verticillata</i> (L. f.) Royle | Hydrilla | NW | L48 (I) |
| HYNI | <i>Hyoscyamus niger</i> L. | black henbane | NW | L48 (I), CAN (I) |
| HYPE | <i>Hypericum perforatum</i> L. | Klamath weed | NW | L48 (I), HI (I), CAN (I) |
| ISTI | <i>Isatis tinctoria</i> L. | dyer's woad | NW | L48 (I), CAN (W) |
| LELA2 | <i>Lepidium latifolium</i> L. | perennial pepperweed | NW | L48 (I), CAN (I) |
| LIDA | <i>Linaria dalmatica</i> (L.) Mill. | Dalmatian toadflax | NW | L48 (I), CAN (I) |
| LIVU2 | <i>Linaria vulgaris</i> Mill. | yellow toadflax | NW | L48 (I), AK (I), CAN (I), GL (I), SPM (I) |
| LYSA2 | <i>Lythrum salicaria</i> L. | purple loosestrife | NW | L48 (I), CAN (I), SPM (I) |
| LYVI3 | <i>Lythrum virgatum</i> L. | purple loosestrife | NW | L48 (I) |
| MYSP2 | <i>Myriophyllum spicatum</i> L. | Eurasian water- milfoil | NW | L48 (I), AK (I), CAN (I) |
| ONAC | <i>Onopordum acanthium</i> L. | Scotch thistle | NW | L48 (I), CAN (W) |
| PEHA | <i>Peganum harmala</i> L. | African rue | NW | L48 (I) |
| PORE5 | <i>Potentilla recta</i> L. | sulfur cinquefoil | NW | L48 (I), CAN (I) |
| ROAU | <i>Rorippa austriaca</i> (Crantz) Besser | Austrian fieldcress | NW | L48 (I), CAN (I) |
| SAAE | <i>Salvia aethiopsis</i> L. | Mediterranean sage | NW | L48 (I) |
| SAM05 | <i>Salvinia molesta</i> Mitchell | giant salvinia | NW | L48 (I), HI (I) |
| SOCA3 | <i>Solanum carolinense</i> L. | Carolina horsenettle | NW | L48 (N), CAN (I) |
| SOEL | <i>Solanum elaeagnifolium</i> Cav. | white horsenettle | NW | L48 (N), HI (I), PR (N) |
| SOAR2 | <i>Sonchus arvensis</i> L. | sowthistle | NW | L48 (I), AK (I), CAN (I), SPM (I) |
| SOAL | <i>Sorghum almum</i> Parodi | Columbus grass | NW | L48 (I) |
| SOBI2 | <i>Sorghum bicolor</i> (L.) Moench | perennial sweet Sudan | NW | L48 (I), HI (I), PR (I), VI (I), CAN (I) |
| SOHA | <i>Sorghum halepense</i> (L.) Pers. | johnsongrass | NW | L48 (I), HI (I), PR (I), CAN (I) |
| SOPR3 | <i>Sorghum propinquum</i> (Kunth) Hitchc. | Sorghum | NW | |
| SPSA3 | <i>Sphaerophysa salsula</i> (Pall.) DC. | Austrian peaweed | NW | L48 (I), CAN (I) |
| TACA8 | <i>Taeniatherum caput-medusae</i> (L.) Nevski | medusahead | NW | L48 (I) |
| TAPA4 | <i>Tamarix parviflora</i> DC. | saltcedar, tamarisk | NW | L48 (I) |

| | | | | |
|------|---|---------------------|----|--------------------------|
| TARA | <i>Tamarix ramosissima</i> Ledeb. | saltcedar, tamarisk | NW | L48 (I) |
| TRTE | <i>Tribulus terrestris</i> L. | puncturevine | NW | L48 (I), HI (I), CAN (W) |

†Code Weed Status

NW Noxious weed

***Code Native Status**

I Introduced

N Native

W Waif

***Code Native Location**

L48 Lower 48 States

US02 Alaska

US15 Hawaii

US72 Puerto Rico

US78 Virgin Islands

CA Canada

GL Greenland

SB St. Pierre and Miquelon

Additional information about noxious plants in this state can be found at:

- [NV-Invasive Weed Identification for Nevada](#)
- [NV-Nevada Agriculture Experiment Station](#)
- [NV-Nevada Division of Plant Industry](#)
- [NV-Nevada Invasive Species Initiative](#)
- [NV-University of Nevada Extension Publications](#)
- [NV-Wanted Weeds of Nevada](#)

Time Generated: 10/28/2009 05:19 PM MDT

Appendix F: Water Chemistry of the Patua Hot Springs

| NBMG Auto_key | GBCGE Data Base ID | Site Location Code | Site ID / Spring | Sample_ No | Name_1 | Area | Date_col | Time | Weather | Recent Rain? |
|---------------|--------------------|--------------------|------------------|------------|-------------------|-------|----------|----------|--------------------------------|--------------|
| 7912 | 24 | HZ | 01 | HZ-01 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7913 | 25 | HZ | 02 | HZ-02 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7914 | 26 | HZ | 03 | HZ-03 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7915 | 27 | HZ | 04 | HZ-04 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7916 | 28 | HZ | 05 | HZ-05 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7917 | 29 | HZ | 06 | HZ-06 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7918 | 30 | HZ | 07 | HZ-07 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7919 | 31 | HZ | 7.5 | HZ-07.5 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| | | HZ | 08 | HZ-8 | Patua Hot Springs | Hazen | 03/27/06 | 11:00:00 | sunny, cool | no |
| 7921 | 35 | HZ | 09 | HZ-09 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7923 | 220 | HZ | 10 | HZ-10 | Patua Hot Springs | Hazen | 02/22/03 | 12:00:00 | partly cloudy, calm 50 degrees | no |
| 7924 | 33 | HZ | 11 | HZ-11 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| 7925 | 34 | HZ | 12 | HZ-12 | Patua Hot Springs | Hazen | 05/23/02 | | Clear 65 - 70 F | |
| | | HZ | 13 | HZ-13 | Patua Hot Springs | Hazen | 03/27/06 | 10:15:00 | sunny, cool | no |
| 3455 | 1615 | HZ | | | SPRING NEAR | Hazen | 04/16/64 | | | |
| 3910 | 1619 | HZ | | | SPRINGS | Hazen | 11/12/66 | | | |
| 2738 | 1670 | HZ | | | SPRINGS, MAGMA | Hazen | | | | |
| 3905 | 2202 | HZ | | | Patua Hot Spring | Hazen | 01/01/89 | | | |

| Collected_by | County | Meridian | Townshi p | Range | Map | Section | Qtr_ sec | UTM_n | UTM_e | NAD | Type of Water | Meter Calibration - Time |
|----------------------|--------|-----------|--------------|-------|-------|---------|-------------|---------|--------|-----|------------------|--------------------------------|
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385179 | 318804 | 27 | | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385204 | 318830 | 27 | Pool | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | | | | Pool | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385221 | 318868 | 27 | Pool | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385235 | 318892 | 27 | | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385235 | 318959 | 27 | Pool | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385387 | 318805 | 27 | Pool | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385408 | 318797 | 27 | Pool | |
| Henkelman and Sladek | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385416 | 318847 | 27 | spring | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385346 | 318714 | 27 | | |
| Sladek & Coolbaugh | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385342 | 318702 | 27 | seep | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385351 | 318687 | 27 | | |
| Shevenell | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385250 | 318740 | 27 | | |
| Henkelman and Sladek | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385235 | 318952 | 27 | spring | 2:30:00 PM |
| | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | SW | 4385302 | 318260 | 27 | Spring | |
| | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | SW | 4384897 | 319396 | 27 | Spring | |
| | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4385462 | 318979 | 27 | Well | |
| | Lyon | Mt Diablo | 20N | 26E | Hazen | 18 | | 4384953 | 318567 | 27 | Spring | |

| pH = 7 Calib | pH = 4 Calib | pH = 10 Calib | Readings @ C | SC std used | SC @ std | SC @ C | Temp_c_alpha | Temp_c | pH_field | Temp(C) of pH | pH with papers | pH_lab | pH_unkn own | Eh_field_alpha |
|--------------|--------------|---------------|--------------|-------------|----------|--------|--------------|--------|----------|---------------|----------------|--------|-------------|----------------|
| | | | | | | | | 61 | | | | | | |
| | | | | | | | | 67 | | | | | | |
| | | | | | | | | 36 | | | | | | |
| | | | | | | | | 65 | | | | | | |
| | | | | | | | | 28 | | | | | | |
| | | | | | | | | 83 | | | | | | |
| | | | | | | | | 71.6 | | | | | | |
| | | | | | | | | 72 | | | | | | |
| 7.01 | 4.01 | 9.91 | 22.3 | 2764 | 2800 | 23.0 | | 83.0 | 6.63 | 28.9 | 6.0 | | | |
| | | | | | | | | 41 | | | | | | |
| | | | | | | | | 95.3 | 7.24 | 71.6 | 6.5 | | | |
| | | | | | | | | 95.1 | | | | | | |
| | | | | | | | | 71.6 | | | | | | |
| 7.01 | 4.01 | 9.91 | 22.3 | 2764 | 2800 | 23.0 | | 85.1 | 7.12 | 29 | | | | |
| | | | | | | | | 86 | | | | | | |
| | | | | | | | | 86.1 | 7.05 | | | 7.1 | | |
| | | | | | | | | 132.2 | | | | | | |
| | | | | | | | | 86 | | | | | 7.6 | |

| Al | As | B | Ba | Be | Bi | Br | Ca | Cd | Cl | Co | Cr | Cs | Cu | F |
|-------|-------|------|-------|-------|--------|------|------|--------|-----|--------|-------|-------|-------|-----|
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| | | | | | | | | | | | | | | |
| 0.072 | 0.119 | 6.79 | 0.038 | 0.003 | <0.001 | 1.48 | 64.5 | <0.001 | 750 | <0.001 | 0.023 | 0.144 | 0.003 | 4.7 |
| | | | | | | | | | | | | | | |
| | 0.139 | 4.91 | 0.04 | 0.007 | <.001 | | 41.6 | <.001 | 757 | 0.001 | 0.003 | 0.149 | 0.002 | 3.4 |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| 0.003 | 0.118 | 7.78 | 0.027 | 0.003 | <0.001 | 1.37 | 55.8 | <0.001 | 785 | <0.001 | 0.015 | 0.189 | 0.002 | 5.5 |
| 0.004 | | | | | | | | | | | | 0.2 | 0.01 | |
| 0.004 | | 5.6 | | | | | 70 | | 820 | | | 0.2 | 0.01 | 4.2 |
| | | | | | | | | | | | | | | |
| | | 6.1 | | | | | 52 | | 829 | | | | | 4.7 |

| Fe | Ga | Ge | Hg | I | K | Li | Mg | Mn | Mo | Na | Ni | NO3 | Pb | Rb |
|-------|-------|-------|--------|-------|------|-------|------|-------|-------|-----|-------|-----|--------|-------|
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| 0.115 | 0.004 | 0.009 | <0.010 | 0.257 | 36.0 | 1.58 | 1.67 | <0.01 | 0.029 | 606 | 0.018 | 0.0 | <0.001 | 0.180 |
| | | | | | | | | | | | | | | |
| 0.040 | 0.005 | 0.012 | <.1 | | 39.0 | 0.744 | 0.8 | 0.004 | 0.046 | 660 | 0.043 | 0.1 | <.001 | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| 0.168 | 0.003 | 0.012 | <0.010 | 0.247 | 49.8 | 1.57 | 1.31 | <0.01 | 0.027 | 643 | 0.005 | 0.0 | <0.001 | 0.235 |
| 0.02 | | | 0.001 | | | | | 0.06 | | | | | | 0.23 |
| 0.02 | | | 0.0001 | | 38 | 1.6 | 1.5 | 0.06 | | 620 | | | | 0.25 |
| | | | | | | | | | | | | | | |
| | | | | | 52 | 1.7 | 0.6 | | | 656 | | | | |

Appendix G:
Wildlife Species Observed During Surveys

| Wildlife species Observed During Surveys | | |
|--|---|--|
| Birds | Mammals | Reptiles and Amphibians |
| Barn owl (<i>Tyto alba</i>) | American badger (<i>Taxidea taxus</i>) | Bullfrog (<i>Rana catesbeiana</i>) |
| Barn swallow (<i>Hirundo rustica</i>) | Big brown bat ¹ (<i>Eptesicus fuscus</i>) | Desert horned lizard (<i>Phrynosoma platyrhinos</i>) |
| Black-crowned night heron (<i>Nycticorax nycticorax</i>) | Black-tailed jackrabbit (<i>Lepus californicus</i>) | Desert spiny lizard (<i>Sceloporus magister</i>) |
| Black-throated sparrow (<i>Amphispiza bilineata</i>) | Brazilian free-tailed bat ¹ (<i>Tadarida brasiliensis</i>) | Great Basin whiptail (<i>Cnemidophorus tigris tigris</i>) |
| Brewer's blackbird (<i>Euphagus cyanocephalus</i>) | Coyote (<i>Canis latrans</i>) | Great Basin rattlesnake (<i>Crotalus viridis lutosus</i>) |
| Brewer's sparrow (<i>Spizella breweri</i>) | Deer mouse * (<i>Peromyscus maniculatus</i>) | Long-nosed leopard lizard (<i>Gambelia wislizenii</i>) |
| Brown-headed cowbird (<i>Molothrus ater</i>) | Desert cottontail (<i>Sylvilagus audubonii</i>) | Northern leopard frog ¹ (<i>Rana pipiens</i>) |
| Common raven (<i>Corvus corax</i>) | Fringed myotis ¹ (<i>Myotis thysanodes</i>) | Side-blotched lizard (<i>Uta stansburiana</i>) |
| Common yellowthroat (<i>Geothlypis trichas</i>) | Kangaroo rat (<i>Dipodomys sp.</i>) | Western fence lizard (<i>Sceloporus occidentalis</i>) |
| Golden eagle ¹ (<i>Aquila chrysaetos</i>) | Kit fox ¹ * (<i>Vulpes macrotis</i>) | Zebra tailed lizard (<i>Callisaurus draconoides</i>) |
| Great horned owl * (<i>Bubo virginianus</i>) | Little brown bat ¹ (<i>Myotis lucifugus</i>) | |
| House finch (<i>Carpodacus mexicanus</i>) | Small-footed myotis ¹ (<i>Myotis ciliolabrum</i>) | |
| Inca Dove (<i>Columbina inca</i>) | Western pipistrelle ¹ (<i>Pipistrellus hesperus</i>) | |
| Killdeer (<i>Charadrius vociferus</i>) | White-tailed antelope ground squirrel (<i>Ammospermophilus leucurus</i>) | |
| Lesser nighthawk (<i>Chordeiles minor</i>) | Woodrat * (<i>Neotoma spp.</i>) | |
| Loggerhead shrike ¹ (<i>Lanius ludovicianus</i>) | Yuma myotis ¹ (<i>Myotis yumanensis</i>) | |
| Mallard (<i>Anas platyrhynchos</i>) | | |
| Marsh wren (<i>Cistothorus palustris</i>) | | |
| Mourning dove (<i>Zenaida macroura</i>) | | |

| Wildlife species Observed During Surveys (Continued) | | |
|---|----------------|--------------------------------|
| Birds | Mammals | Reptiles and Amphibians |
| Northern harrier (<i>Circus cyaneus</i>) | | |
| Osprey ² (<i>Pandion haliaetus</i>) | | |
| Prairie falcon ¹ (<i>Falco mexicanus</i>) | | |
| Red-tailed hawk (<i>Buteo jamaicensis</i>) | | |
| Red-winged blackbird (<i>Agelaius phoeniceus</i>) | | |
| Rock wren (<i>Salpinctes obsoletus</i>) | | |
| Song sparrow (<i>Melospiza melodia</i>) | | |
| Sora (<i>Porzana carolina</i>) | | |
| Turkey vulture (<i>Cathartes aura</i>) | | |
| Western kingbird (<i>Tyrannus verticalis</i>) | | |
| Western meadowlark (<i>Sturnella neglecta</i>) | | |
| Yellow-headed blackbird (<i>Xanthocephalus xanthocephalus</i>) | | |
| * Detected by tracks, scat, carcass, prey remains, feathers, burrow, etc. | | |
| ¹ Nevada Special Status Species protected by NRS 501 | | |
| ² Proposed Nevada Special Status Species - designated proposed Sensitive by BLM State Office | | |

Appendix H: Soils Key

Map Unit Legend

Fallon-Fernley Area, Nevada, Parts of Churchill, Lyon, Storey and Washoe Counties

| Map symbol | Map unit name |
|------------|--|
| Ad | Alluvial land |
| Af | Appian loamy fine sand |
| Am | Appian sandy loam, wet |
| An | Appian sandy loam, clay substratum |
| Ao | Appian fine sandy loam |
| Ap | Appian complex |
| AR | Appian-Isolde complex |
| AS | Appian clay substratum-Isolde complex |
| AT | Appian-Playas association |
| BA | Badland |
| BdA | Bango loamy sand, 0 to 2 percent slopes |
| BdB | Bango loamy sand, 2 to 4 percent slopes |
| BeB | Bango sandy loam, 2 to 4 percent slopes |
| BhA | Bango silt loam, 0 to 2 percent slopes |
| BK | Bango-Stumble association |
| BLB | Biddleman very stony loamy sand, 2 to 4 percent slopes |
| BM | Biddleman association |
| BnC | Bluewing gravelly loamy sand, 2 to 8 percent slopes |
| Bo | Bunejug sandy loam |
| Br | Bunejug sandy loam, slightly saline |
| Bs | Bunejug sandy loam, strongly saline |
| BT | Bunejug-Erber clay loams |
| Ca | Carcity clay |
| Cc | Carcity clay, slightly saline |
| Cd | Carcity clay, strongly saline |
| CE | Carson clay loam, strongly saline |
| Cg | Carson clay |
| Ch | Carson clay, slightly saline |
| Ck | Carson clay, strongly saline |
| CM | Carson-Stillwater complex |
| CNE | Celeton very cobbly sandy loam, 8 to 30 percent slopes |
| CP | Churchill-Playas complex |
| Da | Dia loam |
| Dc | Dia loam, slightly saline |
| Dd | Dia loam, strongly saline |
| De | Dia loam, wet |
| Dh | Dithod loam |
| Dk | Dithod loam, slightly saline |
| Dm | Dithod loam, strongly saline |
| Dp | Dune land-Playas complex |
| Ea | East Fork clay loam |
| Ec | East Fork clay loam, slightly saline |
| Ed | East Fork clay loam, strongly saline |
| Ee | Erber sand |
| Eg | Erber loam |
| Eh | Erber loam, strongly saline |
| Em | Erber clay, slightly saline |
| En | Erber clay, strongly saline |
| Fa | Fallon fine sandy loam |
| Fc | Fallon fine sandy loam, slightly saline |

Map Unit Legend

Fallon-Fernley Area, Nevada, Parts of Churchill, Lyon, Storey and Washoe Counties

| Map symbol | Map unit name |
|------------|--|
| Fd | Fallon fine sandy loam, strongly saline |
| Fe | Fallon fine sandy loam, wet |
| Fn | Fernley sand |
| Fo | Fernley loam |
| Fr | Fernley clay |
| GA | Gardella gravelly silt loam |
| GP | Gravel pits |
| HB | Hooten-Bango-Isolde association |
| HG | Hawsley-Gamgee association |
| HTP | Hawsley-Theon-Pirouette association |
| HU | Huxley gravelly clay loam |
| JuA | Juva sandy loam, 0 to 2 percent slopes |
| JuB | Juva sandy loam, 2 to 4 percent slopes |
| JvB | Juva silt loam, 2 to 4 percent slopes |
| KU | Kolda-Umberland association |
| LBO | Loomer-Bombadil-Old Camp association |
| LR | Labou-Rock outcrop complex |
| Ls | Lahontan clay, slightly saline |
| Lt | Lahontan clay, strongly saline |
| Ma | Marsh |
| MB | Mazuma-Bango association |
| MD | Mine pits |
| PA | Parran silty clay |
| PC | Parran-Isolde complex |
| PD | Patna sand |
| Pe | Pelic sand |
| Pf | Pelic clay |
| Ph | Pelic sand, clay substratum |
| PI | Pirouette-Hawsley association |
| PJ | Pirouette-Osobb-Celeton association |
| PK | Pirouette-Osobb-Isolde association |
| PM | Pirouette-Bluewing association |
| PO | Pirouette-Osobb association |
| PY | Playas |
| Ra | Ragtown sandy clay loam |
| Rc | Ragtown clay loam, slightly saline |
| Rg | Ragtown clay loam, strongly saline |
| Sa | Sagouspe loamy sand |
| Sb | Sagouspe loamy sand, saline |
| ScA | Soda Lake gravelly loamy sand, 0 to 2 percent slopes |
| SdA | Soda Lake gravelly loamy sand, saline, 0 to 2 percent slopes |
| SeD | Soda Lake gravelly loamy sand, 2 to 15 percent slopes |
| SfA | Soda Lake sandy loam, 0 to 2 percent slopes |
| SgA | Soda Lake sandy loam, saline, 0 to 2 percent slopes |
| SH | Soda Lake-Rock outcrop complex |
| Sk | Stillwater clay loam |
| Sm | Stillwater clay loam, slightly saline |
| Sn | Stillwater clay loam, strongly saline |
| So | Stillwater clay loam, wet |
| Sp | Stillwater clay |

Map Unit Legend

Fallon-Fernley Area, Nevada, Parts of Churchill, Lyon, Storey and Washoe Counties

| Map symbol | Map unit name |
|------------|--|
| Sr | Swingler sand |
| Ss | Swingler sandy loam |
| St | Swingler clay loam |
| Su | Swingler clay loam, slightly saline |
| Sv | Swingler clay loam, strongly saline |
| Sw | Swope sandy loam |
| Sx | Swope clay loam |
| Sy | Swope clay loam, slightly saline |
| Sz | Swope clay loam, strongly saline |
| TnA | Hawsley sand, 0 to 2 percent slopes |
| TnC | Hawsley sand, 2 to 8 percent slopes |
| TPB | Isolde fine sand, 0 to 4 percent slopes |
| TPD | Isolde fine sand, 4 to 15 percent slopes |
| TR | Isolde-Appian complex |
| TS | Isolde-Appian clay substratum, complex |
| TU | Isolde-Lahontan complex |
| TV | Isolde-Parran complex |
| W | Water |
| Wc | Weishaupt clay loam |
| We | Weishaupt clay loam, slightly saline |
| Wh | Weishaupt clay loam, strongly saline |
| WM | Miscellaneous water |

Appendix I: Ambient Air Quality Standards for NV

This table lists the minimum standards of quality for ambient air.

| POLLUTANT | AVERAGING TIME | NEVADA STANDARDS ^A | | NATIONAL STANDARDS ^B | | |
|---|---------------------------|---|--|---|---------------------------|--|
| | | CONCENTRATION ^C | METHOD ^D | PRIMARY ^{C, E} | SECONDARY ^{C, F} | METHOD ^D |
| Ozone | 1 hour | 0.12 ppm (235 µg/m ³) | Ultraviolet absorption | 1 hour = 0.12 ppm (235 µg/m ³) | Same as primary | Chemiluminescence |
| Ozone-Lake Tahoe Basin, #90 | 1 hour | 0.10 ppm (195 µg/m ³) | | 8 hours = 0.08 ppm | | |
| Carbon monoxide less than 5,000' above mean sea level | 8 hours | 9 ppm (10,500 µg/m ³) | Nondispersive infrared photometry | 9 ppm (10 mg/m ³) | None | Nondispersive infrared photometry |
| At or greater than 5,000' above mean sea level | | 6 ppm (7,000 µg/m ³) | | | | |
| Carbon monoxide at any elevation | 1 hour | 35 ppm (40,500 µg/m ³) | | | | |
| Nitrogen dioxide | Annual arithmetic mean | 0.053 ppm (100 µg/m ³) | Gas phase chemiluminescence | 0.053 ppm (100 µg/m ³) | Same as primary | Gas phase chemiluminescence |
| Sulfur dioxide | Annual arithmetic mean | 0.030 ppm (80 µg/m ³) | Ultraviolet fluorescence | 0.030 ppm | None | Spectrophotometry (Pararosaniline method) |
| | 24 hours | 0.14 ppm (365 µg/m ³) | | 0.14 ppm | | |
| | 3 hours | 0.5 ppm (1,300 µg/m ³) | | None | 0.5 ppm | |
| Particulate matter as PM ₁₀ | Annual arithmetic mean | 50 µg/m ³ | High volume PM ₁₀ sampling | 50 µg/m ³ | Same as primary | High volume PM ₁₀ sampling |
| | 24 hours | 150 µg/m ³ | | 150 µg/m ³ | | |
| Particulate matter as PM _{2.5} | Annual arithmetic mean | -- | -- | 15.0 µg/m ³ | Same as primary | Low volume PM _{2.5} sampling |
| | 24 hours | | | 65 µg/m ³ | | |
| Lead (Pb) | Quarterly arithmetic mean | 1.5 µg/m ³ | High volume sampling, acid extraction and atomic absorption spectrometry | 1.5 µg/m ³ | Same as primary | High volume sampling, acid extraction and atomic absorption spectrometry |
| Hydrogen sulfide | 1 hour | 0.08 ppm (112 µg/m ³) ^G | Ultraviolet fluorescence | -- | -- | -- |

Notes:

- A. The Director shall use the Nevada standards in considering whether to issue a permit for a stationary source and shall ensure that the stationary source will not cause the Nevada standards to be exceeded in areas where the general public has access.
- B. These standards, other than for ozone, particulate matter, and those based on annual averages, must not be exceeded more than once per year. The 1-hour ozone standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one. The PM₁₀ 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above the standard, rounded to the nearest 10 µg/m³, is equal to or less than one. The expected number of days per calendar year is generally based on an average of the number of times the standard has been exceeded per year for the last 3 years. The National standards are to be used in determinations of attainment or nonattainment.
- C. Where applicable, concentration is expressed first in units in which it was adopted. All measurements of air quality that are expressed as mass per unit volume, such as micrograms per cubic meter, must be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibars); "ppm" in this table refers to parts per million by volume, or micromoles of regulated air pollutant per mole of gas; "µg/m³" refers to micrograms per cubic meter.
- D. Any reference method specified in accordance with 40 C.F.R. Part 50 or any reference method or equivalent method designated in accordance with 40 C.F.R. Part 53 may be substituted.
- E. National primary standards are the levels of air quality necessary, with an adequate margin of safety, to protect the public health.
- F. National secondary standards are the levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a regulated air pollutant.
- G. The ambient air quality standard for hydrogen sulfide does not include naturally occurring background concentrations.

The standards of quality for ambient air are minimum goals, and it is the intent of the NDEP to protect the existing quality of Nevada's air to the extent that it is economically and technically feasible.