BLM

Stillwater Field Office, Nevada

**ENVIRONMENTAL ASSESSMENT**

# TGP Dixie Development Company, LLC

# Coyote Canyon and Dixie Meadows Geothermal Exploration

DOI-BLM-NV-C010-2010-0010-EA

U.S. Department of the Interior
Bureau of Land Management
Carson City District
Stillwater Field Office
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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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# Acronyms and Abbreviations

| | |
|---|---|
| AFY | acre-feet per year |
| AUM | animal unit month |
| BAPC | Bureau of Air Pollution Control |
| BLM | Bureau of Land Management |
| BMP | best management practice |
| CC | Coyote Canyon |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| DM | Dixie Meadows |
| EA | environmental assessment |
| EIS | environmental impact statement |
| EPA | U.S. Environmental Protection Agency |
| FAA | Federal Aviation Administration |
| FEMA | Federal Emergency Management Agency |
| FIRM | Flood Insurance Program Mapping |
| FONSI | finding of no significant impact |
| GDP | Geothermal Drilling Permit |
| GHG | greenhouse gas |
| GIS | geographic information system |
| $H_2S$ | hydrogen sulfide |
| HMA | Herd Management Area |
| kV | kilovolt |
| LR 2000 | Legacy Rehost Report System |
| MBTA | Migratory Bird Treaty Act |
| mg/L | milligram(s) per liter |
| MOA | Military Operating Area |
| NAAQS | National Ambient Air Quality Standards |

| | |
|---|---|
| NDEP | Nevada Division of Environmental Protection |
| NDOM | Nevada Division of Minerals |
| NDWR | Nevada Division of Water Resources |
| NEPA | National Environmental Policy Act |
| NILS | National Integration Land System |
| NPS | National Park Service |
| NRHP | National Register of Historic Places |
| NWI | National Wetland Inventory |
| PEIS | programmatic environmental impact statement |
| PFYC | Potential Fossil Yield Classifications |
| $PM_{10}$ | particulate matter smaller than 10 microns in aerodynamic diameter |
| $PM_{2.5}$ | particulate matter smaller than 2.5 microns in aerodynamic diameter |
| ppm | part(s) per million |
| RCRA | Resource Conservation and Recovery Act |
| RMP | Resource Management Plan |
| SFHA | special flood hazard area |
| SHPO | State Historic Preservation Office |
| SPCC | Spill Prevention Control and Countermeasures |
| SWReGAP | Southwest Regional Gap Analysis Project |
| TDS | total dissolved solids |
| TGP | TGP Dixie Development Company |
| USC | United States Code |
| USDA NRCS | U.S. Department of Agriculture National Resource Conservation Service |
| USDI | U.S. Department of Interior |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VRM | visual resource management |
| $yd^3$ | cubic yard |

SECTION 1

# Introduction/Purpose and Need

## 1.1 Introduction

This Environmental Assessment (EA) analyzes the potential impacts associated with the proposed construction and testing of geothermal exploration wells, access roads, and ancillary facilities in Dixie Valley, Churchill County, Nevada (Figure 1). TGP Dixie Development Company (TGP) proposes to explore the geothermal resource potential of the Coyote Canyon (CC) and Dixie Meadows (DM) lease areas in Dixie Valley, which are located primarily on federal lands managed by the U.S. Bureau of Land Management (BLM). The BLM is the lead agency for this EA in accordance with the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] Parts 1500-1508).

The purpose of the geothermal exploration is to confirm that sufficient reservoir capacity is available to allow long-term production. This EA analyzes potential impacts from the proposed exploration and testing activities at the CC and DM sites. Because both geothermal drilling projects have similar timing, geography, and types of actions, BLM has determined that the two proposals would be analyzed in one EA. The exploration activities are referred to as the Proposed Actions. The geothermal leases held by TGP for the CC exploration project contain 7,681 acres (CC lease area). The geothermal leases held by TGP for the DM exploration project contain 3,960 acres. The Proposed Action for DM also includes an area known as the Lamb Mineral Interests (760 acres). TGP owns the mineral rights for this land, along with the right to surface use in exercise of mineral rights. The U.S. Navy owns the land surface. Although the BLM does not have any jurisdiction to permit any surface activities, and no BLM action is required for exercise of these mineral rights, information on project activities there is included in this EA because they are part of the overall project described for Dixie Meadows.

TGP proposes to conduct geothermal exploration in a portion of each lease area called the project area. Figures 2 and 3 show the lease areas and project areas for each site. (All figures are provided at the end of this report.)

An Operations Plan to drill and test up to 15 explorations wells at the CC project area and to drill and test up to 15 exploration wells at the DM project area was submitted to the Bureau of Land Management (BLM), Stillwater Field Office (SFO) in September 2009. A revised Operations Plan was submitted in October 2009.

In addition to the exploration drilling program, mineral material sales contracts would be required for aggregate material obtained from BLM-managed gravel pits. These contracts (one for CC and one for DM) would be for less than 50,000 cubic yards of aggregate and less than 5 acres of subsurface disturbance each.

Individual Geothermal Drilling Permits (GDPs) would be issued separately from this document.

## Lease Areas and Rights of Way

Currently, four leases are committed to the existing Dixie Valley Unit, serial number NVN-43282X: NVN-61705, NVN-61707, NVN-17282, and NVN-17283A.

All of the CC project area and portions of the DM project area are located within the existing Dixie Valley Known Geothermal Resource (KGRA).

### Coyote Canyon

Leases held by TGP for the Proposed Action at Coyote Canyon are shown in Table 1. On October 23, 2009, TGP submitted applications for rights-of-ways (ROW) at CC to develop roads between TGP's separate geothermal leases. This off lease action will provide access to certain of the proposed exploration activities between lease numbers N-17282 and N-19283A, between lease numbers N-17283A and N-86892, lease numbers N-61707 and N-17282, and between lease numbers N-61705 and N-17282.

**TABLE 1**
CC Geothermal Leases

| Lease Number | Section Number | Township, Range | Dixie Valley KGRA |
|---|---|---|---|
| N-60687 | Section 2 | T24N, R36E | Yes |
| N-60688 | Sections 9 and10 | T24N, R36E | Yes |
| N-62956 | Sections 16 and 17 | T24N, R36E | Yes |
| N-86892 | Section 21 | T24N, R36E | Yes |
| N-17283A | Section 22 | T24N, R36E | Yes |
| N-17282 | Sections 14-15 and 23 | T24N, R36E | Yes |
| N-61705 | Section 24 | T24N, R36E | Yes |
| N-61707 | Sections 12 and 13 | T24N, R36E | Yes |

### Dixie Meadows

Leases held by TGP for the Proposed Action at Dixie Meadows are shown in Table 2. TGP submitted an application on October 23, 2009, for a ROW at DM to develop a road across public lands located off TGP's Geothermal Leases. This off lease action will provide access to certain of the proposed exploration activities. TGP also submitted (October 23, 2009) an application for a right-of-way at DM to develop roads between TGP's separate geothermal leases. This off lease action will provide access to certain of the proposed exploration activities between lease numbers N-60686 and N-60685.

**TABLE 2**
DM Geothermal Leases

| Lease Number | Section Number | Township, Range | Dixie Valley KGRA |
|---|---|---|---|
| N-60686 | Sections 17-20 | T22N, R35E | No |
| N-60685 | Sections 9-10 | T22N, R35E | Yes |
| | Sections 15-16 | | No |
| Lamb Mineral Interest* | Sections 5 and 8 | T22N, R35E | Yes |
| | Sections 17 - 19 | | No |

*TGP owns the mineral rights for this land along with the right to surface use in exercise of mineral rights. The U.S. Navy owns the land surface.

# 1.2 Purpose and Need

## 1.2.1 Purpose

The purpose of the Proposed Actions is to explore the geothermal energy production potential of federal lands managed by the BLM and leased by TGP This EA has been prepared by the BLM in accordance with NEPA to assess the potential for environmental impacts resulting from installation and testing of exploration wells at both the CC and DM sites that comprise the Proposed Actions. This EA serves to support the BLM in determining whether the Proposed Actions, with or without any modifications required by the BLM, would result in significant environmental impacts. Based on this determination, a Finding of No Significant Impacts (FONSI) could be made. Alternatively, if significant impacts have the potential to occur, the BLM could determine that an environmental impact statement (EIS) is required. In addition, this EA has been prepared to enable BLM to determine whether to grant a right-of-way to TGP to build the 0.2-mile road segment that is needed at DM to access the leased area from existing roads.

## 1.2.2 Need

In accordance with the BLM Programmatic Environmental Impact Statement (PEIS) for Geothermal Development (BLM, 2008a) and the Churchill County Master Plan (2005), the expansion and development of geothermal resources is supported and promoted for federal lands in this region in support of the need "to ensure jobs for our future with secure, affordable, and reliable energy. "as identified in the Energy Policy Act of 2005. Additionally, the need for the proposed action is to respond to EO 13212, which directs the BLM to process geothermal leases in a timely manner in order to support efforts to increase energy production from federal minerals, while preserving the health of public lands.

## 1.2.3 Authorizing Actions

Applications for geothermal drilling upon and rights-of-way across public land submitted to BLM may be approved only after an environmental analysis is completed. BLM decision options include approving one or both of the Proposed Actions as defined in geothermal drilling permit and right-of-way applications as submitted by TGP; approving one or both

of the Proposed Actions with stipulations to mitigate environmental impacts; or denying the Proposed Actions.

## 1.3 Land Use Plan Conformance Statement

The proposed action and alternatives described below are in conformance with the Carson City Field Office Consolidated Resource Management Plan, May 2001 page MIN-1, Management Action/Decision #1 (Geothermal Exploration), page MIN-1, Management Action/Decision #1 (Mineral Material Sales), and page ROW-1, Management Action/Decision #1 (Access Road Rights-of-Way)."

## 1.4 Relationship to Laws, Regulations, Policies, and Other Plans

The EA has been prepared in accordance with the following statutes and implementing regulations, policies, and procedures:

- NEPA of 1969, as amended (Public Law [PL] 91-190, 42 U.S.C. 4321 (*et seq*.)
- 40 CFR 1500 (*et seq*.). Regulations for Implementing the Procedural Provisions of NEPA
- Considering Cumulative Effects under NEPA (CEQ, 1997)
- 43 CFR Part 46, Implementation of NEPA of 1969; Final Rule, effective November 14, 2008
- U.S. Department of the Interior (USDI) requirements (Departmental Manual 516, Environmental Quality (USDI, 2008)
- BLM NEPA Handbook (H-1790 1), as updated (BLM, 2008b)
- The Geothermal Steam Act of 1970 (30 USC 1001-1025)
- 43 CFR 3200, Geothermal Resources Leasing and Operations; Final Rule, May 2, 2007
- The 2005 Energy Policy Act; The National Energy Policy, Executive Order 13212, and BMPs as defined in *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition* (Gold Book) (BLM, 2007a)
- The Geothermal Energy Research, Development, Demonstration Act of 1974
- Federal Land Policy and Management Act of 1976, as amended, section 501 [43 USC 1961]
- The Federal Land Policy and Management Act of 1976 (PL 94 579, 43 U.S.C. 1761 (et seq.);
- Rights-of-Way under the Federal Land Policy and Management Act and the Mineral Leasing Act (43 CFR 2880), final Rule, April 22, 2005
- Churchill County Master Plan (2005 Update)
- Carson City District NEPA Compliance Guidebook (Draft) (BLM 2008b)

- Mineral Material Disposals (43 CFR 3601)
- The Act of July 31, 1947, as amended (30 U.S.C. 601 et seq.)
- The U.S. Government is authorized to collect fees and to require reimbursement of its costs, as described in Section 304 of FLPMA [43 U.S.C. 1734] and the Independent Offices Appropriation Act of 1952 [31 U.S.C. 9701]
- *Rights-of-Way, Principles and Procedures; Rights-of-Ways under the Federal Land Policy and Management Act and the Mineral Leasing Act; final Rule April 22, 2005.* (43 CFR 2800)

In 2008, the BLM completed the PEIS for Geothermal Resources Leasing in the Western United States (BLM, 2008a). This PEIS was the foundation for a Record of Decision (ROD) and Resource Management Plan Amendments for Geothermal Resources Leasing in the Western United Stations, (BLM, 2008d). This ROD amended BLM Resource Management Plans, including the Carson City Consolidated RMP (2001), to identify public lands that are administratively and legally closed or open to leasing; and to develop a comprehensive list of stipulations, BMPs, and procedures to serve as consistent guidance for future geothermal leasing and development. Special stipulations developed in the ROD were applied to geothermal resource leases subsequently issued by BLM, including the federal geothermal lease (N-86892) issued to TGP for CC in 2009. The seven other leases for CC (N-17282, N-17283A, N-60687, N-60688, N-61705, N-61707, and N-62956), and the two leases for DM (N-60685 and N-60686) predate issuance of the ROD (BLM, 2008d). The DM leases and four of the leases for CC (N-60687, N-60688, N-61705, and N-62956) do not include any special stipulations relative to geothermal exploration. Copies of the stipulations for all eleven leases are attached to this EA as Appendix A. TGP is required to comply with all lease stipulations.

The Proposed Actions would be subject to other applicable state and local permits listed in Table 3 prior to beginning construction.

**TABLE 3**
List of Federal and State Permits

| Regulatory Agency | Authorizing Action |
|---|---|
| BLM | Access Road Right-of-Way |
| BLM | Notice of Intent |
| BLM | Geothermal Drilling Permit |
| BLM | Contract for the Sale of Mineral Materials |
| Nevada Division of Minerals | State Drilling Permit |
| Nevada Department of Environmental Protection – Bureau of Water Protection Control | Construction Stormwater Permit |
| Department of Conservation and Natural Resources, Nevada Division of Water Resources | Temporary Consumptive Water Use permit |
| Nevada Department of Conservation and Natural Resources, Division of Environmental Protection, Bureau of Air Pollution Control | Surface Area Disturbance Permit |
| BLM, Nevada Division of Historic Preservation and Archaeology | Section 106 compliance with the National Historic Preservation Act. |

SECTION 2

# Proposed Actions and Alternatives

This section presents the Proposed Actions and the No Action Alternative.

## 2.1 Proposed Action

TGP proposes to construct up to 15 wells pads at each project site and may drill up to three wells per pad for geothermal resource exploration. TGP would drill either small diameter explorations wells (slim wells) and/or full-size exploration wells (exploration wells). The primary objective of the project is to further evaluate the characteristics of the geothermal resources at the CC and DM project areas. The proposed action consists of:

- Constructing new access roads,
- Upgrading existing access roads,
- Constructing up to 15 well pads,
- Drilling and completing slim wells and/or exploration wells,
- Flow testing exploration wells to determine commercial potential,
- Constructing a temporary personnel camp.

TGP has identified 25 potential well pad sites; however, it is likely that not all potential sites would be drilled because a maximum of 15 wells would be drilled and up to three wells could be drilled per pad. This EA analyzes potential impacts from the proposed exploration and testing activities at both the CC and DM sites.

### 2.1.1 Overview and Location of Proposed Action

The project sites are located in Dixie Valley, Churchill County, Nevada. Figure 1 shows the project locations for both CC and DM.

The Proposed Actions include drilling up to 15 slim wells and/or exploration wells at each site. Slim wells would be to depths of up to 6,000 feet with a maximum diameter of up to 14 inches and exploration wells would be to depths of up to 10,000 feet with a maximum diameter of approximately 30 inches. Multiple wells could be drilled within the footprint of one well pad which would reduce the total number of well pads to be disturbed. Potential well pad locations and access roads have been placed based on geological information gathered at the sites and with a goal of minimizing environmental impacts. Each drill site would explore a specific geological target. Drill sites were proposed to avoid or minimize environmental issues or constraints identified through the environmental assessment process described in this report.

The wells would be used to provide lithologic and stratigraphic information and to measure the temperature and geochemistry of subsurface fluids at various depths in the wells. Well flow tests would be conducted on selected exploration wells to confirm resource production and generating capabilities and to identify eventual production and injection well top and bottom hole locations.

Following well installation, temperature gradients would be measured and performance testing would be completed in the slim wells and exploration wells. TGP would determine resource production and generating capabilities from the data collected. Drilling operations would be conducted in accordance with BLM and Nevada Division of Minerals (NDOM) regulations and permit requirements. If well conditions warrant changes to the design for completion of a well, any required approval from the responsible regulatory agency would be sought prior to making the changes.

The Proposed Actions also includes construction of access roads, drilling pads and a personnel camp at DM.

#### 2.1.1.1 Coyote Canyon

The CC lease area consists of approximately 7,681 acres in Churchill County, Nevada (Figure 2).

TGP proposes to conduct geothermal exploration in a portion of the lease area called the project area. The CC project area consists of 1,166 acres. Figure 2 shows the CC project area and potential site layout. To maintain flexibility in location of wells, TGP is proposing 25 potential well locations. However, no more than 15 wells would be drilled, resulting in disturbance to a maximum of 15 well pad locations. Specific well locations, potentially including up to three wells at a single drill pad, would be determined during field activities based on observations during drilling. No disturbance would occur at the remaining well pad locations.

The Proposed Action also involves the construction of access roads and drilling pads for conducting exploration drilling activities within the project area. Supporting facilities would also be constructed to support well drilling and testing. The well installation and road construction at the CC site would disturb approximately 73 acres. These facilities are described in Sections 2.1.3 and 2.1.5.

The legal description of the proposed exploration well pad locations at CC and the corresponding Kettleman well numbers is provided in Table 4.

**TABLE 4**
Coyote Canyon Exploration Well Pad Locations

| Lease Number | UTM X | UTM Y | Township Range | Section | Modified Kettleman |
|---|---|---|---|---|---|
| N-17282 | 421136.4936 | 4422630.6539 | 24N 36E | 15 | 24-15 |
| N-17282 | 421578.4295 | 4422878.1380 | 24N 36E | 15 | 42-15 |
| N-17282 | 421993.8492 | 4423046.0737 | 24N 36E | 15 | 61-15 |
| N-61705 | 424486.3676 | 4421428.5883 | 24N 36E | 24 | 31-24 |
| N-61705 | 424123.9802 | 4421181.1042 | 24N 36E | 24 | 12-24 |
| N-61705 | 424318.4320 | 4420862.9104 | 24N 36E | 24 | 24-24 |
| N-17282 | 423885.3348 | 4420456.3294 | 24N 36E | 23 | 86-23 |
| N-17282 | 423849.9799 | 4420076.2645 | 24N 36E | 23 | 88-23 |
| N-17282 | 422983.7856 | 4420686.1360 | 24N 36E | 23 | 35-23 |
| N-17282 | 423089.8502 | 4420367.9422 | 24N 36E | 23 | 47-23 |

**TABLE 4**
Coyote Canyon Exploration Well Pad Locations

| Lease Number | UTM X | UTM Y | Township Range | Section | Modified Kettleman |
|---|---|---|---|---|---|
| N-17282 | 422647.9143 | 4420146.9743 | 24N 36E | 23 | 28-23 |
| N-61707 | 424486.3676 | 4423638.2678 | 24N 36E | 12 | 26-12 |
| N-61707 | 424680.8194 | 4423541.0419 | 24N 36E | 12 | 37-12 |
| N-61707 | 424283.0771 | 4423373.1062 | 24N 36E | 12 | 18-12 |
| N-61707 | 424627.7871 | 4423072.5898 | 24N 36E | 13 | 31-13 |
| N-61707 | 424185.8512 | 4422886.9768 | 24N 36E | 13 | 12-13 |
| N-61707 | 424530.5612 | 4422745.5573 | 24N 36E | 13 | 33-13 |
| N-61707 | 424194.6899 | 4422568.7829 | 24N 36E | 13 | 14-13 |
| N-17282 | 422152.9461 | 4421923.5565 | 24N 36E | 15 | 77-15 |
| N-17283A | 421949.6556 | 4421534.6529 | 24N 36E | 22 | 61-22 |
| N-17283A | 421613.7844 | 4421596.5240 | 24N 36E | 22 | 51-22 |
| N-17283A | 421454.6875 | 4421260.6527 | 24N 36E | 22 | 42-22 |
| N-17283A | 421101.1387 | 4421402.0722 | 24N 36E | 22 | 22-22 |
| N-17283A | 420827.1385 | 4420915.9427 | 24N 36E | 22 | 14-22 |
| N-86892 | 420447.0736 | 4421013.1686 | 24N 36E | 21 | 74-21 |

The CC lease area includes approximately 7,681 acres (see Figure 2). Figure 2 also shows the proposed locations of access roads required to reach the potential well locations.

#### 2.1.1.2 Dixie Meadows

The DM lease area consists of approximately 3,960 acres of land leased by BLM, also in Churchill County, Nevada. In addition, exploration activities are proposed on property owned by the U.S. Navy for which TGP holds the mineral rights. This 760-acre parcel is titled “Lamb Mineral Interests” and is shown on Figure 3.

TGP proposes to conduct geothermal exploration in a portion of the lease area called the project area. The DM project area consists of 1,369 acres within the DM lease area. DM project activities also could be conducted within a 47-acre portion of the Lamb Mineral Interests property. Figure 3 shows the DM project area and potential site layout. To maintain flexibility in location of wells, TGP is proposing 27 potential locations at DM (plus one potential location on the Lamb Mineral Interests property). However, no more than 15 wells would be drilled, resulting in disturbance to a maximum of 15 well pad locations. Specific well locations, potentially including multiple wells at a single drill pad, would be determined during field activities based on observations during drilling. No disturbance would occur at the remaining well pad locations.

The Proposed Action also involves the construction of access roads and drilling pads for conducting exploration drilling activities within the project area. Supporting facilities also would be constructed to support well drilling and testing. The well installation and road

construction at the DM site would disturb approximately 68.6 acres, plus up to 4 acres at the Lamb Mineral Interests property.

The legal description of the proposed drill pads and Kettleman well numbers at DM is provided in Table 5. The DM lease area includes approximately 3,960 acres, in addition to 760 acres at Lamb Mineral Interests (Figure 3). Figure 3 also shows the proposed locations of access roads required to reach the potential well locations.

**TABLE 5**
Dixie Meadows Exploration Well Pad Locations

| Lease Number | Description | UTM X | UTM Y | Township Range | Section | Modified Kettleman |
|---|---|---|---|---|---|---|
| N-60685 | Well Pad | 412164.5992 | 4403284.0597 | 22N 35E | 15 | 74-15 |
| N-60685 | Well Pad | 411935.5075 | 4403548.9469 | 22N 35E | 15 | 63-15 |
| N-60685 | Well Pad | 411326.9829 | 4403541.7878 | 22N 35E | 15 | 33-15 |
| N-60685 | Well Pad | 411112.2096 | 4403241.1050 | 22N 35E | 15 | 25-15 |
| N-60685 | Well Pad | 410675.5037 | 4403054.9681 | 22N 35E | 16 | 86-16 |
| N-60685 | Well Pad | 410883.1179 | 4402654.0578 | 22N 35E | 15 | 18-15 |
| N-60685 | Well Pad | 411369.9376 | 4402668.3760 | 22N 35E | 15 | 37-15 |
| N-60685 | Well Pad | 411778.0071 | 4402675.5351 | 22N 35E | 15 | 57-15 |
| N-60686 | Well Pad | 412207.5538 | 4402661.2169 | 22N 35E | 15 | 77-15 |
| N-60685 | Well Pad | 411756.5297 | 4403026.3316 | 22N 35E | 15 | 56-15 |
| N-60685 | Well Pad | 411706.4159 | 4403276.9006 | 22N 35E | 15 | 54-15 |
| N-60685 | Well Pad | 410002.5471 | 4405546.3394 | 22N 35E | 9 | 42-9 |
| N-60685 | Well Pad | 409923.7968 | 4405159.7473 | 22N 35E | 9 | 43-9 |
| N-60685 | Well Pad | 409830.7283 | 4404816.1099 | 22N 35E | 9 | 45-9 |
| N-60685 | Well Pad | 409744.8190 | 4404443.8360 | 22N 35E | 9 | 37-9 |
| N-60685 | Well Pad | 409587.3185 | 4403899.7434 | 22N 35E | 16 | 32-16 |
| N-60685 | Well Pad | 409458.4545 | 4403541.7878 | 22N 35E | 16 | 23-16 |
| N-60685 | Well Pad | 409336.7496 | 4403176.6730 | 22N 35E | 16 | 15-16 |
| N-60685 | Well Pad | 409179.2491 | 4402775.7627 | 22N 35E | 16 | 17-16 |
| N-60686 | Well Pad | 408935.8392 | 4402260.3066 | 22N 35E | 20 | 82-20 |
| N-60686 | Well Pad | 408749.7023 | 4401938.1465 | 22N 35E | 20 | 73-20 |
| N-60686 | Well Pad | 408542.0880 | 4401666.1002 | 22N 35E | 20 | 65-20 |
| N-60686 | Well Pad | 408277.2008 | 4401351.0992 | 22N 35E | 20 | 56-20 |
| N-60686 | Well Pad | 407962.1999 | 4401093.3712 | 22N 35E | 20 | 38-20 |
| N-60685 | Well Pad | 409709.6076 | 4405422.6012 | 22N 35E | 9 | 32-9 |
| N-60685 | Well Pad | 409287.2199 | 4403582.7092 | 22N 35E | 16 | 13-16 |
| N-60686 | Well Pad | 408163.2392 | 4401434.9753 | 22N 35E | 20 | 46-20 |
| Lamb Mineral Interests | Well Pad | 409447.0845 | 4405991.1894 | 22N 35E | 4 | 28-4 |

Access to the DM project area would require construction of a new road from the existing dirt road to the lease boundary. At both CC and DM, access roads between individual TGP geothermal leases would be constructed. TGP submitted a right-of-way application (SF 299) for the access road outside the DM lease area and for access roads between TGP leases within CC and DM on October 23, 2009. Within each of the project areas, branch roads, where not already in existence, would be constructed to each individual exploration well

site/drill pad off the main access road. Well construction and access roads are discussed in detail in Sections 2.1.3 and 2.1.4.

## 2.1.2 Schedule of Exploration Activities

### 2.1.2.1 Coyote Canyon

The applicant proposes to start exploration drilling activities as soon as possible following BLM approval and NDOM permit issuance. The exploration drilling activities would be completed within 2 years of permit issuance. Reclamation activities would be conducted as described in Section 2.1.9 over an approximately 3-year period following completion of drilling and testing.

### 2.1.2.2 Dixie Meadows

Exploration drilling activities at Dixie Meadows would begin within approximately one year of issuance of the NDOM permit, and would be completed within 2 years of permit issuance, commensurate with the NDOM permit. Reclamation activities would be conducted as described in Section 2.1.10 over an approximately 3-year period following completion of drilling and testing.

## 2.1.3 Site Access and Road Improvements

Existing access roads would be used to the extent possible, and upgraded as necessary to support construction and operational vehicle traffic. The primary access to the leased areas would be via U.S. Route 50. From Route 50, Highway 121 leads to the leased areas. Access roads, where not already in existence, would be provided to interconnect the different lease parcels. Branch access roads of the same width and design as the main access road would be constructed to each of the well pad sites. New access roads would be constructed as part of each Proposed Action according to the following specifications:

- Roads would be 25 feet wide, including travel way, shoulders, and drainage ditches. Roadways would have a travel way of 15 feet with 2-foot shoulders and 3-foot drainage ditches on either side. Road designs, including road cross section and crowns, culvert designs and placement, and road plans and profiles would be executed in keeping with the BLM's Gold Book standards (BLM, 2007a).
- Aggregate would be applied to the approximately 19-foot-wide travel way and to road shoulders, with an average of 6 inches of aggregate base course as necessary.
- Turnouts would be located approximately every 1,000 feet and be mutually visible. Turnouts would be 100 feet long and 12 feet wide, with 21-foot transitions on each end of the turnout.
- Rolling dips would be installed as needed along new access roads in areas of low spots or existing ditches. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. The exact locations of rolling dips have not been determined, but would be provided to the BLM when the final design is complete.
- The roads would be graded to follow existing topography to minimize cut-and-fill requirements.

Specific requirements for each project area are described below.

#### 2.1.3.1 Coyote Canyon

Up to 9.6 miles (50,754 linear feet) of main and branch access roads would be constructed at CC for a total disturbance of up to 30.3 acres as shown in Table 6.

Table 6 includes all potential disturbed areas at the CC project area. A description of well pads is provided in Section 2.1.8 below.

**TABLE 6**
Summary of Disturbed Acreage by Lease Number for Coyote Canyon

| Disturbance Type | Length of Access Roads (feet) | Length of Branch Roads (feet) | Dimensions of Disturbed Area | Number of Turnouts | Acres Disturbed[c] |
|---|---|---|---|---|---|
| Exploration Well Pad Footprint (Total of 15 Wells)[a] | NA | NA | 350 × 350 feet (2.8 acres each) | NA | 42.2 |
| Non-potable Water Exploratory Well Pad | NA | NA | 150 × 150 feet | NA | 0.5 |
| Lease N-17282 Main Access and Branch Roads[b] | 26,233 | 5,600 | 31,833 × 25 feet | 26 | 19.1 |
| Lease N-17283A Main Access and Branch Roads[b] | 8,271 | 1,404 | 9,675 × 25 feet | 8 | 5.8 |
| Lease N-61707 Main Access and Branch Roads[b] | 3,354 | 2,837 | 6,191 × 25 feet | 3 | 3.6 |
| Lease N-61705 Main Access Road and Branch Roads[b] | 0 | 2,071 | 2,071 × 25 feet | 0 | 1.2 |
| Lease N-86892 Main Access and Branch Roads[b] | 984 | 0 | 984 × 25 feet | 1 | 0.6 |
| **Total Disturbed Acreage** | | | | | **73.0** |

[a] The well pad dimensions include space for storage of drilling equipment, drilling vehicles, and storage of topsoil and spoil material. Laydown areas that would be required for drilling operations would be located on each of the well pads as indicated on Figure 4.
[b] Total disturbed acreage for the roads includes (1) the approximate length of the new roads from the closest existing road to the well pad served by the road and (2) turnouts (12 by 100 feet) be located approximately every 1,000 feet along access roads. Each turnout measures 12 by 100 feet with 21-foot transitions at each end.
[c] The exact location for the turnouts and roads within each lease area would be verified using GPS and submitted to the BLM before construction.

NA = not applicable

#### 2.1.3.2 Dixie Meadows

Approximately 8.9 miles (46,853 linear feet) of access road would be constructed on BLM-managed public land, disturbing approximately 28.2 acres. In addition, approximately 0.2 miles (1,182 linear feet) of access road would be constructed on BLM-managed public lands between Highway 121 and the leased area, with an associated disturbance of approximately 0.7 acres. The total disturbance due to construction of access roads on BLM-managed public land would be approximately 28.9 acres as shown in Table 7.

Access to the potential well pad location on the Lamb Mineral Interests property would require construction of a road approximately 0.4 miles (1,939 feet) long. Construction of this road would disturb approximately 1.2 acres on the Lamb Mineral Interests property.

Table 7 includes all potential disturbed areas at the DM project area. A description of well pads is provided in Section 2.1.8 below.

**TABLE 7**
Summary of Disturbed Acreage by Lease Number for Dixie Meadows

| Disturbance Type | Length of Access Roads (feet) | Length of Branch Roads (feet) | Dimensions of Disturbed Area | Number of Turnouts | Acres Disturbed[c] |
|---|---|---|---|---|---|
| Exploration Well Pad Footprint (Total of 14 Wells on BLM-managed public land)[a] | NA | NA | 350 × 350 feet (2.8 acres each) | NA | 39.2 |
| Non-potable Water Exploratory Well Pad | NA | NA | 150 × 150 feet | NA | 0.5 |
| Off-lease Main Access Road[b] | 1,182 | 0 | 1,182 × 25 feet | 1 | 0.7 |
| Lease N-60685 Main Access and Branch Roads[b] | 26,152 | 5,459 | 31,611 × 25 feet | 26 | 19.0 |
| Lease N-60686 Main Access and Branch Roads[b] | 14,216 | 1,026 | 15,242 × 25 feet | 14 | 9.2 |
| **Total Disturbed Acreage (BLM-Managed Public Land):** | | | | | **68.6** |
| Exploration Well Footprint (Total of 1 Well on Lamb Mineral Interests property)[d] | NA | NA | 350 x 350 feet (2.8 acres each) | NA | 2.8 |
| Lamb Mineral Interests Main Access and Branch Roads[b, d] | 1,939 | 0 | 1,939 × 25 feet | 2 | 1.2 |
| **Total Disturbed Acreage (Lamb Mineral Interests):** | | | | | **4.0** |

[a] The well pad dimensions include space for storage of drilling equipment, drilling vehicles, and storage of topsoil and spoil material. Laydown areas that would be required for drilling operations would be located on each of the well pads as indicated on Figure 4.
[b] Total disturbed acreage for the roads includes (1) the approximate length of the new roads from the closes existing road to the well pad served by the road and (2) turnouts (12 by 100 feet) be located approximately every 1,000 feet along access roads. Each turnout measures 12 by 100 feet with 21-foot transitions at each end.
[c] The exact location for the turnouts and roads within each lease area would be verified using GPS and submitted to the BLM before construction.
[d] The acreage of disturbance on the Lamb Mineral Interests property is included for completeness. However, no NEPA decision is required for this action.

Note:

NA = not applicable

## 2.1.4 Land Ownership and Rights of Way

The exploration wells and access roads at DM and CC would be located on land primarily administered by the BLM and leased for exploration activities to TGP.

### 2.1.4.1 Coyote Canyon

Because Highway 121 passes through the CC site, no new access roads outside the existing lease areas would be needed.

TGP has submitted applications for ROW at CC to develop eight roads between TGP's separate geothermal leases (October 23, 2009). This off lease action will provide access to certain of the proposed exploration activities between lease numbers N-17282 and N-19283A, between lease numbers N-17283A and N-86892, lease numbers N-61707 and N-17282, and between lease numbers N-61705 and N-17282 (Figure 2).

An approximately 0.2 mile of new off lease road section would allow access to proposed well 51-22 as follows:

- Beginning off of existing Highway 121 and traveling southeasterly through the SE¼SW¼ of Section 15, T24N, R36E; and
- Terminating at the NE¼NW¼ of Section 22, T24N, R36E, the northern boundary of lease N-17283A.

An approximately 0.7 mile of new off lease road section would allow access to proposed well 35-23 as follows:

- Beginning at the northern boundary of NE¼NW¼ of Section 22 T34N, R36E and traveling about 0.4 mile southeasterly through the N½ of Section 22, T24N, R36E and then traveling about 0.3 mile easterly through S½NE¼ of Section 22, T24N, R36E; and
- Terminating at the SW¼NW¼ of Section 23, T24N, R36E, the eastern boundary of lease N-17282.

An approximately 0.6 mile of new off lease road section would allow access to proposed well 74-21 as follows:

- Beginning at the NE¼NW¼ of Section 22, T24N, R36E, and traveling southwesterly through the NW¼ of Section 22, T24N, R36E; and
- Terminating at the SE ¼ NE ¼ of Section 21, T24N, R36E, the eastern boundary of lease N-86892.

An approximately 0.2 mile of new off lease road section would allow access to proposed well 77-15 as follows:

- Beginning at the NW¼NE¼ of Section 22, T24N, R36E and traveling northeasterly through the NW ¼ NE ¼ of Section 22, T24N, R36E; and
- Terminating at the SW¼SE¼ of Section 15, T24N, R36E.

An approximately 1.6 miles of new off lease road section would allow access to proposed well 14-13 as follows:

- Beginning at the SW¼SE¼ of Section 15, T24N, R36E and traveling about 0.3 mile northerly through the S½SE¼ of Section 15, T24N, R36E and then traveling about 1.3 miles northeasterly through Section 15, T24N, R36E; and
- Terminating at the SW¼NW¼ of Section 13, T24N, R36E.

An approximately 1.3 miles of new off lease road section would allow access to proposed well 24-24 as follows:

- Beginning at the SW¼NW¼ of Section 23, T24N, R36E and traveling about 0.3 miles easterly through the W¼ of Section 23, T24N, R36E and traveling about 0.1 mile southerly through the NE¼SW¼ of Section 23, T24N, R36E and traveling about 0.5 miles generally easterly through the S½ of Section 23, T24N, R36E and traveling about 0.3 mile northeasterly through the E¼ of Section 23, T24N, R36E and traveling about 0.1 mile easterly through the SE¼NE¼ of Section 23, T24N, R36E; and
- Terminating at the SW¼NW¼ of Section 24, T24N, R36E.

An approximately 0.2 mile of new off lease road section would allow access to proposed well 12-24 as follows:

- Beginning at the SE¼NE¼ of Section 23, T24N, R36E and traveling northerly through the SE¼NE¼ of Section 23, T24N, R36E and easterly through the E½NE¼ of Section 23, T24N, R36E; and
- Terminating at the W½NW¼ of Section 24, T24N, R36E.

An approximately 0.2 mile of new off lease road section would allow access to proposed well 31-24 as follows:

- Beginning at the E½NE¼ of Section 23, T24N, R36E and traveling northerly through the NE¼NE¼ of Section 24, T24N, R36E and easterly through the NE¼NE¼ of Section 24, T24N, R36E; and
- Terminating at the NW¼NW¼ of Section 24, T24N, R36E.

The total length for the requested ROWs for the CC lease area is approximately 5.0 miles.

#### 2.1.4.2 Dixie Meadows

DM traffic would be routed from Highway 121 to the west via a proposed new access road, as shown on Figure 3. A portion of this road, approximately 0.2 mile, would be constructed outside the existing lease area (Figure 3). TGP has submitted a ROW application at DM to develop a road across public lands located off TGP's Geothermal Leases (October 23, 2009). This off lease action would provide access to certain of the proposed exploration activities.

An approximately 0.2 mile of new off lease road section would allow access to geothermal lease N-60686 as follows:

- Beginning off of existing Highway 121 and traveling southeast through the NW¼NE¼ of Section 18, T22N, R34E; and
- Terminating at the NE¼NE¼ of Section 18, T22N, R34E, the northern boundary in Section 18, T22N, R34E of lease N-60686.

TGP also submitted ROW applications at DM to develop three roads between TGP's separate geothermal leases (October 23, 2009). This off lease action would provide access to certain of the proposed exploration activities between lease numbers N-60686 and N-60685 and the Lamb Mineral Interest lease.

An approximately 0.3 mile of new road section would allow access from geothermal lease N-60686 to the Lamb Mineral Interest Lease as follows:

- Beginning where the new "off lease" access road terminates at the northern boundary of Section 18, T22N, R34E and traveling southeasterly through the SE¼NE¼ of Section 18, T22N, R34E; and
- Terminating at the NW¼SW¼ of Section 17, T22N, R34E, the northwestern boundary of the Lamb Mineral Interest lease.

An approximately 1.0 mile of new road section would allow access from geothermal lease N-60686 to proposed well number 17-16 as follows:

- Beginning on the northern boundary of the SW¼SW¼ of Section 17, T22N, R34E and traveling easterly through the S¼ of Section 17, T22N, R34E; and
- Terminating at the SE¼SE¼ of Section 17, T22N, R34E, the eastern boundary of lease N-60686.

An approximately 2.0 miles of new road section would allow access from geothermal lease N-60685 to proposed well 28-4 as follows:

- Beginning on the western boundary of the SW¼SW¼ of Section 16, T22N, R34E and traveling about 1.7 miles northerly through the W¼ of Section 16, T22N, R34E and northerly through the W ½ of Section 9, T22N, R34E to well 42-9 and about 0.3 mile northwesterly through the N½NW¼ of Section 9, T22N, R34E; and
- Terminating at the SW¼SW¼ of Section 4, T22N, R34E, the southern boundary of the Lamb Mineral Interest.]

The total length for the requested ROWs for the DM lease area is approximately 3.5 miles.

At DM, a portion of the project area (Lamb Mineral Interests) extends into land owned by the Navy. The mineral rights with surface use for this land were purchased by Oxbow Geothermal in 1988 and subsequently acquired by Nevada Power Vestors (a wholly owned subsidiary of TGP). The deed for mineral rights includes a provision for surface access and no additional rights are required to develop this resource.

## 2.1.5 Site Preparation Activities

Site preparation activities would include setup of a personnel camp and transport and staging of equipment required for exploratory drilling. Staging areas would be established at the Personnel Camp and at the initial well pad locations. In addition, measures would be set up to ensure proper management of hazardous materials and wastes that would be used and generated during implementation of the Proposed Actions. These measures would be the same for both CC and DM.

### 2.1.5.1 Personnel Camp

During drilling operations at both CC and DM, a temporary worker camp would be set up at an existing graded area located within the CC lease area to provide accommodations for drill crews and subcontractors. The existing graded area, which was developed as part of the existing Terra-Gen Dixie Valley geothermal power plant, is located between proposed

Wells 75-15 and 14-13. An existing road would be used to gain access to the camp. The location of the personnel camp is depicted in Figure 2. Because this area has previously been graded and prepared, no additional area would be disturbed for use of the personnel camp.

The camp would comprise self-contained trailers used for offices and prefabricated modules (estimated size up to 12 by 60 feet) for lodging. The camp would typically comprise one to two sleeping modules with a centralized kitchen, dining, and recreational area. The camp components would be transported to the site by trailer along the existing access road and proposed access roads. Up to two portable water tanks would supply water for sanitary use, and drinking water would be bottled water. Sanitary storage tanks would be provided as part of the modules and would be periodically serviced by a commercial entity. Electricity would be provided by up to two portable generators. Because the camp would be placed on an existing disturbed area, no new surface grading would be required to create the camp.

Communication among field operations, TGP offices, BLM, and NDOM offices would be maintained using radio and satellite telephones. Support facilities and equipment would be located on the personnel camp pad.

#### 2.1.5.2 Equipment

Each drill site would be prepared to create a level pad for the drill rig and a graded surface for the support equipment. Support equipment used during exploratory drilling activities includes:

- Standby and start-up diesel generator
- Air compressors
- Geothermal rotary drilling rigs
- Personnel vehicles (pick-up trucks)
- Construction equipment, including dump trucks, road graders, and bulldozers

#### 2.1.5.3 Staging Areas

Equipment and supplies required for implementation of the Proposed Actions would be staged either at the Personnel Camp, at the active well pad, or at an inactive well pad location. No additional areas would be disturbed beyond those shown in Tables 6 and 7. In particular, no more than 15 well pad locations would be disturbed either by construction of well pads or by temporary use as staging areas.

#### 2.1.5.4 Waste and Hazardous Materials Management

Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations. Additionally, absorbent pads or sheets would be placed under likely spill sources and spill kits would be maintained onsite during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.

Small quantities of solid wastes (paper, plastic, and other garbage) generated by the Proposed Actions would be transported offsite to an appropriate landfill facility. Portable chemical toilet wastes would be removed by a local contractor.

A project hazardous material spill and disposal contingency plan would describe the methods for cleanup and abatement of any petroleum hydrocarbon or other hazardous material spill. The hazardous material spill and disposal contingency plan would be submitted to and approved by the BLM and made readily available onsite before operations begin.

Handling, storage, and disposal of hazardous materials, hazardous wastes, and solid wastes would be conducted in conformance with federal and state regulations to prevent soil, groundwater, or surface water contamination and associated adverse effects on the environment or worker health and safety.

The following measures would be taken to prevent the spread of invasive, non-native species:

- Clean construction equipment prior to project work (may be washed in Fallon prior to deployment)
- Avoid or treat existing weed infestations prior to disturbance.
- Any areas that become infested with weeds during construction would be mapped and treated.

## 2.1.6 Aggregate Supply for Road and Pad Construction

Where needed, TGP would obtain aggregate material for the road and well pad surfaces at DM and CC from pits near the project sites, such as the BLM Cottonwood Canyon Pit. Aggregate obtained from private sources may also be considered. Potential aggregate source locations are shown on Figure 2. In addition to the exploration drilling program, mineral material sales contracts would be required for aggregate material obtained from BLM-managed gravel pits. These contracts (one for CC and one for DM) would be for less than 50,000 cubic yards of aggregate and less than 5 acres of subsurface disturbance each. TGP would acquire approval from BLM prior to use of aggregate under categorical exclusions from BLM pits. Tables 8 and 9 summarize the anticipated access road and well pad aggregate needs for CC and DM, respectively.

### 2.1.6.1 Coyote Canyon

**TABLE 8**
Summary of Aggregate Requirements for Coyote Canyon

| | Length | Width | Depth | Aggregate | Total Aggregate |
|---|---|---|---|---|---|
| CC Access Roads (includes branch roads) | 9.6 miles | 19 feet | 6 inches | 1,967 $yd^3$/mile | 18,905 $yd^3$ |
| CC Observation Well Pads Centerline (15) | 110 feet | 350 feet | 8 inches | 951 $yd^3$/pad | 14,265 $yd^3$ |
| CC Well Footprints (15) | 40 feet | 40 feet | 18 inches | 89 $yd^3$/well | 1,335 $yd^3$ |
| **Total Aggregate for CC** | | | | | **34,505 $yd^3$** |

$yd^3$ = cubic yard

### 2.1.6.2 Dixie Meadows

**TABLE 9**
Summary of Aggregate Requirements for Dixie Meadows

| | Length | Width | Depth | Aggregate | Total Aggregate |
|---|---|---|---|---|---|
| DM Access Roads (includes branch roads) on BLM Lands | 41,550 feet | 19 feet | 6 inches | 1,967 $yd^3$/mile | 15,479 $yd^3$ |
| DM Observation Well Pads Centerline on BLM Lands (14) | 110 feet | 350 feet | 8 inches | 951 $yd^3$/pad | 13,314 $yd^3$ |
| DM Well Footprints on BLM Lands (14) | 40 feet | 40 feet | 18 inches | 89 $yd^3$/well | 1,246 $yd^3$ |
| **Total Aggregate for DM – BLM Lands** | | | | | **34,336 $yd^3$** |
| DM Access Roads (includes branch roads) on Lamb Mineral Interests* | 1,939 feet | 19 feet | 6 inches | 1,967 $yd^3$/mile | 722 $yd^3$ |
| DM Observation Well Pads Centerline on Lamb Mineral Interests (1)* | 110 feet | 350 feet | 8 inches | 951 $yd^3$/pad | 951 $yd^3$ |
| DM Well Footprints on Lamb Mineral Interests (1)* | 40 feet | 40 feet | 18 inches | 89 $yd^3$/well | 89 $yd^3$ |
| **Total Aggregate for DM – Lamb Mineral Interests** | | | | | **1,762 $yd^3$** |

$yd^3$ = cubic yard

* Aggregate requirements for Lamb Mineral Interests properties are included for completeness. However, these activities are not subject to BLM action.

## 2.1.7 Water Supply for Grading and Drilling

Water would be required for drilling operations and for construction and compaction of roads, pads, reserve pits, and dust control. Up to 20,000 gallons per day could be required for each exploration well throughout the 8-week period in which drilling would occur. Slim wells would require less. One or more portable water tanks holding a combined total of at least 10,000 gallons but not more than 60,000 gallons would be maintained on the well sites during drilling activities. TGP would obtain water from TGP's nearby existing Terra-Gen Dixie Valley geothermal power facility and truck it to the DM and CC project sites, as needed.

TGP would also install two non-potable water exploratory wells, one at DM and one at CC, to determine the availability of water and the quality of available water for future activities under waiver for the temporary use of groundwater from the Nevada Department of Water Resources. Water wells would be temporary, drilled by a licensed water well driller, and plugged and abandoned in accordance with NAC 534.420. The surficial groundwater aquifer is expected to be at a depth of up to 500 feet below ground surface. The non-potable water exploratory well would be permitted with the Nevada Division of Water Resources (NDWR) before drilling. TGP would locate each exploratory well within the project area. It is estimated that a pad measuring 150 by 150 feet (0.5 acre) would be required to support drilling for each water supply well. In addition, a reserve pit for drill cuttings and pump test water would be required. The reserve pit would measure approximately 50 feet long by 15

feet wide by 10 feet deep. The exact location of each water supply well has not been determined, but each would be located in the project areas. The nonpotable well reserve pits would be maintained subsequent to drilling for the storage of non-potable water to use for activities such as dust suppression. No new roads would need to be constructed to install the water supply wells.

## 2.1.8 Well Pad and Drilling Operations

This section describes construction of well pads, which would be constructed at each location where slim wells and/or exploration wells would be drilled, along with a summary of the drilling process. Well pad construction and drilling processes would be the same at both CC and DM.

### 2.1.8.1 Well Pad Layout and Design

Figure 4 shows a typical well pad layout for slim wells and exploration wells. Each well pad would be 350 by 350 feet. The well pad would accommodate the drilling rig, reserve pit, and support equipment and vehicles necessary during drilling. Exact dimensions and orientations of the individual well pads would be determined by engineers in the field prior to construction to best match the physical and environmental characteristics of the specific site and to minimize grading. The proposed well pad locations are in the relatively flat Dixie Valley with topography that gently slopes southeast toward the Humboldt Salt Marsh (Figures 2 and 3). Because of the existing suitable topography, well pads would not be constructed on steep slopes or narrow ridges. Any fill slopes potentially constructed as a part of well pad grading would be designed with a maximum slope of 2 horizontal to 1 vertical. Slopes would be compacted and maintained to minimize erosion and provide slope stability. The natural washes within the DM and CC lease areas are ephemeral, with intermittent flows only from substantial rainfall or snowmelt events. The well pads would be constructed to avoid the ephemeral washes to the extent practicable. The well pads would be graded so that cut-and-fill requirements would be balanced and no offsite fill material would be needed.

After the well pad area has been graded and spoils from the well pad reserve pit excavation have been laid down for leveling, an average of 8 inches of gravel would be placed over the areas where the drilling work would be conducted, an area of approximately 110 by 350 feet. The well footprint (40 by 40 feet) would require additional stabilizing for heavier equipment and would receive an additional 10 inches (for a total average of 18 inches) of compacted aggregate (Figure 4).

A reserve pit would be excavated on each well pad for the storage of drilling muds and fluids, flow test fluids, and drill cuttings in accordance with the applicable BMPs identified in the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development Activities* (Gold Book) (BLM, 2007a). Each reserve pit would have up to 1 million gallons of capacity and the interior would measure approximately 320 feet long, 125 feet wide, and a minimum of 5.34 feet deep below grade, including at least 2 feet of freeboard. The actual excavation depth for each reserve pit would be determined based on the depth to groundwater to ensure that the bottom of the reserve pit is above the standing water level. Reserve pits would be compacted during construction, and settled bentonite clay from drilling mud would accumulate on the bottom of the reserve pit to act as an unconsolidated clay liner to minimize percolation. A berm would be constructed around the outer edges of

the reserve pit. The berm would measure approximately 4 feet wide by 2 feet tall. Material from reserve pit excavation would be used in the construction of the berm. Stormwater runoff from undisturbed areas around the constructed drill pads would be directed into ditches surrounding the well pad and back onto undisturbed ground consistent with BMPs for stormwater. Each well pad would be graded to prevent the movement of stormwater from the constructed site. Topsoil and spoils from the excavated reserve pit would be stockpiled on the well pad laydown area.

During active drilling, each well pad would include pipe racks, temporary water storage tanks, a fuel storage area with secondary containment, and chemical toilets.

Depending on well production rates identified during flow testing, additional sump capacity may be required. To provide this capacity, TGP would use existing sumps at its Dixie Valley geothermal power plant located approximately 2.5 miles north of the CC site and approximately 10.5 miles north of the DM site along Dixie Valley Road. Excess fluids from flow testing each well would be trucked to the reserve pits at the Dixie Valley site.

Fencing, netting, or other measures would be provided in accordance with Gold Book standards at each well pad to prevent access to the pits and well pad drilling areas by wildlife, domestic livestock, and the public (BLM, 2007a).

#### Well Pad Disturbed Areas

The Proposed Actions include development of up to 15 slim and/or exploration wells in each project area. Figures 2 and 3 show potential locations for the wells at CC and DM. Revisions to the specific proposed well locations within the project areas could occur as new information becomes available from initial drilling and testing results. Disturbance calculations for each well pad shown in Tables 6 and 7 include staging and laydown requirements for equipment, supplies, and stockpiled soil and aggregate required for well drilling and access road construction. No additional disturbance would occur for staging and storage requirements.

##### *Coyote Canyon*

Construction of each of the well pads would disturb up to 2.8 acres, for a total of up to 42.2 acres of disturbance for the 15 wells at Coyote Canyon. Table 6 presents the acreage of disturbance associated with exploration well pads, including staging areas.

##### *Dixie Meadows*

Up to 39.6 acres would be disturbed for construction of the well pads on BLM-managed public land at Dixie Meadows. Up to 2.8 additional acres would be disturbed on the Lamb Mineral Interests property. Table 7 presents the acreage of disturbance associated with well pads, including staging areas.

### 2.1.8.2 Drilling Operations

A detailed geothermal drilling program would be submitted to the BLM for review and approval prior to beginning operations. This section summarizes drilling activities for slim wells and exploration wells for purposes of evaluating potential environmental consequences. If necessary, the BLM may include additional provisions or conditions needed to address environmental concerns or other site-specific issues with the geothermal drilling permit.

Each well would be drilled using a large diesel rotary drilling rig with a power rating ranging from 1,000 to 3,000 horsepower. During drilling, the top of the drill rig derrick would be up to 160 feet above the ground surface, depending on the rig used. The typical drill rig and associated support equipment (rig floor and stands; draw works; mast; drill pipes; trailers; mud, fuel, and water tanks; diesel generators; air compressors) would be brought to the prepared pad on seven to ten large tractor-trailer trucks. An average of six to eight small trucks/service vehicles/workers' vehicles could be driven to the active well site each day throughout the typical 8-week drilling process. Site-specific conditions encountered during the drilling process, including the need to work over or to re-drill the hole, could double the time necessary to complete a full-size exploration well. Drilling would be conducted 24 hours per day, 7 days per week by a crew of up to 12 workers per well. Typically, one drill rig would be onsite at a time but TGP may choose to drill up to three wells at once, bringing the total crew to as many as 36. Crews would include the drilling supervisor, geologists, suppliers, and operators.

Well stimulation operations could involve placing a dilute mixture of hydrochloric (muriatic) acid down the well. The amount of dilute acid placed in the well bore (which can vary from 10,000 gallons to 50,000 gallons or more) is determined by calculating the amount of each type of mineral to be dissolved. Concentrated (35%) hydrochloric acid would be trucked to the site and mixed onsite with water by experienced contractors. The dilute acid mixture is placed in the cased well bore, followed by water to push the mixture into the geothermal reservoir. After dissolving the minerals in the geothermal reservoir, the water and now-spent acids are flowed back through the well to the surface where they are tested, neutralized if necessary (using sodium hydroxide or crushed limestone or marble), and discharged to the reserve pit.

Standard aquifer testing procedures would be employed at targeted depth intervals as the boreholes for exploration wells are advanced. The vertical boundaries of the aquifers, the depth of aquifers (non-thermal and thermal) penetrated during drilling, would be noted from the drilling log. The horizontal boundaries would be noted if any are reflected on time-drawdown plots produced during aquifer testing. Borehole geophysics analysis would be conducted from the ground surface to the total depth of the borehole. Aquifer testing would be used to determine drawdown associated with pumping. If possible, an assessment of whether the aquifer is confined or unconfined would be made, as well as an estimate of aquifer thickness and a qualitative assessment of its relative productivity. The temperature of penetrated aquifers would be noted.

Upon completion of the drilling operations, clean-out and flow tests would be performed on the wells. Flow testing would typically run for an average of 3 days (24 hours a day) for each well, but the duration may vary depending on well characteristics. During these tests, the flow would be routed to the reserve pits. It is anticipated that the initial flow rates of fluid from each well into its reserve pit would be approximately 500 to 1,500 gallons per minute, on average, depending on the productivity of the well.

Selected seeps and springs, determined in consultation with BLM, would be monitored for basic water quality, flow, and temperature prior to and during the Proposed Actions.

Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations. Additionally, absorbent pads or sheets would be

placed under likely spill sources and spill kits would be maintained onsite during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.

TGP may decide to conduct directional drilling at each site based on the location and extent of geothermal resources in proximity to the well site. Directional drilling would likely result in a deep bottom hole located under BLM lease areas. TGP Geothermal Drilling Permit applications would be submitted to the BLM for the drilling of these wells, pursuant to 43 CFR 3260.11.

## 2.1.9 Plans for Surface Reclamation

If exploration activities confirm the expected commercial viability of the resource, TGP plans to build and operate a geothermal power plant to generate and sell renewable energy at both DM and CC. In that case, TGP would submit an application for regulatory approvals to place the wells, associated access roads, and other components required to operate the facility into commercial service. The wells would be monitored and exploration activities would continue in accordance with these plans while the application is processed. Interim reclamation activities would be implemented, as described in the following section. TGP would reassess the usefulness of wells annually, and if TGP were to judge certain wells to be unsuitable for commercial use or monitoring, they would be plugged and abandoned in conformance with the procedures for final reclamation outlined below.

Interim and final reclamation activities proposed in this section conform to BLM and NDOM requirements, including BLM Gold Book recommendations (BLM, 2007a). A final drill site/access road reclamation plan may be developed depending upon final well locations (BLM, 2007a) and as required by BLM. The following information is provided for purposes of evaluating potential environmental impacts from the Proposed Action.

Reclamation could also be required for the aggregate source area and would be described and conducted in accordance with a separate plan as part of permits and sale agreements issued for that purpose.

BLM will include any additional provisions and conditions needed to address environmental concerns or other site-specific issues with the GDP. Surface reclamation procedures would be the same for both CC and DM.

### 2.1.9.1 Interim Reclamation

During the life of the project, all disturbed areas not needed for active support of operations would undergo interim reclamation within 3 years of completion of well testing. During the construction process, topsoil would be salvaged where possible and stockpiled for use during reclamation. Following completion of well testing, drilling and testing equipment would be removed from the site. With the exception of an area required to gain access to maintained wellheads, cut-and-fill slopes would be recontoured to a final or intermediate contour that blends with the surrounding topography, and erosion control BMPs would be implemented. TGP would maintain healthy, biologically active topsoil and minimize habitat, visual, and forage loss during the life of the wells by stockpiling and/or spreading any extra salvageable topsoil over the area of interim reclamation whenever possible.

Surface facilities remaining onsite for wells would consist of a wellhead and potential monitoring equipment. Following completion of testing activities, the well would be fenced, chained, and locked. Wells could be shut in with a mineral oil cap as applicable. Pressure and temperature sensors could be installed in the well at fixed depths to monitor any changes in these parameters over time. The well pads and access roads would be left in place and subject to regular inspection and maintenance by TGP personnel. Portions of the access roads not needed for future vehicle travel may be reclaimed as part of interim reclamation processes. If the well pad is deemed by TGP to be unnecessary or the geothermal lease is released back to the BLM, whichever occurs first, then final reclamation activities would be conducted as described below (Section 2.1.9.2).

The temporary groundwater well would either be abandoned following completion of exploration activities, in accordance with Nevada regulations, or could be converted to permanent use for the facility. If the well is suitable for long-term use, TGP would obtain the necessary permits from the Nevada State Engineer prior to such use.

#### 2.1.9.2 Final Reclamation

Final reclamation would consist of two steps: well reclamation and road reclamation.

**Road Reclamation.** Following completion of project activities, access roads would be reclaimed by recontouring, reseeding, and controlling noxious weeds, unless the BLM requests that the roads remain intact. Project-related equipment and machinery would be decommissioned and, where possible, reused or sold as salvage. Equipment with no resale value would be sold or donated as scrap.

TGP would restore the area to the original landform or, if restoration of the original landform is not feasible, recontour to blend in with the surrounding landform. Disturbed areas would be reseeded with a certified weed-free mix specified by the BLM at the time of reclamation, and erosion-control measures and measures to control invasive non-native plants and noxious weeds would be implemented in accordance with appropriate BLM guidelines.

**Well Site Reclamation.** Well site reclamation will be performed on all wells not required for geothermal production and would be abandoned in accordance with BLM and Nevada State regulations. TGP would reclaim the project area by plugging and abandoning the wells in compliance with BLM and NDOM regulations. A detailed plan for well plugging and abandonment would be analyzed in TGP's Application to Drill (GDP). The GDP is required by 43 CFR 3261 to be submitted by TGP prior to conducting drilling operations. The area would be recontoured to blend with the surrounding topography. TGP would resurface well pads with stockpiled topsoil where available, and reseed with a mix specified by the BLM and free of noxious weeds at the time of reclamation. Any rolling dips that may have been installed would be removed. Project-related equipment and machinery would be decommissioned and, where possible, reused or sold as salvage. Equipment with no resale value would be sold or given as scrap.

TGP would restore the area to the original landform or, if restoration of the original landform is not feasible, recontour to blend in with the surrounding landform during reclamation activities. If available, topsoil would be spread evenly over the surfaces of the disturbed areas and be reseeded with a mix specified by the BLM at the time of reclamation,

and erosion-control measures and measures to control invasive non-native plants and noxious weeds would be implemented in accordance with appropriate BLM guidelines. Where areas have been surfaced with gravel, the gravel would be buried deep in the recontoured cut to prevent possible surface exposure, and reserve pits would be backfilled after they are dry and then graded to conform with the surrounding terrain.

## 2.2 No Action Alternative

Section 1502.14(d) of NEPA's implementing regulations requires the alternatives analysis to "include the alternative of no action" as a baseline against which to assess impacts of the Proposed Actions.

Under the No Action alternative, BLM would not issue a geothermal drilling permit for the CC Proposed Action and/or would not issue a geothermal drilling permit and access road right-of-way for the DM Proposed Action. As a consequence, TGP would not perform exploratory well drilling and testing in support of developing existing geothermal resources in conformance with existing lease conditions for the CC or DM lease areas.

SECTION 3

# Affected Environment

## 3.1 Scoping and Issue Identification

The BLM Stillwater Field Office held an interdisciplinary team (IDT) meeting on November 2, 2009. The following issues were identified as needing to be addressed in the environmental assessment: Air Quality; Cultural Resources; Invasive, Nonnative and Noxious Species; Migratory Birds; Native American Religious Concerns; Wastes; Water Quality; Wetlands/Riparian Zones; Visual Resources; Noise; Soils; Vegetation; Geology/Minerals; Livestock Grazing; Wildlife; and Special Status Species. Subsequent evaluation determined that noise did not need to be addressed in the environmental assessment because no receptors are present in the vicinity of the site; and that Lands should be addressed to clearly delineate land ownership status and resulting issues for the Proposed Action at DM.

The following issues were identified as not being present in either of the proposed Project areas: Areas of Critical Environmental Concern; Environmental Justice; Farm Lands; Floodplains; Threatened and/or Endangered Species; Wild and Scenic Rivers; and Wilderness. Threatened and Endangered Species are discussed in this EA to clearly lay out the reason for a conclusion of no impact to this resource, in accordance with the Endangered Species Act.

## 3.2 Proposed Action

### General Setting

Both project areas are located in the western portion of Dixie Valley and are approximately 27 air miles northeast of Fallon, Nevada. The western edge of Dixie Valley is defined by the Stillwater Range and the eastern edge is defined by the Clan Alpine Mountains.

#### Coyote Canyon

The CC project area is located at elevations ranging from approximately 3,400 feet to 3,600 feet in the northern part of Dixie Valley.

#### Dixie Meadows

The proposed DM project area is located in the west-central part of Dixie Valley, approximately 13.5 miles south-southwest of the CC project site. The project area is at an elevation of approximately 3,380 feet immediately east of the alluvial fans at the base of the Stillwater Range.

## 3.3 Supplemental Authorities and Other Resources

This chapter identifies and describes the current condition and trend of elements or resources in the human environmental which may be affected by the Proposed Action or Alternatives. Appendix 1 of BLM's NEPA Handbook (BLM, 2008) identifies resource

elements to consider under NEPA and their associated supplemental authorities that contain procedural requirements that BLM must consider as part of its Federal action. 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.

The BLM's specialists evaluated the potential applicability of the supplemental authorities and the potential impact of the Proposed Actions 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 10 summarizes the elements listed in Appendix 1 of the BLM's NEPA Handbook and documents the BLM's determination of which elements are relevant to the analysis in this EA. Each of the resource elements in Table 10 is described in this Affected Environment section and subsequently analyzed in Section 4.

The BLM also determined that resource elements not included in Appendix 1 of the NEPA Handbook be considered for inclusion in this EA. Table 11 presents those additional elements and documents the BLM's determination of which elements are relevant to the analysis in this EA.

**TABLE 10**
Supplemental Authorities

| Elements[a] | Not Present[b] | Present/ Not Affected | Present/May Be Affected[c] | Addressed in Sections | Rationale |
|---|---|---|---|---|---|
| Air Quality | | | X | 3.2, 4.1.1 | |
| Areas of Critical Environmental Concern | X | | | | |
| Cultural Resources | | | X | 3.3, 4.1.2 | |
| Environmental Justice | X | | | | |
| Farm Lands (prime or unique) | X | | | | |
| Forests and rangelands (Healthy Forests Restoration Area projects only) | X | | | | |
| Human Health and Safety (herbicide projects) | X | | | | |
| Floodplains | | | X | 3.9, 4.1.8 | |
| Invasive, Nonnative, and Noxious Species | | | X | 3.6.2, 4.1.5 | |
| Migratory Birds | | | X | 3.6.3, 4.1.5 | |
| Native American Religious Concerns | | | X | 3.4, 4.1.3 | |

**TABLE 10**
Supplemental Authorities

| Elements[a] | Not Present[b] | Present/ Not Affected | Present/May Be Affected[c] | Addressed in Sections | Rationale |
|---|---|---|---|---|---|
| Threatened and/or Endangered Species | X | | | 3.6.4, 4.1.5 | There are no federally listed threatened or endangered species in the lease areas. |
| Wastes, Hazardous or Solid | | | X | 3.8, 4.1.7 | |
| Water Quality (Surface/Ground) | | | X | 3.9, 4.1.8 | |
| Wetlands/Riparian Zones | | | X | 3.9, 4.1.8 | |
| Wild and Scenic Rivers | X | | | | |
| Wilderness | X | | | | |

[a] See H-1790-1(January 2009) Appendix 1 *Supplemental Authorities to be Considered*.
[b] Supplemental Authorities determined to be Not Present or Present/Not Affected need not be carried forward or discussed further in the document.
[c] Supplemental Authorities determined to be Present/May Be Affected must be carried forward in the document.

**TABLE 11**
Other Resources

| Resource or Issue | Present/ Not Affected[a] | Present/May Be Affected[b] | Addressed in Sections | Rationale |
|---|---|---|---|---|
| Visual Resource Management | | X | 3.12, 4.1.11 | |
| Paleontology | | X | 3.5, 4.1.4 | |
| Noise | X | | | No receptors are present in the vicinity of the project area. |
| Soil | | X | 3.11, 4.1.10 | |
| Vegetation | | X | 3.6.1, 4.1.5 | |
| Geology/Minerals | | X | 3.10, 4.1.9 | |
| Livestock Grazing | | X | 3.7, 4.1.6 | |
| Wildlife | | X | 3.6.5, 4.1.5 | |
| Special-status Species BLM Sensitive | | X | 3.6.4, 4.1.5 | |
| Lands | | X | 3.13, 4.1.12 | |

[a] Resources or uses determined to be Present/Not Affected need not be carried forward or discussed further in the document.
[b] Resources or uses determined to be Present/May Be Affected must be carried forward in the document.

The BLM also identified several specific issues relevant to the Proposed Actions that required discussion in this EA:

- A habitat assessment based on geographic information system (GIS) vegetation layers from the Southwest Regional Gap Analysis Project (SWReGAP) is required.
- Native American Tribal Consultation is a key component of the NEPA analysis.

## 3.4 Air Quality

The CC and DM project areas are located in a rural area with minimal industrial sources or potential contribution to emissions to the airshed from vehicle traffic. Activities associated with the Proposed Actions would occur in Groundwater Basin 128 in Churchill County, Nevada (Figure 5). Groundwater basins in the state of Nevada correspond to airsheds and, therefore, Groundwater Basin 128 is the analysis area for air quality. This basin is in attainment for all National Ambient Air Quality Standards (NAAQS) and Nevada air quality standards. In addition, the area is not a maintenance area for any criteria pollutants.

### Regulatory Environment

The U.S. Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards and NDEP have set NAAQS and Nevada ambient air quality standards for the following criteria pollutants: nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter smaller than 10 microns in aerodynamic diameter ($PM_{10}$), particulate matter smaller than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), ozone, and lead. In addition to the above-listed criteria pollutants, NDEP has established an ambient air quality standard of 0.08 parts per million (ppm) or 112 micrograms per cubic meter for hydrogen sulfide ($H_2S$). Nevada Administrative Code 445B.22097 provides the minimum standards of quality for Nevada ambient air.

Attainment is achieved when the existing background concentrations for criteria air pollutants are less than the maximum allowable ambient concentrations defined in the NAAQS. The attainment status, with respect to the NAAQS, of the airshed in which the Proposed Actions are located precludes the requirement for an air quality conformity analysis.

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.

The Nevada Division of Environmental Protection (NDEP) also requires GHG emissions reporting. However, NDEP has exempted geothermal projects from GHG reporting.

## 3.5 Cultural Resources

Cultural resources include historic and prehistoric sites of interest and may include structures, archaeological sites, or religious sites of importance to Native American cultures. Section 106 of the National Historic Preservation Act as amended (16 USC 40 *et seq*.) requires federal agencies to take into account the effects of their actions on properties listed or eligible for listing on the National Register of Historic Places (NRHP). The National Park

Service (NPS) defines archaeological and historic resources as "the physical evidences of past human activity, including evidences of the effects of that activity on the environment. What makes a cultural resource significant is its identity, age, location, and context in conjunction with its capacity to reveal information through the investigatory research designs, methods, and techniques used by archeologists." Ethnographic resources are defined as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS, 1998).

The basic cultural chronology of the western Great Basin includes the Pre-Archaic and Archaic Periods (Elston, 1986). A more thorough background of the prehistoric, historic, and ethnographic resources found in the area can be found in the inventory report conducted for this project (Young and Garner 2009). Below is a very brief summary of this 12,000 years of human occupation in western Nevada.

The Pre-Archaic period is defined by artifacts including Clovis and Folsom fluted lanceolate projectile points and Lake Mojave lanceolate projectile points. Reliance on big game hunting dominated the Pre-Archaic subsistence strategy. The main indicator of the shift to the Archaic period is a change to a broader strategy focused on hunting and gathering of resources. The projectile points became smaller and more suited for hunting smaller game, although they were still mounted on the ends of a dart or spear, and there was an increase in the number and type of stone grinding implements used for plant and seed processing. The material culture diversified greatly with the contemporaneous introduction of pottery and the bow and arrow with smaller projectile points. By around A.D. 1200, an expansion of Numic-speaking peoples into the area seems to have replaced or displaced the previous inhabitants (Bettinger and Baumhoff, 1982). Archaeologically, the primary material culture of the Numic includes Intermountain Brownware pottery and Desert Side Notched and Cottonwood Triangular arrow points. The subsistence strategy appears to have shifted back to a focus on hunting and gathering, although there is some evidence of at least limited reliance on horticulture. The Numic-speaking peoples, including the Northern Paiute, were the occupants of the Great Basin upon the initial arrival of Europeans and their influences.

Cultural resource investigations of the project areas for both CC and DM were conducted in July 2009 (Young and Garner, 2009). The investigations included Class I literature reviews of both State of Nevada and BLM field office files and Class III pedestrian inventories of the CC and DM project areas.

The Class I literature search reviewed files at both the BLM Carson City Field Office and the Nevada State Museum Annex in Carson City (Garner and Young, 2009), which included the project area and a one-mile buffer. The files indicate numerous small projects have been conducted in the past, mainly in support of geothermal exploration in Dixie Valley. Forty-seven previously recorded sites have been identified within the project area and a one-mile buffer. Most of these sites are small, simple lithic and ground stone scatters. Most of the prehistoric sites are generally located on the gentle alluvial fan on the west side of Dixie Valley. Historic resources previously documented include historic roads, homesteads, and a borax mine. All previously recorded sites within the project area were revisited during the cultural resource surveys conducted for this project (see below).

### 3.5.1 Coyote Canyon

The entire CC project area was surveyed for cultural resources, either by Far Western during the 2009 surveys for this project or by other recent investigations in the area for small geothermal exploration or testing projects (McGuire, 1993). Fifteen cultural resource sites have been identified in the project area, two of which were combined into one site based on the recommendations of the cultural resources study, resulting in a total of 14 cultural resource sites. Prehistoric sites dominate the assemblage; one historic site was identified during a previous investigation (McGuire 1993). The historic site consists of a small-scale mining venture with associated artifacts and was previously recommended as not eligible. The site was reexamined and updated during the current inventory and is recommended as not eligible to the NRHP..

Of the remaining 13 sites, nine are classified as a simple flaked stone assemblage, two as a complex flaked stone assemblage, one as a simple ground stone assemblage, and one as a complex ground stone assemblage. Six prehistoric sites (three previously identified and three identified during the current inventory) have been determined to be eligible for listing to the NRHP based upon the potential to yield data that would contribute to the understanding of the prehistoric occupation of the area. Seven prehistoric sites are not recommended eligible for listing on the NRHP. At this stage, all recommendations for site eligibility for listing on the NRHP are based on preliminary field recommendations and are subject to review and possible changes during BLM and State Historic Preservation Office (SHPO) consultations.

### 3.5.2 Dixie Meadows

The DM project area was surveyed for cultural resources in 2009, except for a small 288 acre portion that lies within the muddy playa floor of Dixie Valley. Two hundred eighty-eight acres of the Dixie Meadows Area of Potential Effect (APE) could not be inventoried at Class III intervals due to inclement conditions; this area is part of the seasonal pool area of the Dixie Valley open playa. Survey crews attempted to access the area but were repeatedly repelled by surface water and deep mud. Although the pool area shifts due to wind and other surface conditions, the survey area (and APE) has experienced consistent inundation/saturation for the past several years. The playa surface in this portion of Dixie Valley (also known as the Humboldt Salt Marsh) is subject to periodic sediment and mineral deposition during wet periods followed by scouring and redistribution in dry intervals. In the long-term this cyclical process results in a net erosional landform where the potential for buried Late Pleistocene and Holocene-age archaeological sites is negligible.

Six cultural resources have been identified within the DM project area. Two historic sites (one historic road with associated debris and one domestic dump with associated debris scatter) are recommended as not eligible to the NRHP. Four prehistoric sites were identified during the current inventory. Three of the prehistoric sites have been identified as not eligible and one was recommended as eligible for listing to the NRHP based upon the potential to yield data that would contribute to the understanding of the prehistoric occupation of the area.

## 3.6 Native American Religious Concerns

Consultation was initiated with the Fallon Paiute-Shoshone Tribe on July 6, 2009. Correspondence included a description of the proposed project, cultural resource inventory and a map. Subsequent correspondence provided the results of the cultural resource inventory and subsequent final report (October 27 and November 30, 2009). A face to face meeting was conducted between the BLM and tribal staff on January 12, 2010. A request for additional information was made and concerns have been documented for the Dixie Hot springs, located within the current Dixie Meadow project area. The location has been and continues to be used by tribal members for healing and ceremonial purposes (Bingston 2002). Consultation will be ongoing.

## 3.7 Paleontological Resources

An Initial Paleontological Resources Assessment for the CC and DM project areas was completed in August 2009 (CH2M HILL, 2009a). In it, the initial Potential Fossil Yield Classifications (PFYC) of the geological units affected by the Proposed Actions were determined following the guidance of BLM's Instructional Memorandum no 2008-009 (BLM, 2007c). Initial PFYC classifications were based on the results of literature searches and record reviews, as well as an analysis of remote imagery of the project areas. In the case of both the CC and DM project areas, there are sediments designated as possessing low paleontological sensitivity (PFYC = 2), and those possessing unknown sensitivity but which have yielded scientifically important fossils in other parts of the Great Basin (PFYC = 3b). These latter are sediments that were similar in character and geomorphic setting to those laid down on the margins of Pleistocene (Ice Age) lakes and at ancient springs, both of which are found in the DM and CC project areas. Satellite imagery was used to estimate the extent of these sediments, and then these findings were field checked during a paleontological resources survey.

A paleontological survey of the areas with a PFYC of 3b was completed in September 2009 to more specifically characterize their paleontological sensitivity. This field work included surveys of areas with the potential to yield fossil material, in-field determinations of "low" paleontological sensitivity based on (especially) topographic position and nature of the sediments (e.g., alluvium vs. lacustrine silt), and spot-checking areas with a PFYC of 2 to confirm their low paleontological sensitivity.

Fossil material was discovered in only one restricted part of the CC project area. In the case of most of the CC project area, however, field evidence justifies a downgrade of areas with an initial PFYC of 3b (unknown) to a PFYC of 2 (low). Areas identified in remote imagery as paleospring deposits based on their albedo and hue were found to actually be salt-encrusted playa surface. Playa sediment normally possesses low paleontological sensitivity near the surface because bone and other organic debris are not only quickly oxidized, but also mechanically degraded by the seasonal dissolution and recrystalization of salts in these soil environments. In the DM project area, however, survey evidence supports retention of a PFYC Class 3b (unknown with possible potential at depth).

The location of remaining areas where sediments possess sensitivity is confidential resource information and maps showing these areas are documented separately with the BLM.

### 3.7.1 Coyote Canyon

Alluvium seldom yields fossils and therefore the alluvial fan sediments that comprise most of the surfaces of Sections 12, 13, 14, 15, 21, and 22 (T24N,R36E) were given a "low" PFYC of 2. Portions of Sections 13, 14, 15, 21, 22, 23, and 24 that were assigned an initial PFYC of 3b (unknown) were subsequently subject to survey and field review. The subsequent field review and survey established the low paleontological potential (PFYC = 2) of all these areas except portions of Sections 14 and 15.

In portions of Sections 14 and 15 subfossil wood consisting primarily of the logs of pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) were found on the alluvial fans of two of the larger canyons issuing from the Stillwater Range. Similar wood material was observed outside of the project area on the surface on the Cottonwood Canyon alluvial fan several miles to the northeast. Woodland currently lies several miles into the Stillwater Range and more than 1,500 feet higher in elevation. Unlike conventional paleontological material, subfossil wood is simply "mummified" in the dry climate, and its scientific potential lies in its dendrochronological, paleoecological and surface-age dating potential. Therefore, the portions of Sections 14 and 15 where subfossil wood was found were assigned a PFYC Class 4 (high potential).

### 3.7.2 Dixie Meadows

In contrast to the CC project area where the principal set of fault scarps is at the foot of the mountain, the DM project area is host to a series of fault scarps and footwall remnants immediately adjacent to the Holocene playa and presently active spring systems. These geomorphic remnants of past seismic events along the DM Fault System (Blackwell et al., 2007), as well as the active springs of Dixie Meadows itself, provided a more varied lake-margin environment during high lake stands than a geomorphically simple shoreline. Eroded footwall remnants are linear, subparallel, discontinuous ridges cored with very poorly sorted, angular alluvium. They are not constructional beach ridges; their composition, up to and including boulders approaching a meter in diameter, clearly shows that they are alluvial fan remnants; presumably upthrust footwall remnants of prior fault-induced ruptures. The lacustrine sediment deposited along the shore of Paleolake Dixie have accumulated to some depth behind these footwall remnants.

In addition to deposits of relative deep lacustrine sediment there are also extensive spring discharge areas and associated wet meadows, mashes and pools in the Dixie Meadows project area. In other parts of the Great Basin spring discharge environments have provided important sites for the preservation of the fossils of extinct late Pleistocene mammals. No Pleistocene fossils were found in the vicinity during the survey, but few exposures of sediment were located and hence such fossils could still occur at depth. Therefore, areas with extensive spring systems, as well as those with potentially deep lacustrine silt deposits, were assigned a PFYC Class of 3b (unknown, but with possible potential at depth). These occur in limited portions of Sections 4, 5, 8, 9, 17, 18, 19, and 20 (T22N, R35W). These four sections therefore have exposed paleontologically sensitive sediment.

## 3.8 Biological Resources

Biological surveys, including a habitat assessment and general wildlife explorations, of the CC and DM lease areas, were conducted on June 29, 30, and July 1, 2009 (CH2M HILL,

2009b). An additional assessment of vegetation in portions of the project areas was conducted August 24 to 27, 2009. Southwest Regional Gap Analysis Project (SWReGAP) landcover data were supplemented and updated with field explorations and reference to *Intermountain Flora, Volume 1* (U.S. Geological Survey [USGS], 2004; Cronquist et al., 1972).

### 3.8.1 Vegetation

The vegetation within this semi-arid area is controlled greatly by elevation, substrate, aspect, and landform. Alluvial fan surfaces above 3,430 feet above sea level and below the mountain front support the intermountain basins mixed salt desert scrub community, with the exception of dry wash channels, which contain intermountain basins greasewood flats. The area between 3,430 feet above sea level and the edge of the intermountain basin playa community (generally 3,390 to 3,400 feet above sea level) is composed of a mosaic of halophytic (salt-tolerant) and hydrophytic (wetland) plant communities. The halophytic communities include intermountain basins greasewood flats, saltgrass (*Distichlis spicata* var. *stricta*) meadows, and iodinebush (*Allenrolfea occidentalis*) scrub. The hydrophytic communities are primarily marshes typified by cattail (*Typha latifolia*), rush (*Juncus* spp. and *Scirpus* spp.), and common reed (*Phragmites australis)* among other species. The playa is largely barren of vegetation.

The intermountain basins mixed salt desert scrub community is characterized by open shrubland dominated by shadscale (*Atriplex confertifolia*) with scattered bush seepweed (*Suaeda moquinii),* yellow rabbitbrush (*Chrysothamnus viscidiflorus*), Nevada jointfir (*Ephedra nevadensis*), spiny hopsage (*Grayia spinosa*), budsage (*Artemisia spinescens*), broom snakeweed (*Gutierrezia sarothrae*), winterfat (*Krascheninnikovia lanata*), Indian ricegrass (*Achnatherum hymenoides*), and cheatgrass (*Bromus tectorum*). Despite its apparent diversity there is much barren ground between the shrubs, and there is little grass cover. Cheesebush (*Hymenoclea salsola*) and desert trumpet (*Eriogonum inflatum* var. *deflatum*) were found occupying disturbed areas.

The intermountain basins greasewood flats community is dominated by greasewood (*Sarcobatus vermiculatus*) and contains sparsely scattered Torrey's saltbush (*Atriplex torreyi*), yellow rabbitbrush, saltlover (*Halogeton glomeratus*), budsage, and bush seepweed. Bare ground is common and the substrate usually possesses the poorly developed soils of wash-bottoms. Again there are few perennial grasses.

At the fringe of the playa, where the salt concentration appears too great for greasewood, more salt-tolerant communities such as saltgrass meadow and iodinebush scrub are found. Marshes are found at springs, seeps, and around open water in both the CC and DM project areas. These palustrine emergent wetlands are surrounded by desert vegetation or playa. The marsh vegetation is adapted to saturated soil conditions and includes species of rush, knotweed (*Polygonum* spp.), canarygrass (*Phalaris* spp.), spikerush (*Eleocharis* spp.), duckweed (*Lemna* sp.), as well as common reed and cattail. Riparian trees and shrubs are not common and are restricted to isolated stands of willow (*Salix* sp.), wild rose (*Rosa woodsii*), Russian olive (*Eleaegnus angustifolia*), and saltcedar (*Tamarix ramosissima*), the latter two being introduced species, invasive in many hydric habitats.

#### 3.8.1.1 Coyote Canyon

Just fewer than half the potential well pads in the CC project area and their associated access routes are located in intermountain basins mixed salt desert scrub community. Most of the remainder of the potential well pads and their access routes are located in salt-tolerant communities (e.g., intermountain basins greasewood flats, saltgrass meadow, and iodinebush scrub). A minority of the potential well pads are located within the intermountain basin playa community, some of which may be in the vicinity of marsh vegetation associated with seeps and springs, based on analysis of aerial photographs. Wetland vegetation is discussed further in Section 3.9.

#### 3.8.1.2 Dixie Meadows

The majority of the well pads and access routes in the DM project area are located in salt-tolerant communities. A minority of the well pads are located within the intermountain basin playa community. Using aerial photography, two of the well pads (28-4 and 32-9) appear to be in the vicinity of marsh vegetation. One of the proposed access roads passes through intermountain basins mixed salt desert scrub.

### 3.8.2 Invasive, Non-native, and Noxious Species

The State of Nevada lists 47 noxious weed species that require control (Nevada Administrative Code 555.10; Nevada Department of Agriculture, 2008). Of these, saltcedar (*Tamarix ramosissima*) was the only noxious weed identified in the project areas during field surveys. In addition, the following invasive, non-native species were identified within or in the vicinity of the project areas: Russian olive (*Elaeagnus angustifolia*), cheat grass (*Bromus tectorum*), Russian thistle (*Salsola kali*), and common sowthistle (*Sonchus oleraceus*).

### 3.8.3 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. Management for these species is based on Instruction Memorandum – IM 2008-050 dated December 18, 2007 (BLM, 2007b). Migratory birds with potential to use the project areas, such as black-throated sparrow (*Amphispiza bilineata*), horned lark (*Eremophila alpestris*), and common raven (*Corvus corax*), are species associated with intermountain basins mixed salt desert scrub, salt-tolerant communities, marsh, and playa habitats.

#### 3.8.3.1 Coyote Canyon

Table 12 below lists migratory birds potentially present in CC.

**TABLE 12**
Migratory Bird Species of Concern, Habitat Association, and Presence/Absence of Suitable Habitat in Coyote Canyon

| Common Name | Scientific Name | Habitat Association | Presence/ Absence of Suitable Habitat |
|---|---|---|---|
| **Game Birds of Conservation Concern** | | | |
| Canvasback | *Aythya valisineria* | Marshes, ponds, lakes, rivers and bays. | May be present |

**TABLE 12**
Migratory Bird Species of Concern, Habitat Association, and Presence/Absence of Suitable Habitat in Coyote Canyon

| Common Name | Scientific Name | Habitat Association | Presence/ Absence of Suitable Habitat |
|---|---|---|---|
| Dove, Mourning | *Zenaida macroura* | Open woodland, forest edge, cultivated lands with scattered trees and bushes, parks and suburban areas, arid and desert county and second growth. | Present |
| Duck, Ring-necked | *Aythya collaris* | Marshes, lakes, rivers, swamps, especially in wooded areas. | May be present |
| Duck, Wood | *Aix sponsa* | Quiet inland waters near woodland, such as wooded swamps, flooded forest, greentree reservoirs, ponds, marshes and along streams. | May be present |
| Mallard | *Anas platyrhynchos* | Primarily shallow waters such as ponds, lakes, marshes, and flooded fields. | May be present |
| Pintail, Northern | *Anas acuta* | Lakes, rivers, marshes and ponds in grasslands, barrens, dry tundra, open boreal forest or cultivated fields. | May be present |
| **Bird Species of Conservation Concern** | | | |
| Avocet, American | *Recurvirostra americana* | Lowland marshes, mudflats, ponds, alkaline lakes, and estuaries. | May be present |
| Bittern, American | *Botaurus lentiginosus* | Primarily large freshwater and brackish marshes, including lakes and pond edges where cattails, sedges, or bulrushes are plentiful and marshes where there are patches of open water and aquatic-bed vegetation. | May be present |
| Curlew, Long-billed | *Numenius americanus* | Short-grass grasslands and sometimes wheatfields or fallow fields; nests usually close to standing water | May be present |
| Eagle, Golden | *Aquila chrysaetos* | Generally open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions. | Present; observed at existing Dixie Valley geothermal facility |
| Falcon, Prairie | *Falco mexicanus* | Primarily open situations, especially in mountainous areas, steppe, plains or prairies. | Present; observed in Coyote Canyon |
| Harrier, Northern | *Circus cyaneus* | Marshes, meadows, grasslands, and cultivated fields. | May be present |
| Hawk, Ferruginous | *Buteo regalis* | Grasslands and semidesert shrublands; nest in isolated trees, on rock outcrops, or ground | Present |
| Hummingbird, | *Calypte costae* | Desert, shrubland/chaparral | Present |

**TABLE 12**
Migratory Bird Species of Concern, Habitat Association, and Presence/Absence of Suitable Habitat in Coyote Canyon

| Common Name | Scientific Name | Habitat Association | Presence/ Absence of Suitable Habitat |
|---|---|---|---|
| Costa's | | | |
| Owl, Burrowing | *Athene cunicularia* | Open dry shrub/steppe grasslands, agricultural and rangelands, and desert habitats associated with burrowing animals. | Present |
| Phalarope, Wilson's | *Phalaropus tricolor* | Shallow freshwater and saline ponds, marshes and wet meadows. Uses both fresh and alkali wetlands with open water, emergent vegetation, and open shoreline. | May be present |
| Plover, Snowy | *Charadrius alexandrinus* | Beaches, dry mud or salt flats, sandy shores of rivers, lakes and ponds. | May be present |
| Shrike, Loggerhead | *Lanius ludovicianus* | Open county with scattered trees and shrubs, savanna, desert scrub, and occasionally open woodland. | Present; observed in lease area |
| Sparrow, Brewer's | *Spizella breweri* | Strongly associated with sagebrush over most of range, in areas with scattered shrubs and short grass. | Present |
| Sparrow, Sage | *Amphispiza belli* | Strongly associated with sagebrush for breeding; also found in saltbush brushland, shadscale, antelope brush, rabbitbrush, black greasewood, mesquite, and chaparral. | Present |
| Vireo, Gray | *Vireo vicinior* | Inhabits hot, semi-arid, shrubby habitats. | Present |
| Willet | *Tringa semipalmata* | Marshes, tidal mudflats, beaches, lake margins, mangroves, tidal channels, river mouths, coastal lagoons, sandy or rocky shores, less frequently open grassland. | May be present |

### 3.8.3.2 Dixie Meadows

Table 13 below lists migratory birds potentially present in DM.

**TABLE 13**
Migratory Bird Species of Concern, Habitat Association, and Presence/Absence of Suitable Habitat in Dixie Meadows

| Common Name | Scientific Name | Habitat Association | Presence/ Absence of Suitable Habitat |
|---|---|---|---|
| **Game Birds of Conservation Concern** | | | |
| Canvasback | *Aythya valisineria* | Marshes, ponds, lakes, rivers and bays. | Present |
| Dove, Mourning | *Zenaida macroura* | Open woodland, forest edge, | Present |

**TABLE 13**
Migratory Bird Species of Concern, Habitat Association, and Presence/Absence of Suitable Habitat in Dixie Meadows

| Common Name | Scientific Name | Habitat Association | Presence/ Absence of Suitable Habitat |
|---|---|---|---|
| | | cultivated lands with scattered trees and bushes, parks and suburban areas, arid and desert county and second growth. | |
| Duck, Ring-necked | *Aythya collaris* | Marshes, lakes, rivers, swamps, especially in wooded areas. | Present |
| Duck, Wood | *Aix sponsa* | Quiet inland waters near woodland, such as wooded swamps, flooded forest, greentree reservoirs, ponds, marshes and along streams. | Present |
| Mallard | *Anas platyrhynchos* | Primarily shallow waters such as ponds, lakes, marshes, and flooded fields. | Present; observed in Dixie Meadows |
| Pintail, Northern | *Anas acuta* | Lakes, rivers, marshes and ponds in grasslands, barrens, dry tundra, open boreal forest or cultivated fields. | Present |
| **Bird Species of Conservation Concern** | | | |
| Avocet, American | *Recurvirostra americana* | Lowland marshes, mudflats, ponds, alkaline lakes, and estuaries. | Present |
| Bittern, American | *Botaurus lentiginosus* | Primarily large freshwater and brackish marshes, including lakes and pond edges where cattails, sedges, or bulrushes are plentiful and marshes where there are patches of open water and aquatic-bed vegetation. | Present |
| Curlew, Long-billed | *Numenius americanus* | Short-grass grasslands and sometimes wheatfields or fallow fields; nests usually close to standing water | May be present |
| Eagle, Golden | *Aquila chrysaetos* | Generally open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions. | Present; observed at existing Dixie Valley geothermal facility |
| Falcon, Prairie | *Falco mexicanus* | Primarily open situations, especially in mountainous areas, steppe, plains or prairies. | Present |
| Harrier, Northern | *Circus cyaneus* | Marshes, meadows, grasslands, and cultivated fields. | Present; observed in Dixie Meadows |
| Hawk, Ferruginous | *Buteo regalis* | Grasslands and semidesert shrublands; nest in isolated trees, on rock outcrops, or ground | Present |
| Hummingbird, Costa's | *Calypte costae* | Desert, shrubland/chaparral | Present |

**TABLE 13**
Migratory Bird Species of Concern, Habitat Association, and Presence/Absence of Suitable Habitat in Dixie Meadows

| Common Name | Scientific Name | Habitat Association | Presence/ Absence of Suitable Habitat |
|---|---|---|---|
| Owl, Burrowing | *Athene cunicularia* | Open dry shrub/steppe grasslands, agricultural and rangelands, and desert habitats associated with burrowing animals. | Present |
| Phalarope, Wilson's | *Phalaropus tricolor* | Shallow freshwater and saline ponds, marshes and wet meadows. Uses both fresh and alkali wetlands with open water, emergent vegetation, and open shoreline. | Present |
| Plover, Snowy | *Charadrius alexandrinus* | Beaches, dry mud or salt flats, sandy shores of rivers, lakes and ponds. | Present |
| Shrike, Loggerhead | *Lanius ludovicianus* | Open county with scattered trees and shrubs, savanna, desert scrub, and occasionally open woodland. | Present; observed in lease area |
| Sparrow, Brewer's | *Spizella breweri* | Strongly associated with sagebrush over most of range, in areas with scattered shrubs and short grass. | Present |
| Sparrow, Sage | *Amphispiza belli* | Strongly associated with sagebrush for breeding; also found in saltbush brushland, shadscale, antelope brush, rabbitbrush, black greasewood, mesquite, and chaparral. | Present |
| Vireo, Gray | *Vireo vicinior* | Inhabits hot, semi-arid, shrubby habitats. | Present |
| Willet | *Tringa semipalmata* | Marshes, tidal mudflats, beaches, lake margins, mangroves, tidal channels, river mouths, coastal lagoons, sandy or rocky shores, less frequently open grassland. | Present |

## 3.8.4 Special-status Species

### 3.8.4.1 Threatened and Endangered Species

BLM Manual 6840 – Special Status Species Management, establishes policy for management of species listed or proposed for listing pursuant to the Endangered Species Act that are found on BLM-administered lands (BLM, 2008c).

Pursuant to the requirements of Section 7(c) of the Endangered Species Act, for federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) concerning listed species, separate letters were sent to USFWS on July 15, 2009, requesting information regarding threatened and endangered species that may occur in the CC and DM project areas. USFWS responded in separate letters dated August 26, 2009, that to the best of its

knowledge no listed, proposed, or candidate threatened and endangered species exist in the CC or DM project areas.

#### 3.8.4.2 BLM Sensitive Species

BLM Manual 6840 – Special Status Species Management, establishes policy for management of BLM sensitive species that are found on BLM-administered lands (BLM, 2008c). Species designated as BLM sensitive must be native species found on BLM-administered lands for which the BLM has the capability to significantly affect the conservation status of the species through management, and either:

1. There is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range, or
2. The species depends on ecological refugia or specialized or unique habitats on BLM-administered lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk.

BLM mapping confirmed (USGS, 2008) and field surveys verified that no greater sage grouse (*Centrocercus urophasianus*) habitat is present within the lease boundary. However, sage grouse may use water sources in desert scrub habitat that is relatively near sagebrush habitat (Wilson, 2009). Table 14 presents BLM sensitive species, their habitat association, and presence/absence of habitat in the project areas.

**TABLE 14**
Nevada BLM Sensitive Species, Habitat Association, and Presence/Absence of Suitable Habitat in Project Areas

| Common Name | Scientific Name | Habitat Association | Presence/Absence of Suitable Habitat |
|---|---|---|---|
| Northern leopard frog | *Rana pipiens* | Springs, slow streams, marshes, bogs, ponds, canals, floodplains, reservoirs, and lakes; usually permanent water with rooted aquatic vegetation | Present |
| Golden eagle | *Aquila chrysaetos* | Generally open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions | Present; observed at existing Dixie Valley geothermal facility |
| Ferruginous hawk | *Buteo regalis* | Grasslands and semidesert shrublands; nest in isolated trees, on rock outcrops, or ground | Present |
| Prairie falcon | *Falco mexicanus* | Primarily open situations, especially in mountainous areas, steppe, plains or prairies. | Present; observed in Coyote Canyon |
| Burrowing owl | *Athene cunicularia* | Open dry shrub/steppe grasslands, agricultural and rangelands, and desert habitats associated with burrowing animals | Present |
| Loggerhead shrike | *Lanius ludovicianus* | Open county with scattered trees and shrubs, savanna, desert scrub, and occasionally open woodland. | Present; observed in lease area |
| Vesper sparrow | *Pooecetes gamineus* | Plains, prairie, dry shrublands, savanna, weedy pastures, fields, sagebrush, arid scrub and woodland clearings | Present |
| Gray vireo | *Vireo vicinior* | Inhabits hot, semi-arid, shrubby habitats | Present |
| Sandhill crane | *Grus canadensis* | Open grasslands, marshes, marshy edges of lakes and ponds, river banks | Present; migrant |
| Snowy plover | *Charadrius alexandrinus* | Beaches, dry mud or salt flats, sandy shores of rivers, lakes and ponds | Present |
| Black tern | *Chlidonias niger* | Marshes, along sloughs, rivers, lakeshores, and impoundments, or in wet meadows, typically in sites with mixture of emergent vegetation and open water | Present; migrant |
| Long-billed curlew | *Numenius americanus* | Prairies and grassy meadows, generally near water | May be present |

**TABLE 14**
Nevada BLM Sensitive Species, Habitat Association, and Presence/Absence of Suitable Habitat in Project Areas

| Common Name | Scientific Name | Habitat Association | Presence/Absence of Suitable Habitat |
|---|---|---|---|
| Least bittern | *Ixobrychus exilis* | Tall emergent vegetation in marshes, primarily freshwater, less commonly in coastal brackish marshes and mangrove swamps | Present |
| Western pipistrelle bat | *Pipistrellus hesperus* | Deserts and lowlands, desert mountain ranges, desert scrub flats, and rocky canyons | Present |
| Pallid bat | *Antrozous pallidus* | Arid deserts and grasslands, often near rocky outcrops and water | Present |
| Spotted bat | *Euderma maculatum* | Found in various habitats from desert to montane coniferous stands, including open ponderosa pine, pinyon-juniper woodland, canyon bottoms, open pastures, and hayfields | Present |
| Silver-haired bat | *Lasionycteris noctivagans* | Prefers forested (frequently coniferous) areas adjacent to lakes, ponds, and streams | May forage in lease area |
| Townsend's big-eared bat | *Corynorhinus townsendii* | Maternity and hibernation colonies typically are in caves and mine tunnels | May forage in lease area |
| Big brown bat | *Eptesicus fuscus* | Various wooded and semi-open habitats, including cities | Present |
| Hoary bat | *Lasiurus cinereus* | Prefers deciduous and coniferous forests and woodlands. | May forage in lease area |
| Brazillian free-tailed bat | *Tadarida braziliensis* | Roosts primarily in caves | May forage in lease area |
| Long-eared myotis | *Myotis evotis* | Mostly forested areas, especially those with broken rock outcrops; also shrubland, over meadows near tall timber, along wooded streams, over reservoirs | May forage in lease area |
| Fringed myotis | *Myotis thysanodes* | Primarily at middle elevations for 1,200-2,150 meters in desert, grassland, and wooded habitats | Present |
| California myotis | *Myotis californicus* | Western lowlands; sea coast to desert, oak-juniper, canyons, riparian woodlands, desert scrub, and grasslands | Present |

**TABLE 14**
Nevada BLM Sensitive Species, Habitat Association, and Presence/Absence of Suitable Habitat in Project Areas

| Common Name | Scientific Name | Habitat Association | Presence/Absence of Suitable Habitat |
|---|---|---|---|
| Small-footed myotis | *Myotis ciliolabrum* | Generally inhabits desert, badland, and semiarid habitats | Present |
| Little brown myotis | *Myotis lucifugus* | Adapted to using human-made structures for resting and maternity sites, also uses caves and hollow trees; foraging habitat is generalized, usually in woodlands near water | May forage in lease area |
| Long-legged myotis | *Myotis volans* | Primarily in montane coniferous forests; also riparian and desert habitats | May forage in lease area |
| Desert bighorn sheep | *Ovis canadensis nelsoni* | Steep slopes on or near mountains with a clear view of surrounding area | Present in Stillwater Range western portion of project area |
| Pallid wood nymph | *Cercyonis oetus pallescens* | Alkaline flats | Present |
| Sand Mountain blue | *Euphilotes pallescens arenamontana* | No data | Present; known to occur within Dixie Valley |
| Nevada dune beardtongue | *Penstemon arenarius* | Deep, volcanic, sandy soils at 1,200-1,350 meter elevation; common associates include fourwing saltbush, littleleaf horsebrush, and greasewood | Potentially present; not known to occur in Dixie Valley |
| Lahontan beardtongue | *Penstemon palmeri* var. *macranthus* | Along washes, roadsides, and canyon floors, particularly on carbonate-containing substrates, usually where subsurface moisture is available throughout most of the summer; unknown if restricted to calcareous substrates | Present; known to occur within Dixie Valley |

### 3.8.5 Wildlife Resources

Wildlife found in the project areas is typical of Great Basin deserts. Wildlife species observed in the area during biological surveys included various bird species, coyote (*Canis latrans*), black-tailed jackrabbit (*Lepus californicus*), cottontail (*Sylvilagus* spp.), white-tailed antelope squirrel (*Ammospermophilus leucurus*), horned lizard (*Phyrnosoma platyrhinos*), zebra-tailed lizard (*Callisaurus draconoides*), western whiptail (*Aspidoscelis tigris*), side-blotched lizard (*Uta stansburiana*), and long-nosed leopard lizard (*Gambelia wislizenii*). Bat habitat is found in mines, caves, and rock crevices of the Stillwater Range.

Marsh and open water habitats are found in and around the CC and DM project areas. Herons, egrets, bitterns, ducks, geese, and other birds associated with open water and wetland habitats occur in these areas. The marsh areas also provide habitat for amphibian species.

## 3.9 Livestock Grazing

BLM manages rangelands on public lands under 43 CFR Part 4100 and BLM Handbooks 4100 to 4180. BLM conducts grazing management practices in accordance with BLM Manual H-4120-1 (BLM, 1984).

Under this management, ranchers may obtain a grazing permit for an allotment of public land on which a specified number of livestock may graze. An allotment is an area of land designated and managed for livestock grazing. The number of permitted livestock on a particular allotment 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, 2008b).

### 3.9.1 Coyote Canyon

The CC lease area lies within the Boyer Ranch Allotment, which comprises approximately 127,194 acres and 1,789 AUMs of currently authorized grazing capacity. Within this allotment, one AUM is equal to approximately 71 acres.

The grazing allotments within the project areas consist entirely of public lands administered by the BLM Carson City Office. Table 15 displays land ownership in the Boyer Ranch Allotment (BLM, 2009b).

**TABLE 15**
Livestock Permit Information—Coyote Canyon

| Permit | Number of Livestock | On Date | Off Date | Animal Unit Months |
|---|---|---|---|---|
| **Boyer Ranch Allotment** | | | | |
| A | 179 cows | 5/1 | 6/30 | 359 |
| B | 179 cows | 10/1 | 2/28 | 889 |
| C | 179 sheep | 7/1 | 9/30 | 541 |

### 3.9.2 Dixie Meadows

Portions of the DM lease area are located across three grazing allotments: Cow Canyon, Boyer Ranch, and Dixie Valley (BLM, 2009b). The Cow Canyon Allotment comprises 146,179 acres and 2,390 AUMs of currently authorized annual grazing capacity (BLM, 2009b). Within this allotment, one AUM is equal to approximately 61 acres. The Dixie Valley Allotment comprises 282,801 acres and 6,341 AUMs of currently authorized grazing capacity. Within this allotment, one AUM is equal to approximately 44 acres. The Boyer Ranch Allotment comprises approximately 127,194 acres and 1,790 AUMs of currently authorized grazing capacity. Within this allotment, one AUM is equal to approximately 71 acres.

The grazing allotments within the project areas consist entirely of public lands administered by the BLM Carson City Office. Table 16 displays land ownership in each allotment (BLM, 2009b).

**TABLE 16**
Livestock Permit Information—Dixie Meadows

| Permit | Number of Livestock | On Date | Off Date | Animal Unit Months |
|---|---|---|---|---|
| **Boyer Ranch Allotment** | | | | |
| A | 179 cows | 5/1 | 6/30 | 359 |
| B | 179 cows | 10/1 | 2/28 | 889 |
| C | 179 sheep | 7/1 | 9/30 | 541 |
| **Total** | | | | **1,789** |
| **Cow Canyon Allotment** | | | | |
| A | 365 cows | 5/1 | 11/15 | 2,388 |
| **Total** | | | | **2,388** |
| **Dixie Valley Allotment** | | | | |
| A | 528 cows | 3/1 | 2/28 | 6,336 |
| B | 5 cows | 3/1 | 3/31 | 5 |
| **Total** | | | | **6,341** |

## 3.10 Wastes, Hazardous or Solid

There are no known hazardous wastes or hazardous materials known to occur in the project area. Numerous federal and state laws and regulations have been enacted including the Resource Conservation and Recovery Act (RCRA) and Nevada Revised Statute 459.400 and are enforced by the Nevada Division of Environmental Protection (NDEP) Bureau of Waste Management to ensure that hazardous materials, hazardous waste and solid wastes are properly handled, stored, and disposed of.

## 3.11 Water Quality, Wetlands, and Floodplains

### Groundwater

The CC and DM lease areas are located in the internally drained Dixie Valley groundwater basin (NDWR-designated Administration Groundwater Basin 128, Figure 5). Dixie Valley is

located in Nevada Hydrographic Region 10 (Central Region) (NDCNR-DWR, 2005), and is in the Great Basin hydrographic area. By Order 715, dated June 8, 1978, the Nevada State Engineer has "designated" the Dixie Valley groundwater basin, which indicates that the permitted groundwater rights approach or exceed the estimated average annual recharge and the water resources are being depleted or require additional administration (NDCNR-DWR, 2009).

Groundwater Basin 128 has an area of 1,303 square miles and a perennial yield of 15,000 acre-feet per year (AFY). The basin has committed underground water rights of 18,076 AFY and geothermal water rights of 13,428 AFY (NDCNR-DWR, 2009). Groundwater occurs in alluvial basin fill sediments and in underlying bedrock. In the northern portion of Dixie Valley, where the project areas are located, groundwater moves south through the valley, east from the Stillwater Mountains, and west from the Clan Alpine Mountains. Recharge to groundwater occurs from precipitation, primarily snowmelt, at higher elevations in the Stillwater Range and Clan Alpine Range west and east of Dixie Valley and in the alluvial fans and landslide deposits at the base of these mountains. The Humboldt Salt Marsh (playa) is the ultimate groundwater sink for Dixie Valley and six subbasins that are adjacent to Dixie Valley (Fairview, Pleasant, Jersey, Eastgate, Cowkick, and Stingaree valleys). Groundwater moves radially from the surrounding mountains and converges on the playa, where it discharges. Vertically, groundwater moves upward in the central part of the valley in response to hydraulic gradients, where it discharges to the playa and is lost to evaporation and transpiration.

Groundwater occurs in two separate but related aquifers in Dixie Valley: a shallow, non-thermal, alluvial aquifer and a deep, thermal, bedrock aquifer (Karst, 1987). Groundwater in the alluvium occurs under unconfined and confined conditions; however, hydraulic heads are typically beneath the elevation of the valley floor. Thermal groundwater is confined and generally occurs in fractured, zones within the bedrock underlying the alluvial basin fill sediments. Deep thermal groundwater and shallower alluvial groundwater are separated by a confining sequence thousands of feet thick, composed of shale, siltstone, volcaniclastic rocks, and a complex of intrusive and extrusive igneous rocks that includes gabbro, diorite, and basalt (Bruton et al., 1997). Fumaroles, hot springs, and warm springs along the west edge of Dixie Valley near the base of the Stillwater Range are believed to originate from deep geothermal water moving up a zone of locally enhanced permeability caused by the DM fault system (Smith et al., 2001). Chloride isotope analysis and a geochemical mixing evaluation reported by Bruton et al. (1997) indicates that shallow groundwater in Dixie Valley contains approximately 15 percent geothermal water, likely from fumaroles and hot springs in the area. As a groundwater discharge area, the depth to groundwater is anticipated to be shallow throughout much of northern Dixie Valley and would be expected to be shallowest close to the Humboldt Salt Marsh.

The total dissolved solids (TDS) concentration in shallow alluvial groundwater in Dixie Valley ranges from 900 to 1,900 milligrams per liter (mg/L) according to data tabulated by Karst (1987). Thermal groundwater in the area generally has higher dissolved solids content; however, the maximum TDS value reported by Karst was 1,920 mg/L, essentially the same as the maximum non-thermal groundwater concentration of 1,900 mg/L (Karst, 1987).

### Surface Water

Based on analysis of USGS topographic maps and NDWR groundwater basin mapping (Figure 5), the Proposed Actions would be located in an internally drained desert basin that is a great distance from and lacks hydrographic connectivity to major rivers and water bodies. Therefore, there are no navigable waters of the United States within Rivers and Harbors Act jurisdiction (as defined by 33 CFR part 329) and no waters of the United States within Clean Water Act jurisdiction (as defined by 33 CFR 328) in the CC or DM project areas. A letter asking for an approved jurisdictional determination concurring with this finding was sent to the U.S. Army Corps of Engineers on July 13, 2009. A response is pending.

## 3.11.1 Coyote Canyon

The geothermal reservoir to be explored in CC is at an expected depth of up to 10,000 feet.

The USGS 7.5-minute topographic map of the area (Bolivia, Nevada Quadrangle 1990) shows ephemeral washes flowing southeast across the alluvial fan and valley bottom within the CC lease area and into the Humboldt Salt Marsh within Dixie Valley (Figure 6). These ephemeral washes only flow from significant rainfall or snowmelt events and those observed during field visits were dry. There are no Federal Emergency Management Agency (FEMA) Flood Insurance Program Mapping (FIRM) special flood hazard areas (SFHAs) or floodway areas within the CC project area (FEMA, 2008a). USGS mapping shows three seeps in Section 23 and one seep in Section 24 (Figure 6). There is a spring on the southern border of the lease area, on the border of Sections 22 and 27. There are numerous seeps and springs mapped directly south of the lease area. There are no National Wetland Inventory (NWI) mapped wetlands within the CC lease area (USFWS, 2008); however, palustrine emergent wetlands associated with seeps in Sections 23 and 24 were observed during field visits. These seeps and wetlands are shown on Figure 6.

## 3.11.2 Dixie Meadows

The geothermal reservoirs to be explored in DM are at expected depths of between 6,000 feet and 10,000 feet.

The USGS 7.5-minute topographic map of the area (Dixie Hot Springs, Nevada Quadrangle 1990) shows ephemeral washes flowing across the valley bottom within the DM lease area and into the Humboldt Salt Marsh (Figure 7). These ephemeral washes only flow from significant rainfall or snowmelt events and those observed during field visits were dry. Sections 10, 15, and 16 in the DM lease area lie within a FEMA FIRM Zone A "SFHA subject to inundation by the 1% annual chance flood" (FEMA, 2008b; Figure 7). USGS mapping shows numerous seeps, springs, and/or wetland areas in Sections 4, 5, 8, 9, 17, 18, and 19 (Figure 8). NWI mapping shows palustrine emergent wetlands associated with DM within Sections 5, 8, 9, and 17 in the DM lease area (USFWS, 2008; Figure 7). These wetlands were observed during field visits and additional wetlands were observed in Sections 4 and 19, associated with USGS mapped seeps (Figure 8).

# 3.12 Geology and Minerals

## 3.12.1 Coyote Canyon

The non-mountainous portions of the CC lease area, where wells would be installed as part of the Proposed Actions, is located at elevations ranging from approximately 3,400 feet to 3,600 feet in the northern part of Dixie Valley. Dixie Valley is a north-northeast/south-southwest-trending elongated valley in west-central Nevada, within the Great Basin Section of the Basin and Range Physiographic Province. The western edge of Dixie Valley is defined by the Stillwater Range and the eastern edge is defined by the Clan Alpine Mountains. Alluvial fans and pediment surfaces flank the area between the mountains and the valley interior. The proposed project is located on alluvial fans at the base of the Stillwater Range on the western edge of Dixie Valley.

Paleozoic marine carbonate rocks and clastic sedimentary rocks crop out in the Clan Alpine Mountains; however, these rocks have not been penetrated by wells drilled within Dixie Valley. Dixie Valley wells have penetrated marine siltstone, shale, sandstone, and volcaniclastic rocks exposed in the Stillwater Range (Bruton et al., 1997). The Miocene Table Mountain basalt overlies older sedimentary and igneous rocks and has been encountered at a depth of approximately 7,000 to 8,000 feet within Dixie Valley. It is overlain by a thick sequence of late Tertiary basin-fill sediments, including lacustrine, playa, and alluvial fan sediments. Hydrothermal alteration and mineralization from geothermal fluids has locally affected the rocks in the area (Bruton et al., 1997).

Structurally, Dixie Valley is an elongated down-dropped block, or graben, bounded by high-angle faults of Holocene age (Ryall and Vetter, 1982). The Dixie Valley fault lies beneath the west valley edge at the base of the Stillwater Range. Seismic activity subsequent to the tectonism that formed the Dixie Valley graben has further deformed the bedrock, resulting in a complex series of faults in the bedrock beneath the valley floor. Dixie Valley is located in an active seismic area. A major earthquake of magnitude 6.8 occurred in 1954 beneath Dixie Valley and created a visible scarp along the portions of the west margin of Dixie Valley (Ryall and Vetter, 1982).

## 3.12.2 Dixie Meadows

The proposed DM project site is located in the west-central part of Dixie Valley, approximately 13.5 miles south-southwest of the CC project site. It is at an elevation of approximately 3,380 feet immediately east of the alluvial fans at the base of the Stillwater Range. Section 3.10.1 summarizes the geologic setting of the area.

# 3.13 Soils

Soil types in the project areas were identified using the "Churchill County Area, Parts of Churchill and Lyon Counties" soil survey (U.S. Department of Agriculture National Resource Conservation Service [USDA NRCS], 2009). Descriptions of the soil types found in the lease areas are provided in this section.

Soil unit 343 is the Slaw-Trocken-Chuckles association. Slaw soils occur on 0-4 percent slopes, are well drained, occasionally flood, but never pond, and are moderately to strongly saline. The typical profile is composed of silt loam underlain by stratified very fine sandy

loam to silty clay. Trocken soils occur on 0-2 percent slopes, are well drained, occasionally flood, but never pond, and are moderately to strongly saline. The typical profile includes very gravelly loam and gravelly loamy coarse sand. Chuckles soils occur on 0-2 percent slopes, are moderately well drained, never flood or pond, and are moderately to strongly saline. The typical profile is composed of loam and silt loam underlain by stratified very fine sandy loam to silty clay. Soil unit 343 has a slight hazard of off-road or off-trail erosion and is poorly to moderately suited for natural surface road construction, primarily due to flooding potential and low strength (USDA NRCS, 2009).

Soil unit 184 is the Bluewing-Pineval association. Bluewing soils occur on 4-8 percent sloping fans or washes, are excessively drained, and flood rarely to occasionally, but never pond. The soil profile typically consists of very gravelly loamy sand underlain by stratified very gravelly sand to extremely loamy coarse sand. Pineval soils occur on 4-8 percent slopes, are well drained, and rarely flood and never pond. The typical soil profile includes very cobbly loam and very gravelly sandy clay loam underlain by stratified extremely gravelly sand to gravelly sandy loam. Soil unit 184 has a slight hazard of off-road or off-trail erosion and is moderately suited for natural surface road construction, due to flooding potential, sandiness, and slope (USDA NRCS, 2009).

Soil unit 330 is the Settlement-Louderback-Rustigate association. Settlement soils occur on 0-2 percent slopes, are poorly drained, have a water table depth of 12 to 36 inches, rarely flood and never pond, and are slightly to moderately saline. The typical soil profile consists of silty clay and clay. Louderback soils occur on 0-2 percent slopes, are somewhat poorly drained, have a water table at 36 to 40 inches, rarely flood and never pond, are very slightly or slightly saline, and support saline meadow vegetation. The typical soil profile is composed of sand underlain by stratified sand to loam. Rustigate soils occur on 0-2 percent slopes, are somewhat poorly drained, have a water table at 36 to 40 inches, rarely flood and never pond, and support a saline meadow vegetation community. The profile is typically silt loam underlain by loam. Soil unit 330 has a slight hazard of off-road or off-trail erosion and is moderately suited for natural surface road construction, primarily due to low strength and sandiness (USDA NRCS, 2009).

Soil unit 900 is composed entirely of playa. Playas occur on 0-1 percent slopes, are poorly drained, have a water table at the surface, rarely flood, but have frequent ponding, and are moderately or strongly saline. The typical soil profile is silty clay loam underlain by silty clay. Soil unit 900 has a slight hazard of off-road or off-trail erosion and is poorly suited for natural surface road construction, primarily due to frequent ponding, wetness, and low strength (USDA NRCS, 2009).

Soil unit 960 is the Kolda-Umberland association. Kolda soils occur on 0-2 percent slopes, are very poorly drained, have a water table at the surface, never flood, but frequently pond, are very slightly or slightly saline, and typically support wetland vegetation. The soil profile is typically silt loam, underlain by silty clay and clay. Umberland soils occur on 0-2 percent slopes, are somewhat poorly drained, have a water table at 18 to 30 inches, rarely flood, but never pond, are moderate to strongly saline, and support wet meadow vegetation. The soil profile is typically a silty clay loam underlain by silty clay. Soil unit 960 has a slight hazard of off-road or off-trail erosion and is poorly to moderately suited for natural surface road construction, primarily due to frequent ponding, wetness, and low strength (USDA NRCS, 2009).

### 3.13.1 Coyote Canyon

Soil units 184, 343, and 330 are present in the CC project area; a similar number of well pads are planned within each soil unit (Figure 9). The western portion of the CC lease area was not considered in this analysis because no Proposed Action is planned in this area of steep mountainous terrain.

### 3.13.2 Dixie Meadows

Soil units 900, 330, 343, 184, and 960 are present in the DM project area (Figure 10). Most of the proposed well pads are located within soil unit 900. The rest of the well pads are located in soil unit 330. Access roads cross soil units 184 and 343. A small portion of the DM lease area lies in soil unit 960; however, there are no proposed well pads or access roads located within this soil unit.

## 3.14 Visual Resources

BLM utilizes a visual resource management (VRM) process to manage the quality of landscapes on public land and to evaluate the potential impacts to visual resources resulting from development activities. VRM class designations are determined by assessing the scenic value of the landscape, viewer sensitivity to the scenery, and the distance of the viewer to the subject landscape. These management classes identify various permissible levels of landscape alteration, while protecting the overall visual quality of the region. They are divided into four levels (Classes I, II, III, and IV). Class I is the most restrictive and Class IV is the least restrictive in terms of changes that are allowed to the characteristic landscape (BLM, 1986).

Based on information contained in the *Consolidated Resource Management Plan* (BLM, 2001) and environmental assessments for other projects sharing this vicinity, both the CC and DM lease areas are located within a Class IV VRM category. The objective for this class is to provide for management activities that allow major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. Activities in a Class IV category may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

The closest transportation route is Dixie Valley Road, which is designated State Route 121. The closest urban sensitive receptor (park, church, residence, school, or hospital) is located in Lovelock, Nevada, approximately 27 air miles west of the project sites. The Stillwater Mountain Range, with peaks higher than 8,500 feet, is located between the CC and DM lease areas and Lovelock. The closest receptor would be the 7 Devils Ranch located approximately 14 miles northeast of CC.

## 3.15 Lands

Most of the land in Dixie Valley is federal land managed by the BLM and nearly all of it is designated as having the highest geothermal resource potential of any BLM-managed public lands in the state (BLM, 2001). The federal government administers more than 82 percent of the land in Churchill County. In accordance with the BLM PEIS for Geothermal Development (BLM, 2008a) and the Churchill County Master Plan (2005), the expansion and

development of geothermal resources is supported and promoted for federal lands in this region in support of a national energy policy for renewables. A BLM designated utility corridor exists within Dixie Valley with the express purpose of providing an outlet for geothermal power to be produced in the valley (BLM, 2001). There is a transmission line within this corridor.

Small private parcels exist throughout the valley, and a large portion of the southern half of the valley is controlled by the Department of Defense for testing of low-level supersonic flight operations as part of the Fallon Range Training Complex.

The existing Terra-Gen Dixie Valley geothermal plant is just north of the CC and DM lease areas, and a small private ranch is approximately 12 miles northeast of the Dixie Valley geothermal plant. The area is relatively undeveloped and most of the valley is utilized for cattle grazing, with BLM assuming grazing management responsibility on adjacent military-controlled lands.

Several rights-of-way or other authorizations have been granted on public lands within the project areas. These include rights-of-way for transmission lines, roads, and geothermal leases. There are 24 BLM-registered geothermal well leases in the area.

A BLM right-of-way planning corridor exists in Dixie Valley with the express purpose of providing an outlet for geothermal power to be produced in the valley (BLM, 2001). There is an existing 230-kilovolt (kV) transmission line owned by TGP within this corridor. BLM also has prepared a PEIS for Geothermal Leasing in the Western U.S. (BLM, 2008a), which analyzes potential impacts of geothermal development and provides a list of stipulations and best management practices (BMPs) related to geothermal leasing and related development on BLM-managed public land. In 2008, BLM issued a Record of Decision (ROD) for geothermal leasing in the Western U.S., including adoption of Resource Management Plan amendments related to geothermal leasing (BLM, 2008d).

### 3.15.1 Coyote Canyon

The CC lease area is located in Township 24N, Range 36E, in Sections 2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 21, 22, 23, and 24. The project area is located on land administered by BLM and leased for exploration activities to TGP. The Department of Defense operates the Gabbs North Military Operating Area (MOA) designated for low-level supersonic flight operations in the vicinity of Coyote Canyon.

The BLM Legacy Rehost (LR 2000) Report System and the BLM National Integration Land System (NILS) GeoCommunicator lists several non-producing geothermal leases and lease agreements within the leased area of the CC project, as well as producing leases, owned by TGP, within Sections 12 and 13 (BLM, 2009c). Within Section 12 is a right-of-way granted to the Navy for a remote relay station. Just east of the project area is a road right-of-way associated with the Terra-Gen Dixie Valley 230-kV transmission line, which runs southwest to northeast through Sections 12, 13, 14, 15, 21, and 22 of the lease area. There are also active lode mining claims located across Sections 2, 9,10,11,12, 13, 14, and 15 of the lease area (BLM, 2009c).

### 3.15.2 Dixie Meadows

The DM lease area is located in Township 22N, Range 35E, in Sections 4, 5, 8, 9, 10, 11, 15, 16, 17, 18, 19, and 20. The project components would be located primarily on BLM-managed lands. One well (Kettleman Number 28-4), and a portion of its access road, would be located on land controlled by the U.S. Navy for which TGP (through its wholly owned subsidiary, Nevada Power Vestors) owns the mineral rights.

The Department of Defense operates the Gabbs North MOA designated for low-level supersonic flight operations in the vicinity of Dixie Meadows, which also lies within the northwest boundary of Restricted Area 4816N of the Gabbs North MOA.

The BLM LR 2000 Report System and the BLM NILS GeoCommunicator list several non-producing geothermal leases within the lease area of the DM project, as well as lease agreements and lease nominations surrounding the lease area (BLM, 2009c). Just south of the project area are two rights-of-way for water well testing by the USGS in Sections 28 and 32, and northwest of the site in Section 6 is a right-of-way for a seismic station site run by University of Nevada-Reno. Surrounding the site in Sections 4, 5, 8, 17, 18, and 19 are lands controlled by the Department of Defense. Just north of State Route 121, the BLM right-of-way alignment for the Terra-Gen Dixie Valley transmission line and its associated access road runs southwest to northeast through the center of the project. There are no active mining claims in this area.

SECTION 4

# Environmental Effects

This section evaluates the potential direct, indirect, and cumulative impacts that could result from the Proposed Actions. Section 4.1 identifies potential direct and indirect impacts, and Section 4.4 evaluates potential cumulative impacts when considered in the framework of past, present, and reasonably foreseeable future activities.

## 4.1 Proposed Actions – Direct and Indirect Impacts

The following subsections discuss the potential impacts of the Proposed Actions and the No Action Alternative.

### 4.1.1 Air Quality

Air emissions from the Proposed Actions at the CC and DM sites would be primarily attributable to the following air pollution sources:

- Heavy equipment and drill rig (diesel exhaust and GHG emissions)
- Earth moving and grading (particulate fugitive and GHG emissions)
- Well testing ($H_2S$ and GHG emissions)

Because the proposed exploration activities at the CC and DM sites would have approximately the same potential impacts on air quality, the following discussion applies to both sites.

**Heavy Equipment, Drill Rig, and Earth-moving and Grading Activities.** Fugitive dust emissions during construction and from construction vehicles using the access roads would result in temporary emissions of particulate matter, but these emissions would be of larger particulate sizes and the majority of these fugitive particulate emissions would settle before leaving the leasehold site. Since the proposed total disturbed area is greater than 5 acres for CC and DM, the NDEP Bureau of Air Pollution Control (BAPC) requires a Surface Area Disturbance Permit and corresponding Dust Control Plan. The NDEP BAPC has jurisdiction of air quality programs over all counties in Nevada except Washoe and Clark counties.

Short-term construction and drill rig exhaust emissions, including volatile organic compounds, carbon monoxide, nitrogen dioxide, $PM_{10}$, hazardous air pollutants, and oxides of sulfur would result from internal combustion engines and heavy equipment used at the construction site. These short-term fugitive emissions would be below the threshold level that would require a permit from NDEP BAPC.

**Well Testing.** Small quantities of naturally occurring non-condensable gases, such as $H_2S$ and GHGs (carbon dioxide and much smaller amounts of methane) would be emitted to the air during well testing. $H_2S$ initial concentrations in CC and DM area geothermal fluids are estimated at approximately 70 ppm, and methane concentrations are estimated at less than 2 percent of non-condensable gases, based on historical data (Freeman, 1986). This estimate is conservative in that more recent tests at the existing Dixie Valley geothermal plant indicate

lower concentrations (TGP, 2009). As discussed in Chapter 2 of this EA, up to 15 slim wells and/or exploration wells up to 10,000 feet deep at DM and up to 15 slim wells and/or exploration wells at CC would be drilled and performance tested. Well testing would be conducted for an average of 3 days (24 hours per day) for each well. It is anticipated that the initial flow rates of fluid from each well into its reserve pit (and to the existing Dixie Valley sumps, as required) would be approximately 500 to 1,500 gallons per minute on average (with up to 700,000 pounds per hour geothermal flow) depending upon the productivity of the well. Based on this estimate, total potential emissions from the proposed well testing would be approximately 26.40 tons $H_2S$ (1.76 tons per well) at each site (CC and DM).

Air emission sources that exceed 5 tons per year of criteria air pollutant emissions require an air permit from the NDEP BAPC. This permit would be a temporary permit for operations of less than 1 year duration or a stationary source permit for operations greater than 1 year duration.

The Proposed Actions would each require temporary permits because project-related emissions would be greater than 5 tons per year and performance testing would last less than 1 year. If the total activity duration were extended beyond 1 year, TGP would obtain a stationary source permit.

**Heavy Equipment and Well Testing.** Cumulative GHG emissions from well testing and construction-related diesel engines were reviewed and determined to be less than 25,000 tons per year, which is below the level that triggers federal reporting requirements. Additionally, according to State of Nevada regulations, only electrical generating power plants are required to report GHG emissions; therefore, the Proposed Actions would not be required to report GHG emissions.

To minimize air pollution emissions from construction activities and construction and drill rig diesel engines, the following BMPs for fugitive dust and diesel exhaust would be implemented during operational activities:

- Surfacing access roads with aggregate materials, wherever appropriate
- Using dust abatement techniques, such as watering on unpaved, unvegetated surfaces to minimize airborne dust, as needed (The source of water to be used for dust abatement is described in Section 2.1.8.)
- Posting and enforcing speed limits to reduce fugitive dust (speed limit of 15 miles per hour, as necessary)
- Applying dust abatement techniques (such as watering, requiring loader buckets to be emptied slowly, minimizing drop heights, etc.) to earth-moving, excavating, trenching, and grading activities
- Minimizing equipment and vehicle idling times during construction activities

### 4.1.2 Cultural Resources

Consultation with the SHPO on Determinations of Eligibility and Finding of Effect for cultural resources located within the project area are ongoing, and finalizing the evaluation below is contingent on completing that consultation process. Following the State Protocol

Agreement between the Bureau of Land Management, Nevada and the Nevada State Historic Preservation Office for Implementing the National Historic Preservation Act, 2009, Appendix H. Avoiding Properties, Sections A and B, archaeological resources recommended as eligible will be avoided.

**Coyote Canyon.**

Six archaeological resources were recommended as eligible. Following the State Protocol Agreement between the Bureau of Land Management, Nevada and the Nevada State Historic Preservation Office for Implementing the National Historic Preservation Act, 2009, Appendix H., Sections A and B., the design of the proposed project construction (pads or roads) would be relocated to avoid those sites recommended as eligible. A thirty meter buffer will be placed around historic properties identified within the APE. In the event that any construction overlaps this buffer an archaeological monitor will be on site during the construction.

**Dixie Meadows.**

One archaeological resource was recommended as eligible. Following the State Protocol Agreement between the Bureau of Land Management, Nevada and the Nevada State Historic Preservation Office for Implementing the National Historic Preservation Act, 2009, Appendix H., Sections A and B., the design of the proposed project construction (pads or roads) would be relocated to avoid those sites recommended as eligible. A thirty meter buffer will be placed around historic properties identified within the APE. In the event that any construction overlaps this buffer an archaeological monitor will be on site during the construction.

### 4.1.3 Native American Religious Concerns

Consultation regarding the CC and DM sites between the BLM and federally recognized Native American tribes is ongoing. During consultation for the proposed project following concerns were identified: cultural resources including historic properties; continued access and use of the Dixie Hot Springs for healing and spiritual purposes; and other resources that may be effected by the current project.

### 4.1.4 Paleontological Resources

Direct impacts to paleontological resources could result from the mechanical destruction of fossils as a consequence of uncontrolled excavations of paleontologically sensitive sedimentary units. This includes grading, and excavating and drilling. Other activities, such as laying roadway gravel over the top of paleontologically sensitive sediment, would have little or no impact on paleontological resources. Indirect effects to paleontological resources could include unauthorized fossil collection after fossil-rich sediment is exposed by excavation, in the absence of measures to restrict public access to such sites or to educate workers on paleontological resource avoidance.

**Coyote Canyon.** Construction activities that include surface disturbance of the immediate subsurface at one well pad (Well 61-15) would have the potential to impact paleontological resources because subfossil wood occurs in the immediate vicinity (PFYC = 4). Prior to construction at this site, this impact would be mitigated by moving the location of Well 61-15 to the west away from this resource, staking for avoidance that area within Sections 14

and 15 where subfossil wood exists, subsequent avoidance of the area during construction, and by worker education that would include the importance of paleontological resources avoidance.. The paleontological potential of the other 24 well pads and their access routes is low (PFYC Class 2), and therefore impacts to paleontological resources are not expected.

Of the 25 well sites in the CC area, only one possesses high (PFYC Class 4) paleontological sensitivity (Well 61-15), because of the presence of subfossil wood on the surface in the immediate vicinity. The subsurface potential of all well pads in the CC area is considered to be low (PFYC Class 2) because they are located at sites underlain by alluvium or oxidized playa sediments. Impacts to paleontological resources from project development in the CC area would therefore not occur because the one area designated PFYC Class 4 (high sensitivity) will be avoided by relocation of the well pad, and by educating workers on paleontological resources avoidance.

**Dixie Meadows.** Because all well sites occur within the limit of the current dry lake, they possess low (PFYC Class 2) paleontological potential. The area possessing unknown potential with the possibility of fossils occurring at depth (PFYC Class 3b) lies to the east of the wells and their associated access roads. In this area deep, relatively unweathered lacustrine sediment and spring discharge deposits occur, and theses sediments have yielded scientifically important paleontological resources in other portions of the Great Basin. A north-south segment of access road is the only portion of the Dixie Valley project area to cross sediments that have unknown potential (PFYC Class 3b). This would be mitigated by assuring that the roadway in that area is not bladed, but instead would consist of material imported to create a roadbed elevated above potentially sensitive sediments.

With the exception of this access road, no project facilities are proposed for these areas, and therefore, with avoidance by building up of the access road bed, no impact to paleontological resources is expected.

## 4.1.5 Biological Resources

### 4.1.5.1 Vegetation

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. Topsoil would be salvaged whenever possible and reused in a timely manner.

Withdrawal of groundwater for flow testing has the potential to affect hydrophytic marsh vegetation that is supported by hot springs in the vicinity of DM by lowering the water table. This potential impact is discussed in the water quality section of this EA (Section 4.1.8). Disturbance to marsh vegetation would be avoided to the extent possible.

***Coyote Canyon.*** The specific locations of the 15 wells to be installed at CC would be determined prior to drilling. This analysis conservatively assesses impacts based on the potential maximum number of well locations identified within each vegetation type to identify impacts to vegetation, even though the area disturbed by CC exploration activities would not be more than 73 acres.

According to SWReGAP analysis, up to 20 acres of disturbance could be located on intermountain basins playa, which is generally lacking vegetation, although scattered salt-tolerant communities also occur (USGS, 2004). Implementing the Proposed Actions could

lead to the disturbance of up to 62 acres of intermountain basins mixed salt desert scrub and up to 17 acres of salt-tolerant communities. In addition, disturbance could occur to small areas of fringing wetland vegetation associated with seeps and springs in the vicinity of well pads and access roads on the margin of the playa; however, this disturbance would be minimized by implementation of the BMPs described in Sections 4.1.8.1 and 4.1.10.1.

***Dixie Meadows.*** The specific locations of the 15 wells to be installed at DM would be determined prior to drilling. This analysis conservatively assesses impacts based on the potential maximum number of well locations identified within each vegetation type to identify impacts to vegetation, even though the area disturbed by DM exploration activities would not be more than 73 acres.

According to SWReGAP analysis, the area of disturbance is generally lacking vegetation, although scattered salt-tolerant communities also occur (USGS, 2004). The majority of disturbance to vegetation would occur to salt-tolerant communities. Up to 5 acres of intermountain basins mixed salt desert scrub would be disturbed from access road construction. Disturbance may occur to small areas of fringing wetland vegetation associated with seeps and springs in the vicinity of well pads 28-4 and 32- 9; however, this disturbance would be minimized by implementation of the management practices described in Sections 4.1.8.1 and 4.1.10.1.

#### 4.1.5.2 Invasive, Non-native Species

The Proposed Actions have the potential to increase the spread of invasive, non-native species. Weed seeds can germinate when soils are disturbed by 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 for the Proposed Actions to increase the spread of invasive, non-native species would be minimized through the use of BMPs, including mapping and treating weed infestations prior to disturbance or during construction, and use of certified weed-free seed and mulching materials, as described in Section 2.1.

A noxious weed control program consisting of monitoring and eradication for species listed on the Nevada Designated Noxious Weeds List (NRS 555.010) also would be implemented. With implementation of these measures, no long-term impacts associated with invasive, non-native species are anticipated.

#### 4.1.5.3 Migratory Birds

Direct impacts stem from approximately 73 acres of actual habitat that would be disturbed in both CC and DM during the life of the Proposed Action, although effective habitat loss from the disturbance and fragmentation may encompass a larger area for some species. Construction, human activity, and increased noise in the area from construction and drilling could temporarily displace migratory birds from the area. However, large tracts of similar habitat are found adjacent to the project areas, and migratory birds would likely return to the area after construction.

The Migratory Bird Treaty Act (MBTA) analyzes requirements related to ground-disturbing activities during the migratory bird nesting season. To meet these requirements, 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. This 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, TGP would coordinate with BLM 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, in addition to the management practices described above, well pads and roads would be recontoured and reseeded following completion of the Proposed Actions as described in Section 2.1.10. Erosion-control measures would be implemented as described in Section 4.1.10. Topsoil would be salvaged and reused whenever possible and in a timely manner.

#### 4.1.5.4 Sensitive Species

**Threatened and Endangered Species**

Because no threatened or endangered species were observed during field surveys or are known to exist in either CC or DM lease areas, there would be no impacts to threatened or endangered species from the Proposed Action (BLM, 2003; USFWS, 2009a; USFWS, 2009b).

**BLM Sensitive Species**

Sage grouse may use the project area as a water source. Mitigation measures as described in Section 4.1.8 would be implemented to minimize impacts to water resources; therefore, negligible impacts to sage grouse are expected as a result of implementation of the Proposed Actions.

No sensitive bat roosting habitat is expected to be disturbed due to implementation of the Proposed Actions. However, direct impacts stem from approximately 73 acres of actual habitat that would be disturbed in both CC and DM during the life of the Proposed Action, although effective habitat loss from the disturbance and fragmentation may encompass a larger area for some bat species. Bat species in the area are insectivorous and it is not expected that insect populations would be adversely affected by construction activities. There are large tracts of similar habitat in the vicinity of the project area for bats to forage; therefore, no impacts to sensitive bat species are anticipated.

In the project areas for both CC and DM, resident BLM sensitive avian species (including golden eagle, ferruginous hawk, prairie falcon, and loggerhead shrike) and breeding sensitive avian species (such as burrowing owl and vesper sparrow) would lose approximately 73 acres of habitat at each site as a result of the Proposed Actions. Effective habitat loss from disturbance and fragmentation may encompass a larger area for some avian species. Indirect effects from noise and increased human activity could temporarily displace and reduce breeding success of these sensitive avian species; however, the species would be able to return to the disturbed areas upon completion of ground-disturbing activities. No population-level impacts to the sensitive avian species are expected as a result of implementation of the Proposed Actions. Because sensitive avian species would likely

return to the area after construction is complete and because similar habitat is available near the project area, impacts to sensitive avian species are expected to be minor from implementation of the Proposed Actions. There are large tracts of similar habitat in the vicinity of the project area; therefore, no impacts to BLM sensitive avian species are anticipated.

Impacts to BLM sensitive species associated with marsh habitats (e.g., northern leopard frog, sandhill crane, snowy plover, black tern, long-billed curlew, and least bittern) would be similar to avian species described above.

Bighorn sheep habitats within the Stillwater Range are not anticipated to be disturbed by construction or drilling activities because drilling and road construction would not occur in these areas. Therefore, no impacts to bighorn sheep are expected as a result of the implementation of the Proposed Actions.

#### 4.1.5.5 Wildlife Resources

***Coyote Canyon.*** Direct impacts to wildlife species stem from disturbance of approximately 73 acres of actual habitat, although effective habitat loss from disturbance and fragmentation may encompass a larger area for some species. Because the specific locations of the 15 wells to be installed would not be determined until drilling begins, the potential habitat impacts are calculated based on the worst-case scenario for each habitat type (assuming the maximum number of wells in each habitat type). As a result, the total acreage impacts reflected in this analysis add up to more than 73 acres. Up to 62 acres of intermountain basins mixed salt desert scrub, up to 17 acres of intermountain basins greasewood flat/saltgrass meadows/iodinebush scrub, and up to 20 acres of intermountain basins playa habitat could be disturbed by implementation of the Proposed Actions. In addition, disturbance may occur to small areas of fringing wetland vegetation associated with seeps and springs in the vicinity of well pads and access roads on the margin of the playa; however, this disturbance would be minimized by implementation of the BMPs described in Section 4.1.5.1.

Construction of access roads and installation of wells would result in direct loss of habitat. Direct impacts from mortality to smaller, less mobile species could occur during construction if those species are present. Noise, human presence, and heavy equipment present during construction activities are likely to temporarily displace wildlife that may be present or near the project area and could have an indirect effect on wildlife species in the area. These indirect effects could reduce breeding success of species that are sensitive to human activity. These impacts are expected to 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 implementation of the CC Proposed Action. 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 are expected to be minor from implementation of the CC Proposed Action.

***Dixie Meadows.*** Direct impacts to wildlife species stem from disturbance of approximately 69 acres of habitat within the DM lease area and approximately 4 acres within the Lamb Mineral Interests property, although effective habitat loss from disturbance and fragmentation may encompass a larger area for some species. Because the specific locations

of the 15 wells to be installed would not be determined until drilling begins, the potential habitat impacts are calculated based on the worst-case scenario for each habitat type (assuming the maximum number of wells in each habitat type). As a result, the total acreage impacts reflected in this analysis add up to more than 73 acres. Up to 5 acres of intermountain basins mixed salt desert scrub, up to 22 acres of intermountain basins greasewood flat /saltgrass meadows/iodinebush scrub, and up to 80 acres of intermountain basins playa habitat could be disturbed by implementation of the DM Proposed Action. Disturbance could occur to small areas of fringing wetland vegetation associated with seeps and springs in the vicinity of well pads 28-4 and 32-9; however, this disturbance would be minimized by implementation of BMPs as described in Sections 4.1.8 and 4.1.10.

Direct impacts from mortality to smaller, less mobile species could occur during construction if those species are present. Noise, human presence, and heavy equipment present during construction activities are likely to temporarily displace wildlife that may be present or near the project area and could have an indirect effect on wildlife species in the area. These indirect effects could reduce breeding success of species that are sensitive to human activity. These impacts are expected to 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 implementation of the DM Proposed Action. 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 are expected to be minor from implementation of the DM Proposed Action.

### 4.1.6 Livestock Grazing

As outlined in Tables 6 and 7, the proposed projects would collectively disturb up to 146 acres (73 acres for CC and 73 acres for DM) within various grazing allotments. As stated in Section 2.1, to maintain flexibility in location of slim wells and/or exploration wells, TGP is proposing 25 potential well locations at CC and 28 potential locations at DM. However, a maximum of 15 slim and/or exploration wells would be drilled in each project area.

Conservatively, it is estimated that up to 2.81 AUMs, or less than three one-hundredths of one percent of the 10,521 AUMs within the three grazing allotments, would be compromised by disturbance from the projects. Due to this small disturbance, there is no impact to the AUMs from the Proposed Actions, and no reduction in authorized grazing use would be required. All activities for both projects are located away from sources of water in the vicinity and would not compromise livestock access to available water sources.

**Coyote Canyon.** The CC Proposed Action could disturb up to 73 acres, less than one percent of the 127,194 acres comprising the Boyer Ranch Allotment, reducing the 1,790 AUMs within the allotment by approximately 1.02 AUMs. No reduction in authorized grazing use would be required.

**Dixie Meadows.** The DM Proposed Action would disturb up to 69 acres within the DM lease area, or less than less than 1 percent of the 10,512 acres comprising the three allotments within DM. Because it is unknown at this time which of the 28 potential well locations would be used to install the 15 wells planned for DM, this analysis conservatively assesses

impacts based on the potential maximum number of well locations identified within each allotment.

If the all the wells proposed for the Boyer Ranch Allotment were installed, the DM Proposed Action could disturb up to 44 acres within the Boyer Ranch Allotment. This is less than 1 percent of the 127,194 acres comprising the Boyer Ranch Allotment, reducing the 1,790 AUMs within the allotment by approximately 0.62 AUM. No reduction in authorized grazing use would be required.

If all the potential well locations identified within the Cow Canyon Allotment were utilized, the DM Proposed Action could disturb up to 40 acres within the Cow Canyon Allotment. This is less than 1 percent of the 146,179 acres comprising the Cow Canyon Allotment and would reduce the 2,390 AUMs within the allotment by approximately 0.65 AUM. No reduction in authorized grazing use would be required.

If all the potential well locations within the Dixie Valley Allotment were utilized, the DM Proposed Action could disturb up to 23 acres within the Dixie Valley Allotment. This is less than 1 percent of the 282,801 acres comprising the Dixie Valley Allotment and would reduce the 1,790 AUMs within the allotment by approximately 0.52 AUM. No reduction in authorized grazing use would be required.

### 4.1.7 Wastes, Hazardous or Solid

Diesel fuel, lubricants, hydraulic fluids, and drilling chemicals (drilling mud, caustic soda, barite, etc.) would be transported to, stored on, and used at both project areas. The Proposed Action must conform to federal and state requirements for handling these hazardous materials. Typical of most construction projects, the storage and use of these materials could result in minor, incidental spills of diesel fuel or oil to the ground during fueling of equipment, filling of fuel storage tanks, and handling lubricants. Other incidental spills could be associated with equipment failures such as ruptured hoses. Management practices, described in Section 2 and including development of a spill plan, use of secondary containment structures, and worker training, would be used to prevent the release of hazardous wastes to the environment. Solid wastes would be transported offsite to a landfill. Implementation of these procedures would prevent or minimize potential impacts on the environment due to generation of hazardous or solid wastes.

### 4.1.8 Water Quality, Wetlands, and Floodplains

As described in Section 2, access roads would be constructed as part of the Proposed Actions. Roads and wells would be located and designed to avoid impacts to surface water features such as springs, seeps, ponds, and ephemeral washes to the extent possible.

Well testing would involve removing thermal groundwater and discharging it to the drill pad reserve pit. Excess fluids from each well would be trucked to existing reserve pits at the Dixie Valley geothermal power plant. The anticipated test flow rates (500 to 1,500 gallons per minute) and durations (average of 3 days) may result in 2 to 6 million gallons of thermal groundwater being extracted from the geothermal aquifer for each well during testing. Installation and testing of deep geothermal wells has the potential to cause impacts on surface water through accidental release of geothermal fluids to surface water features. The hot springs in the DM lease area indicate there may be a hydrologic connection between

the geothermal aquifer and the aquifer that feeds surface water features, such as springs. To prevent a release of geothermal fluids to surface water features, drilling muds and geothermal fluids would be contained in the reserve pit or trucked to the existing sumps at the Dixie Valley geothermal power plant when quantities dictate.

BMPs for well installation and testing would be implemented as described below. In addition, a hydrologic evaluation plan would be put in place to confirm the expectation that no impacts to quality, quantity, or temperature of surface water occurred as a result of slim well and/or exploration well installation and testing.

The release of hazardous materials to the environment could affect surface water features. BMPs to prevent such a release, including development of a construction Stormwater Pollution Prevention Plan (SWPPP) and spill prevention, control, and countermeasures (SPCC) plan, are described in Section 4.1.7. Similarly, erosion could affect surface water quality. Erosion-control measures would be implemented as described in Section 4.1.9. In addition to these measures, the following steps would be undertaken during construction to avoid or minimize the potential for impacts to surface water or groundwater in the area:

- 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.
- Drill pad reserve pits would be compacted during construction and settled bentonite clay from drilling mud would accumulate on the bottom of the drill pad reserve pit to act as an unconsolidated clay liner, reducing the potential for drilling fluid to percolate to groundwater.
- TGP would obtain necessary working in waters and/or groundwater discharge permits and provide a Notice of Intent to NDEP prior to well pad construction.
- Wetland boundaries would be avoided to the extent possible.
- A BLM-approved grouting and casing program for construction of slim well and/or exploration 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.
- BMPs would be implemented to ensure that any geothermal fluid encountered during the drilling does not flow uncontrolled to the surface. These include the use of “blow-out” prevention equipment during drilling and the installation of well casing cemented into the ground.
- A hydrologic evaluation plan will be submitted to the BLM for approval prior to drilling.

### Surface Water and Groundwater Monitoring Plan

Standard aquifer testing procedures would be employed at targeted depth intervals as the boreholes for slim wells and/or exploration wells are advanced. The vertical boundaries of the aquifers, the depth of aquifers (non-thermal and thermal) penetrated during drilling, would be noted from the drilling log. The horizontal boundaries would be noted if any are reflected on time-drawdown plots produced during aquifer testing. Borehole geophysics analysis would be conducted from the ground surface to the total depth of the borehole. Aquifer testing would be used to determine drawdown associated with pumping. If possible, an assessment of whether the aquifer is confined or unconfined would be made, as well as an estimate of aquifer thickness and a qualitative assessment of its relative productivity. The temperature of penetrated aquifers would be noted. A hydrologic evaluation plan would be put in place to confirm the expectation that no impacts to quality, quantity, or temperature of surface water and groundwater occurred as a result of slim well and/or exploration well installation and testing.

Selected seeps and springs, determined in consultation with BLM, would be monitored for basic water quality, flow, and temperature prior to and during the Proposed Actions.

**Coyote Canyon.** As discussed in Section 3.9, palustrine emergent wetlands associated with springs and seeps are present within the CC lease area in Sections 23 and 24 (Figure 6). Based on a review of USGS topographic maps and NDWR groundwater basin mapping, these water bodies are not jurisdictional waters of the U.S. because they are located in an internally drained desert basin that is distant from and lacks hydrographic connectivity to major rivers and water bodies. A request for jurisdictional determination concurring with this finding is pending from the U.S. Army Corps of Engineers. Although the waters are not jurisdictional waters of the U.S., construction activities would avoid wetland areas associated with seeps and springs to the extent possible.

**Dixie Meadows.** Eleven potential wells and associated access roads are located within the FEMA FIRM Zone A "SFHA subject to inundation by the 1% annual chance flood" (FEMA, 2008b; Figure 7). The well pads would be constructed at ground level, using aggregate to create a stable foundation. As described in the BMPs, the wells would be grouted and cased so that flood water could not penetrate if wells are inundated.

As discussed in Section 3.9, wetland marshes associated with springs (hot and cold) and seeps are present within the DM lease area in Sections 4, 5, 8, 9, 17, and 19 (Figure 8). Similar to CC, above, a request for jurisdictional determination is pending from the U.S. Army Corps of Engineers concurring with the finding that the springs and seeps are not waters of the U.S. Although the waters are not jurisdictional waters of the U.S., construction activities would avoid wetland areas associated with seeps and springs to the extent possible.

## 4.1.9 Geology and Minerals

A history of recent (1954) seismicity and the presence of hot springs on the surface trace of the Dixie Valley fault zone led Ryall and Vetter (1982) to suggest that Dixie Valley would have a relatively high potential for induced seismicity if injection of geothermal fluids into deep wells occurs. Because the exploration activities described in this document do not involve injecting fluids into the slim wells and/or exploration wells, induced seismicity is not expected to occur related to exploration activities.

### 4.1.10 Soils

The hazard of off-road or off-trail soil erosion in the project areas is slight (USDA NRCS, 2009). The soils are poorly to moderately suited for natural surface road construction (USDA NRCS, 2009); therefore, TGP would implement the BMPs described below when constructing access roads and well pads.

The loss of soil productivity is expected to be low because the soils have low native fertility and no farmlands, as covered under the Farmland Protection Policy Act (Public Law 97-98, 7 USC 4201), are present within the CC or DM lease areas.

The release of hazardous materials to the environment could affect soil resources. BMPs to prevent such a release, including development of a SPCC plan, are described in Section 4.1.7.1.

Erosion and loss of soil productivity would be minimized by implementing the following BMPs during access road and well pad construction:

- Excavation into native soil during construction of well pad reserve pits would be minimized to the maximum extent possible.
- Wells and roads not required for development purposes would be re-contoured to blend with the surrounding topography, in accordance with lease stipulations.
- Topsoil would be salvaged and reused whenever possible and in a timely manner.
- Temporarily disturbed areas would be reseeded where previously vegetated using a BLM-approved seed mixture.
- 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.
- 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, 2007a).
- An average of 6 inches of gravel would be used as road surface because roads would be used during all seasons. Up to 3 feet of gravel may be used on some sections of road, and no gravel would be used on road sections where the natural surface is adequate.
- Additional gravel would be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation and severe compaction. As a general rule, if vehicles or other project equipment create ruts in excess of 4 inches deep, a gravel surface would be installed prior to additional use.
- When construction occurs in areas of very soft soils, up to 3 feet of aggregate would be used.
- An NDEP BAPC Surface Area Disturbance documenting the BMPs to be used would be required for the project because the surface disturbed would be greater than 5 acres.

- Overland route corridors may be used for infrequently accessed locations.

**Coyote Canyon.** Construction of roads and well pads in the CC project area could disturb up to 73 acres (see Table 6). Erosion and loss of soil productivity would be minimized as described above.

**Dixie Meadows.** Construction of roads and well pads in the DM project area could disturb up to 69 acres on BLM-managed public lands, and up to 4 acres on the Lamb Mineral Interests property (see Table 7). Erosion and loss of soil productivity would be minimized as described above.

### 4.1.11 Visual Resources

Temporary impacts to visual resources would occur during road and well pad construction activities at the project area and as a result of the presence of drill rigs. Drilling equipment would be seen from Dixie Valley Road. Roads, drill pads, and laydown areas are near ground level and would not affect visual resources. Construction impacts would be minor and short-term and would be consistent with the objectives of Class IV VRM objective.

During the drilling operations, the drill rig could extend up to about 160 feet above ground level. These operations would be 24 hours per day, 7 days per week. During drilling operations, the rig would be visible at distances of greater than 1 mile from the respective drill sites, and lights used when drilling at night would increase rig visibility. All drill rig and well test facility lights would be limited to those required to safely conduct the operations and would be shielded and/or directed in a manner that focuses direct light to the immediate work area.

Access roads would remain after the wells have been drilled until reclamation is conducted as described in Section 2.1.10. Laydown areas and concrete slab drill pads would be removed as described in Section 2.1.10 if they are no longer needed.

The Stillwater Mountain Range, with peaks higher than 8,500 feet, is between the CC and DM lease areas and Lovelock. The CC and DM project areas are, therefore, not visible from the Lovelock area. The CC and DM project areas are located approximately 14 miles away from and The 7 Devils Ranch and are therefore not likely to be visible.

### 4.1.12 Lands and Realty

Existing linear rights-of-way in the vicinity of the CC and DM lease areas include the Terra-Gen Dixie Valley 230-kV transmission line and its associated access road and State Route 121 to the south, which would be used only for access to the project areas. The Proposed Actions do not include drilling or other exploration activities in the State Route 121 right-of-way. The use of the lands for geothermal development would not preempt the other current uses of the land identified in Section 3.13.

The Department of Defense operates the Fallon Range Training Complex, a portion of an MOA designated for low-level supersonic flight operations over the Dixie Valley region. Impacts to the MOA are reviewed by the Federal Aviation Administration (FAA) if the FAA obstruction thresholds are triggered. The Proposed Actions would not trigger the FAA obstruction thresholds (14 CFR Part 77.13) because they would not include:

- Construction or alteration exceeding 200 feet above ground level

- Construction or alteration:
  - within 20,000 feet of a public use or military airport which exceeds a 100:1 (horizontal:vertical) surface from any point on the runway of each airport with at least one runway more than 3,200 feet
  - within 10,000 feet of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 feet
  - within 5,000 feet of a public use heliport which exceeds a 25:1 surface
- Highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards
- Construction or alteration located on a public use airport or heliport regardless of height or location

## 4.2 No Action Alternative

Project features would not be constructed under the No Action Alternative. Therefore, none of the resources described in Section 3 would be affected by the Proposed Action.

## 4.3 Residual Impacts

Solid waste would be generated as a result of the Proposed Actions, resulting in residual impacts. The waste would be disposed in approved, permitted disposal facilities. Impacts to vegetation and soils would be mitigated by interim and final reclamation process. Impacts to wildlife, including migratory birds and sensitive species, would be temporary. The potential introduction of invasive, non-native species as a result of the Proposed Actions would be minimized through the use of BMPs but some potential for the spread of non-native species could remain once all reclamation procedures have been completed.

## 4.4 Cumulative Impacts Analysis

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." Cumulative impacts from geothermal leasing in the Western United States were analyzed as part of the PEIS (BLM, 2008a).

The following discussion evaluates the potential impacts of the Proposed Actions when taken in combination with one another and 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 4.1. For purposes of assessing cumulative impacts, both the CC and DM projects are considered together and cumulative to one another.

### 4.4.1 Past and Present Actions

Current land use activities in the vicinity include geothermal energy production, grazing, and wild horse management. In the past, mining claims were active in the vicinity, but no mining activities are currently known. A BLM right-of-way planning corridor exists within Dixie Valley with the express purpose of providing an outlet for geothermal power to be produced in the valley (BLM, 2008a). Currently, there is a transmission line within this corridor, and the 62-MW Dixie Valley geothermal power plant has been producing energy here for more than 20 years.

Small private parcels exist throughout the valley, and a large portion of the southern half of the valley is owned by the Department of Defense for testing of low-level supersonic flight operations.

### 4.4.2 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 Actions. For the Proposed Actions, 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 (grazing, current geothermal energy production, and wild horse management) as well as geothermal development. There are currently 24 geothermal leases in Dixie Valley, and additional geothermal exploration and development is likely during the duration of the CC and DM leases.

If the proposed exploration well testing determines that geothermal energy production would be cost effective, TGP proposes to construct and operate geothermal power plant projects at both the CC and DM lease areas using geothermal fluid to generate approximately 62 megawatts gross of electricity each.

### 4.4.3 Cumulative Impacts

#### 4.4.3.1 Air Quality

Air quality impacts from the Proposed Actions at CC and DM would consist only of temporary impacts during well construction, including fugitive dust from construction vehicles and hydrogen sulfide emissions during well testing. If well installation activities are performed concurrently at other sites, the Proposed Actions could contribute to a cumulative temporary increase in fugitive dust and hydrogen sulfide emissions. These impacts would be minimized through the use of as the management practices described in Section 4.1.1.

#### 4.4.3.2 Cultural Resources

The Proposed Actions have been designed to avoid identified cultural resources in Dixie Valley. Increased traffic and activity in the lease area, when combined with traffic from other current and potential future activities, could cause an incremental additional risk of unintentional disturbance of cultural resource areas. BMPs would be used to prevent or minimize unauthorized or unintentional disturbance of cultural resource areas.

#### 4.4.3.3 Native American Concerns

Much of the state of Nevada is part of the traditional Paiute and Western Shoshone lands occupied for centuries before Europeans arrived, and the land maintains cultural significance for the Native American community. Over the last couple of decades more activities have begun encroaching on what has been a largely unpopulated and pristine environment. Increases in livestock grazing, oil and gas exploration, geothermal exploration and development, mining, and recreational activities such as OHV, hunting and fishing, hiking, and mountain biking have become more common in the vicinity. These multiple uses, and the increased frequency of them, contribute to the overall decline in cultural resource sites and traditional cultural properties significant to the spiritual or cultural identities of the Native American Tribes.

In order to minimize the potential cumulative contribution of the Proposed Actions to impacts such as these, BLM Stillwater Field Office and the affected Tribal organizations need to maintain an open and honest dialog in managing public lands. All interested parties need to remain flexible in their approach to making decisions on how to administer the multiple activities taking place on public lands. Through productive communications and understanding the needs of the other parties, the decisions made on how to manage the land can reduce or eliminate impacts to any party's interests on public lands.

#### 4.4.3.4 Paleontological Resources

Paleontological resources would be disturbed through implementation of the Proposed Actions, as described in Section 4.1.4. Such disturbances, when combined with disturbances from other current and future activities that disturb the surface and subsurface of the land, would have a cumulative impact on paleontological resources. However, implementation of BMPs to prevent unauthorized or uncontrolled disturbance of the land would limit the impacts.

#### 4.4.3.5 Biological Resources

The Proposed Actions would have impacts to biological resources. Vegetation and habitat would be disturbed and removed, and invasive, non-native plant species may spread as a result of the Proposed Actions. Other development such as described in Section 4.2.1 in the area may also remove vegetation and increase growth of invasive species. However mitigation measures including reseeding of disturbed areas and monitoring of invasive species would reduce potential impacts. Wildlife habitat, including habitat for migratory birds and BLM sensitive species, could be disturbed or removed due to other development in the area. Human activity and noise could displace wildlife to surrounding areas. However, similar abundant habitat is found in the area and region, and reseeding of disturbed areas could re-establish wildlife habitat. Overall, the Proposed Action would have a negligible contribution to cumulative effects on biological resources within the analysis area.

#### 4.4.3.6 Livestock Grazing

Because the Proposed Actions would result in a reduction of AUMs of less than 1 percent, no reduction in authorized grazing capacity would occur. No other forage-disturbing activities are known to be planned in the area

#### 4.4.3.7 Wastes, Hazardous or Solid

Solid waste and hazardous materials would be transported, stored, and used as part of the Proposed Actions. 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 4.1.7 would minimize the potential for wastes and hazardous materials to be released to the environment.

#### 4.4.3.8 Water Quality and Water Quantity

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 would be minimized through the use of BMPs for well construction. Percolation of geothermal fluids from well testing could have a temporary local impact on groundwater quality and water levels. Potential impacts to surface water would be temporary and local, and also would be minimized through the use of BMPs.

#### 4.4.3.9 Geology and Minerals

Because there are mining claims within the lease area, it is possible that the Proposed Actions could occur simultaneously with use of the area by mineral claimants. There are currently no mining Plans of Development identified within the project area. Therefore, the Proposed Actions are not expected to negatively impact mining claims in the lease area.

#### 4.4.3.10 Soils

Soil erosion could be caused by the combination of the Proposed Actions along with other current and potential future area activities. The contribution of the Proposed Actions to soil erosion would be minimized through the use of the BMPs described in Section 4.1.10.1.

#### 4.4.3.11 Visual Resources

Visual impacts from the Proposed Actions would be limited and would occur primarily during the construction process. If other geothermal exploration activities associated with the existing geothermal leases were to take place at the same time, the Proposed Actions could contribute to a temporary cumulative impact on visual resources. This contribution would be largely limited to the duration of construction when drill rigs are present onsite because any remaining structures would be low-level and not visible from a distance.

#### 4.4.3.12 Lands and Realty

The Proposed Actions are 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.

SECTION 5

# Consultation and Coordination

## 5.1 Agencies, Groups, and Individuals Contacted

| Name | Agency | Project Expertise |
|---|---|---|
| Jeryl Gardner | Bureau of Water Pollution Control, NDEP | Water Resources |
| Kristine Hansen | USACE, Reno District Office | Wetlands and Waters of the U.S. |
| Karen Clementsen | USACE, Reno District Office | Wetlands and Waters of the U.S. |
| Tom McKay | Natural Resource Conservation Service | Soils |
| Melissa Marr | Nevada Division of Water Resources (DWR) | Water Resources |
| Ken Haffey | Nevada Division of Water Resources (DWR) | Water Resources |
| Alvin Moyle | Chairman Fallon Paiute Shoshone Tribe | Native American Consultation |
| Rochanne Downs | Vice Chairperson Fallon Paiute Shoshone Tribe | Native American Consultation |
| Richard Black | Fallon Paiute Shoshone Tribe | Native American Consultation |

## 5.2 List of Preparers

| Name | Title | Project Expertise |
|---|---|---|
| **BLM Stillwater Field Office** | | |
| Desna Young | | NEPA PM, Noise |
| Jim deLaureal | | Air Quality, Floodplains, Noxious Species, Wetlands, Soil, Farmlands |
| Chuck Kihm | | Visual Resources and Lands |
| Linda Appel | | Vegetation, Livestock Grazing, Wetlands, |
| John Wilson | | Migratory Birds, Wetlands, Wildlife, Special Status Species |
| Carla James | | Geology/Minerals |
| Susan McCabe | | Cultural Resources |
| Rita Suminski | | Wildlife Biology |
| Gabriel Venegas | | Water Quality (Surface/Ground) |
| **CH2M HILL** | | |
| Linnea Eng, P.E. | Task Manager | Project Description; Cumulative Impacts |

| | | |
|---|---|---|
| | | Analysis |
| W. Geoffrey Spaulding, Ph.D. | Paleontologist | Paleontological Resources |
| Amy Hammontree | Biologist/Environmental Scientist | Recreation; Range Resources; Lands and Realty; Economic Values |
| Katy Oakes | Biologist | Biological Resources |
| Aaron Fergusson | Cultural Resources Specialist | Cultural Resources |
| Cindy Newman | Ecologist/Environmental Scientist | Soils; Water Resources; Biological Resource |
| Kenneth Shump, P.G. | Senior Hydrogeologist | Geology; Water Resources |
| Jennifer Claghorn, P.E. | Environmental Engineer | Air Quality |
| Staci Hill, P.E. | Environmental Engineer | Visual Resources; Wastes |
| Mark Greenig | Environmental Planner | Visual Resources |
| Christine Roberts | Senior Environmental Planner | NEPA Specialist; senior review |
| Amy Lahav | EA preparation manager | Permitting Specialist |
| Jerry Salamy | Senior Project Manager | Permitting specialist |
| **Intertech Services Corporation** | | |
| Mike Baughman, Ph.D. | Consultant | NEPA compliance, senior review |

## 5.3 List of Agencies, Tribes, Organizations Contacted

| | | |
|---|---|---|
| Rochanne Downs | Cultural Resources Director | Fallon-Paiute Shoshone Tribe |
| Ray Stands | Cultural Resource Coordinator | Fallon-Paiute Shoshone Tribe |
| Richard Black | Environmental Director | Fallon-Paiute Shoshone Tribe |
| Nevada State Clearinghouse | | |
| Commanding Officer | NAS Fallon | |
| Kenny Pirkle | Nevada Division of Wildlife | |
| Paul Pluoviez | Dixie Valley Ranch | |
| Friends of Nevada Wilderness | | |
| Brad T. Goetsch | Churchill County Manager | |

SECTION 6

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