United States Department of the Interior
Bureau of Land Management
Las Cruces District Office
1800 Marquess
Las Cruces, NM 88005

Environmental Assessment for Rincon #1 and Rincon #2 Geothermal Lease Sale

(NMNM125604 and NMNM125605)

DOI-BLM-NM-L000-2011-005-EA

/s/ Michael Smith, Geologist — Feb. 16 2012

Signature and Title of Project Lead — Date

/s/ Jennifer Montoya, Planning & Environmental Coordinator Feb. 24, 2012

Signature and Title Lead of Reviewer — Date

Contents

1 INTRODUCTION 3

1.1 Purpose and Need 4
1.2 Decision to be Made 4
1.3 Plan Conformance 4
1.4 Scoping and Issues 4
1.4.1 Internal Scoping 4
1.4.2 External Scoping 5
1.4.3 Resource Issues Identified 5

2 PROPOSED ACTION AND ALTERNATIVES 5

2.1 Proposed Action 5
2.2 No Action Alternative 7
2.3 Other Alternatives 7
2.4 Alternatives Considered but Eliminated from Detailed Analysis 7

3 AFFECTED ENVIRONMENT 8

3.1 Air Quality 8
3.2 Climate Change 8
3.3 Cultural Resources 9
3.4 Invasive, Non-Native Species 9
3.5 Livestock Grazing 10
3.6 Migratory Birds 10
3.7 Minerals 10
3.7.1 Mining claims: 10
3.7.2 Leasable Minerals: 11
3.7.3 Mineral Materials: 11

3.8 Paleontology 12
3.9 Lands and Realty 12
3.10 Recreation 12
3.11 Soils 13
3.12 Special Status Species 15
3.12.1 Special Status Plants 15
3.12.2 Special Status Animals 16

3.13 Vegetation 17
3.14 Visual Resources 18
3.15 Wastes, Hazardous and Solid 18
3.16 Water Quality 20
3.17 Watershed Hydrology 20
3.18 Wilderness/Special Management Areas 20
3.19 Wildlife 21

4 ENVIRONMENTAL EFFECTS 21

4.1 Impacts of Proposed Action on Air Quality 21
4.2 Impacts of Proposed Action on Climate Change 22
4.3 Impacts of Proposed Action on Cultural Resources 22
4.4 Impacts of Proposed Action on Invasive and non-native species 23

4.5 Impacts of Proposed Action on Livestock Grazing 23
4.6 Impacts of Proposed Action on Migratory Birds 24
4.7 Impacts of Proposed Action on Minerals 24
4.8 Impacts of Proposed Action on Paleontology 25
4.9 Impacts of Proposed Action on Lands and Realty 25
4.10 Impacts of Proposed Action on Recreation 25
4.11 Impacts of Proposed Action on Soils 26
4.12 Impacts of Proposed Action on Special Status Species 26
4.12.1 Impacts to Special Status Plants 26
4.12.2 Impacts to Special Status Animals 27
4.13 Impacts of Proposed Action on Vegetation 28
4.14 Impacts of Proposed Action on Visual Resources 28
4.15 Impacts of Proposed Action on Wastes, Hazardous and Solid 29
4.16 Impacts of Proposed Action on Water Quality 29
4.17 Impacts of Proposed Action on Watershed Hydrology 30
4.18 Impacts of Proposed Action on Wilderness/Special Management Areas 31
4.19 Impacts of Proposed Action on Wildlife 31
4.20 Impacts of the No Action Alternative 32
4.21 Cumulative Impacts 32
5 TRIBES, INDIVIDUALS, ORGANIZATIONS OR AGENCIES CONSULTED 34
6 LIST OR PREPARERS 34
7 REFERENCES 34

1 INTRODUCTION

On October 4, 2010, the Las Cruces District Office (LCDO) received nominations for competitive geothermal leasing for Federal lands and mineral estate located near Rincon in northern Dona Ana County, New Mexico (figure 1). Review of these nominations by LCDO staff determined the application to be complete, and that all required nomination fees were submitted. The nominated areas encompass two separate leases (NMNM125604 and NMNM125605), the legal descriptions for which are presented below:

<u>NMNM125604 (Rincon North Lease: 4398.48 acres):</u>
T18S, R2W, sec 27, 28, 29, 30, 31, 33 (All)
T18S, R2W, sec 34 (NW, SW, SE, W½NE, E½NE)

<u>NMNM125605 (Rincon South Lease: 3930.61 acres):</u>
T19S, R2W, sec 3 (NWNW, S½NW, NE, SE, S½SW, N½SW)
T19S, R2W, sec 4, 5, 6 (All)
T19S, R2W, sec 7 (E½NE)
T19S, R2W, sec 8 (W½NW)
T19S, R2W, sec 9 (NE, SE, SW, NENW, S½NW)
T19S, R2W, sec 10 (All)

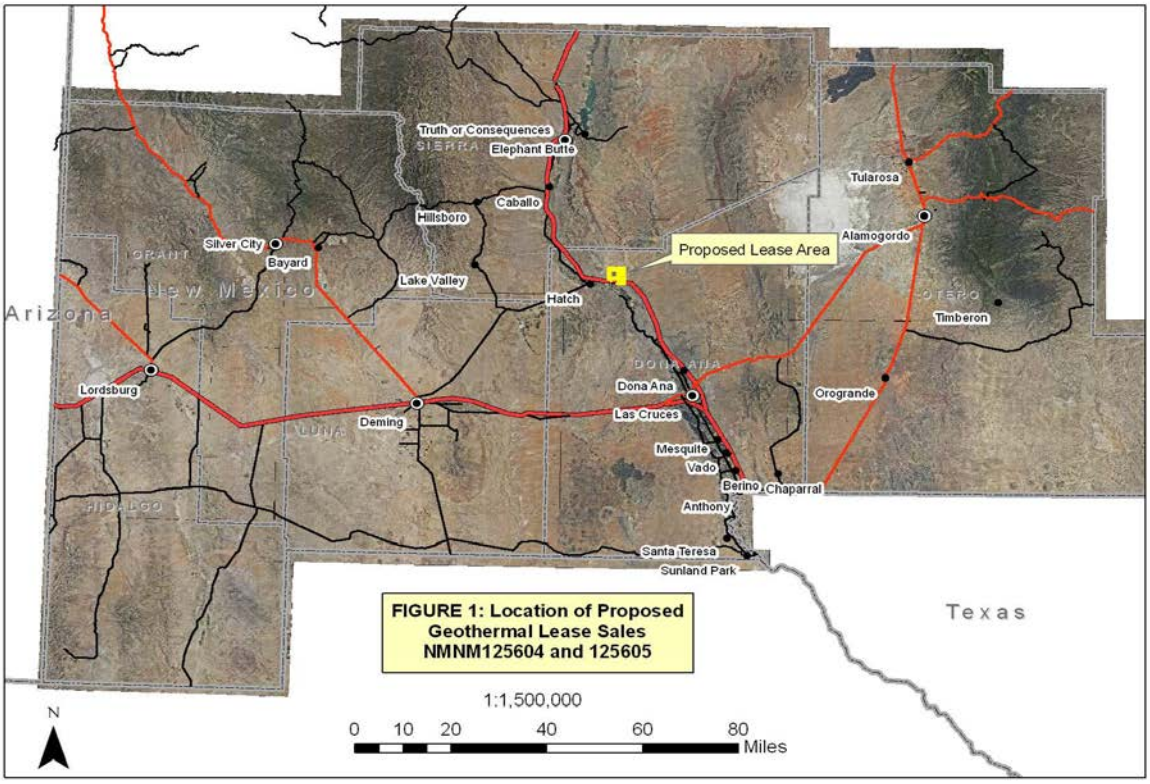

FIGURE 1APPROXIMATE LOCATION OF PROPOSED GEOTHERMAL LEASE SALE.

1.1 Purpose and Need

The purpose of this proposal is to competitively lease the known geothermal resource in the Rincon area. Competitive leasing will provide an opportunity for the future lessee to access this resource for development of electricity or direct-use applications, while creating a revenue stream for the Department of Treasury.

The need for analyzing this proposal is to comply with BLM's obligations under the Geothermal Steam Act of 1970 (30 USC 1001-1028), which authorizes the Secretary of the Interior to issue leases for the development and utilization of Federal geothermal resources. The BLM need is also driven by the Energy Policy Act of 2005, which mandates that Federal Agencies facilitate resource leasing in an environmentally responsible manner to help meet the increasing interest in geothermal energy development on public lands.

1.2 Decision to be Made

The decision to be made is whether or not to offer all, none or a subset of the nominated area for competitive geothermal leasing. Should it be determined that competitive leasing can proceed, the EA will identify lease stipulations necessary for the protection of surface resources and the sustainable development of the geothermal resource.

1.3 Plan Conformance

This proposed action conforms to the Mimbres Resource Management Plan (RMP) approved December, 1993 and amended by the Programmatic Environmental Impact Statement (PEIS) for Geothermal Leasing in the Western United States, approved December 2008,and it is specifically provided for in the following land use decision(s):

The remainder of the resource area is open to mineral leasing subject to standard terms and conditions…geothermal and nonenergy leasables, 3,499,500 acres (Mimbres RMP, 1993, p. 2-6).

And it is specifically provided for in the following land use decision(s):

RINCON ACEC: *Designate NSO (No-surface Occupancy) for mineral leasing within 100 feet of petroglyphs site* (Mimbres RMP p. 5-41).

Geothermal leasing on public lands and mineral estate is authorized under the Geothermal Steam Act of 1970 (30 U.S.C. §§ 1001-1027, December 24, 1970, as amended 1977, 1988 and 1993).

1.4 Scoping and Issues

1.4.1 Internal Scoping

The proposed action was originally presented to the LCDO NEPA Interdisciplinary (ID) Team on October 25, 2010. ID team review was completed on September 19, 2011.

1.4.2 External Scoping

The proposed action was originally posted on the BLM Las Cruces District Office online NEPA log on October 21, 2010. This posting includes instructions on commenting and contact information regarding this project. The LCDO identified sixteen potentially interested parties for project scoping. Letters requesting comment were mailed to these parties on February 4, 2011 and comments were accepted until March 14, 2011. Three letters were received during this period; two from the current range permit holders and one from the Village of Hatch, New Mexico.

1.4.3 Resource Issues Identified

Cultural Resources: The area of the proposed action completely overlaps the 840 acre Rincon Area of Critical Environmental Concern (ACEC), which was established to protect petroglyphs and other archeological resources. The remainder of the lease area is considered to have a high potential for the occurrence of archeological sites.

Climate Change: Greenhouse gas (GHG) emissions from geothermal generation plants are significantly lower than those from comparable fossil-fuel powered operation. Not proceeding with the lease auction will limit opportunities for future development of renewable, low-emissions energy sources.

Livestock Grazing: Lease development may alter access to water, forage and allotment improvements (fences, dirt tanks, etc.). Of particular concern are the dirt tanks in section 32 (State land) and 34 of T. 18 S., R. 2 W. Exploration and development could increase vehicle traffic and adversely affect range operations and surface resources. Affected range permitees should participate in the review of activities proposed by the lease operator.

Minerals: The proposed action is located in a well-documented geothermal source, with temperatures sufficient for generating electricity using binary generation systems. Not proceeding with the lease auction will limit opportunities for future economic development.

Paleontology: In many of the quaternary geologic units associated with the lease area, Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Ground disturbing activities need to be evaluated on a case-by-case basis for the need to mitigate.

Visual resources: The entire lease area is identified as Visual Resource Management (VRM) class II, which require retention of the existing character of the landscape. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. Additional visual resource issues are recognized due to the proximity of the proposed project area to a National Historical Trail (the Camino Real trail) and associated interpretive sites.

2 PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

On October 4, 2010, the LCDO received nominations for competitive geothermal leasing. The applicant properly described the area to be nominated, paid all necessary fees, and provided justification for a block

nomination. The specific activity being proposed is to offer for competitive lease approximately 8329.09 acres of Federal mineral estate. A map of the proposed leasing area is shown in figure 2. Because the regulatory maximum on competitive lease areas is established as 5120 acres (43 CFR 3200.12),

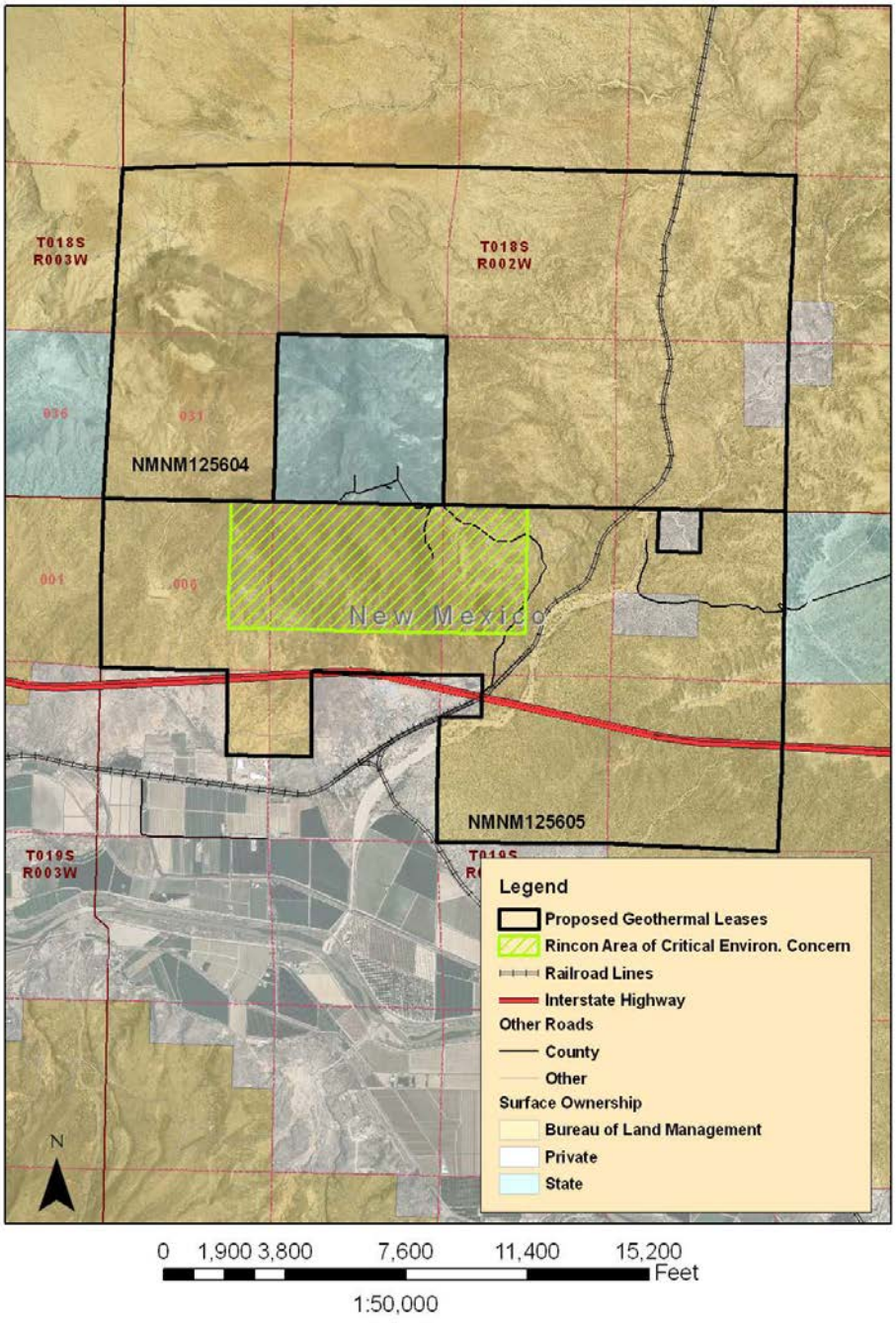

FIGURE 2PROPOSED RINCON GEOTHERMAL LEASING AREA

the proponent has submitted two separate competitive lease nominations and requested that they be auctioned in block. In a block auction, both leases would be offered simultaneously and both awarded to the highest bidder. A block auction is justified in this case because geologic evidence (Witcher, 1995;

Fleischmann, 2006) indicates that a common geothermal resource underlies both leases; development of the resource would be more sustainable if the leases were developed in common.

The proposed leasing area overlaps the Rincon ACEC (figure 2), which has been established to protect identified cultural resources. As part of the proposed action, it has been determined by the LCDO District Manager that the area of the Rincon ACEC will be subjected to the No Surface Occupancy (NSO) stipulation. This will effectively close the 840 acres of the Rincon ACEC from any surface disturbing activity associated with the development of lease NMNM125604. Any development of the geothermal resource under the Rincon ACEC would have to be accomplished through directional drilling or reservoir drainage from an offsite well.

Two approximately 80-acre parcels of split mineral estate are also encompassed in the proposed lease area (figure 2). These parcels consist of Stock-Raising Homestead Act of 1916 (SRHA) patent number 1006095 within lease NMNM125604 and Taylor Grazing Act exchange number 1118316 within lease NMNM125605. Prior to any surface disturbing activity, the leaseholder or their designated operator will be encouraged by the BLM to enter into an access agreement with the surface owner.

Sale of a geothermal lease does not authorize the leaseholder or their designated operator to begin development of the lease. Development activities such as exploration, roadwork, drilling, and facility development must be authorized separately after the proponent has met regulatory requirements defined in 43 CFR 3200. Such authorizations will require separate NEPA analysis specific to the location and nature of the proposed lease development action.

The competitive lease will be held at the Las Cruces District Office following procedures defined in current BLM regulations (43 CFR 3203). An auction date has not been established, but it is not anticipated that the auction will occur before the summer of 2012. Once issued, a geothermal lease is effective for a primary term of ten years. The lease may be extended up to 35 years and renewed for up to 55 years provided the leaseholder meets specific development requirements defined in 43 CFR 3207.11 - .16.

2.2 No Action Alternative

Under the No Action alternative, the nominated 8329.09 acres would not be offered for competitive lease sale. The nominated area would remain open to mineral leasing subject to existing stipulations and restrictions, and would remain eligible for nomination in future competitive or noncompetitive geothermal leases. However, the no action alternative assumes no future geothermal exploration or development would occur in order to provide a baseline scenario for determining affects.

2.3 Other Alternatives

Existing Federal laws and regulations limits disposal of geothermal resources through leasing. Geothermal resources cannot be appropriated by mining claims or otherwise obtained through permits or right-of-way. Therefore, there are no other alternatives that could reasonably meet the purpose and need.

2.4 Alternatives Considered but Eliminated from Detailed Analysis

Leasing under existing surface management direction: Surface-use restrictions for the Rincon ACEC are defined on page 5-41 of the Mimbres RMP (1993);these restrictions do not explicitly close the entire 840 acre ACEC to surface occupancy, but only 100' from known petroglyph sites. Based on information collected since 1993, it was decided that this current restriction is insufficient to protect the resource values within the ACEC. Instead, the NSO stipulation for important cultural and archeological resources, as defined in the Record of Decision (ROD) for the Geothermal PEIS (Bureau of Land Management and U.S. Forest Service, 2008), will be applied.

3 AFFECTED ENVIRONMENT

3.1 Air Quality

The area of the proposed action is considered a Class II air quality area. A Class II area allows moderate amounts of air quality degradation. Throughout most of the year, the air quality is very good and the air is considered clean. Carbon monoxide and ozone levels are elevated on rare occasions when temperature inversions prevent the escape and dispersion of air to the upper atmosphere. During the dry spring months, windstorms and blowing dust can become a problem throughout the area. In 1999, monitors throughout Dona Ana County recorded 16 days which exceeded National Ambient Air Quality Standards (NAAQS) for airborne particulate matter (PM_{10}). Excessive dust in the air can impair driving visibility and, when breathed, be potentially harmful, especially to high-risk people with respiratory conditions. A Natural Events Action Plan (NEAP) was prepared for Dona Ana County and released in December, 2000 by the Air Quality Bureau of the New Mexico Environment Department.

3.2 Climate Change

In addition to the air quality information in the RMPs cited above, new information about greenhouse gases (GHGs) and their effects on national and global climate conditions has emerged since the RMPs were prepared. Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies, 2007). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Without additional meteorological monitoring and modeling systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change.

In 2001, the Intergovernmental Panel on Climate Change (IPCC) predicted that by the year 2100, global average surface temperatures would increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels. The National Academy of Sciences (2006) supports these predictions, but has acknowledged that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. It is not, however, possible at this time to predict with any certainty the causal connection of site specific emissions from sources to impacts on the global/regional climate relative to the proposed action and subsequent actions of geothermal development.

Geothermal energy is generally recognized as a low-emissions method for generating electrical power, especially when compared to fossil fuels (Williams et. al., 2007; Pew Center on Global Climate Change, 2010). Although traces of CO_2 are generally dissolved in geothermal fluids, concentrations are low and

recorded emissions from geothermal plants are negligible. A typical geothermal plant produces less than one percent of the CO_2 emissions per megawatt-hour than a typical coal-fueled power plant. It is estimated that replacing a 500 MW coal-fueled power plant with electricity from geothermal plants would avoid approximately 3 million metric tons of carbon-dioxide emissions in a single year (Pew Center on Global Climate Change, 2010). Direct use of geothermal resources (aquaculture, space heating, etc.) can also reduce GHG emissions if used to replace or supplement the use of fossil fuels.

3.3 Cultural Resources

The proposed geothermal leasing area completely encompasses the 840 acre Rincon Area of Critical Environmental Concern (ACEC), which is an important petroglyph site (see also section 3.19). Rock art and petroglyphs within this area are believed to be associated with the Jornada-Mogollon culture (A.D. 200 to A.D. 1400) and are generally pecked into large boulders or clustered in steep-sided canyon areas. Specimens of petroglyphs have been damaged in the past by construction of communication sites, mineral prospecting, and treasure hunting. Because of the proximity to I-25, the Rincon ACEC has potential as an interpretive site.

Archeological sites are likely to occur throughout the entire proposed lease area. Native American archeological sites are known to occur within the proposed boundaries of lease NMNM125605, particularly in the area north of Interstate 25 (see figure 1). It is unlikely that all such sites have been inventoried by the BLM or the New Mexico State Historic Preservation Office (SHPO). BLM records and field observations indicate that the entire nomination area is likely to contain archeological sites ranging from prehistoric to sites associated with the historic settlement of Dona Ana County. Additional field and inventory work is necessary to fully identify, document and evaluate these sites.

3.4 Invasive, Non-Native Species

The following invasive, non-native plant species have been identified in Dona Ana County:

- Russian knapweed (*Acroptilon repens*)
- Jointed goatgrass (*Aegilops cylindrica*)
- Camelthorn (*Alhagi maurorum*)
- Whitetop (*Cardaria draba*)
- Malta starthistle (*Centaurea melitensis*)
- Field blindweed (*Convovulus arvensis*)
- Saltcedar (*Tamrix ssp*.)
- Perennial Pepperweed (*Lepidium latifolium*)
- Russian Olive (*Elaeagnus angustifolia*)
- Onionweed (*Asphodelus fistulosus*)
- African Rue (*Peganum harmala*)
- Siberian elm (*Ulumus pumila*)

Common locations for invasive, non-native species include roadsides and disturbed areas. Although there are no document occurrences of invasive, non-native species in the proposed leasing area, there has not been a comprehensive survey for such species.

3.5 Livestock Grazing

The area proposed for the geothermal lease sale is within the two grazing allotments (Table 1):

TABLE 1LIVESTOCK GRAZING ALLOTMENT IN PROPOSED GEOTHERMAL LEASE AREA.

Allot. Number	Allotment Name	Public Acres	State Acres	Private Acres	Cattle Yearlong
03058	Palma Park	28,792	3,132	114	146
03067	Rincon	11,671	1,329	380	89

The following base waters are allocated for the Palma Park allotment (03058):

- Johnson Well (NWNW Sec 36, T. 18 S., R. 3 W).
- Natural Rock Water Holes (Secs 21 & 22, T. 18 S, R. 2 W.)
- Railroad Tank (SWNW Section 34, T. 18 S., R. 2 W.)
- Headquarters Well (NESW Sec 4, T. 19 S, R. 3 W.)
- Griffith Well (NESW Sec 16, T. 18 S., R. 3 W.)
- McLeod Well (Sec 5, T. 18 S., R. 3 W.)

Base waters for the Rincon allotment (03067) are summarized below:

- Wash Well (NWNW Sec 35, T. 18 S., R. 2 W.)
- Salt Spring (SWSENW Sec 25, T. 19 S., R. 2 W.)

3.6 Migratory Birds

The BLM has entered into a cooperative agreement with other agencies to promote conservation of migratory birds and minimize the potential adverse effects of take under the Migratory Bird Treaty Act (Title 16 United States Code [U.S.C.] Parts 703-711). A review of available data has identified 145 species of migratory birds known to occur at least part of the year in Dona Ana County, New Mexico (New Mexico Department of Game and Fish, 2011). The extensive desert grasslands in the vicinity of the proposed geothermal lease sale are important habitat for wintering birds. Riparian habitats along the nearby Rio Grande are important flyover corridors and stopover areas for migratory birds.

3.7 Minerals

3.7.1 Mining claims:

Review of BLM records (November, 2010) identified four active mining claims within the limits of lease NMNM125604 (table 2):

TABLE 2MINING CLAIMS IN PROPOSED GEOTHERMAL LEASING AREA.

CLAIM NUMBER	NAME	TWN	RNG	SEC	LOC. DATE
NMMC171887	Apache #. 1	T.18.S	R.2.W.	30 & 31	05/02/2005
NMMC185987	Serendipity	T.18.S	R.2.W.	30	04/30/2008
NMMC187159	Apache #. 2	T.18.S	R.2.W.	30	09/02/2008
NMMC187319	Sarah #1	T.18.S	R.2.W.	30	09/26/2008

The claims consist of two lode claims (NMMC185987 and NMMC187319) and two tunnel site claims (NMMC171887 and NMMC187319). None of these claims were located prior to July 25, 1955 and are thus not subject to surface rights. There are no active or proposed mining Notices or Plans of Operation files on file with BLM for these claims.

3.7.2 Leasable Minerals:

The Rincon Hills area is a blind geothermal system (no surface hot-springs) previously described by various researchers (Ikelman, and Theberge, 1980; Witcher, 1995; Fleischmann, 2006). The geothermal resource had been previously studied by researchers at New Mexico State University during the 1980s, and the New Mexico State legislature funded a 1,218' deep exploratory borehole in 1992. Temperatures from 300-600' depth in this borehole ranged between 185 and 194°F (85 - 90°C) (Witcher, 1995). Between 600 and 1218' depth, bedrock consists of relatively unaltered clayey siltstone, which was interpreted by Witcher (1995) to form an aquitard above a deep-seated hotter geothermal reservoir located in a fault zone dipping east. The bottom-hole temperature was recorded at 212°F (100°C) and the thermal gradient is estimated at nearly 300°F/mile (250°C/km) in the bottom 200' of the hole.

Possible uses for the geothermal resource could include greenhouse heating, aquaculture, agricultural and dairy processing, and binary electrical power. Close proximity to powerlines, rail lines and Interstate 25 could facilitate development of any significant geothermal resource (Witcher, 1994; Fleischmann, 2006). Reservoir production rates for the Rincon geothermal source have not been determined (Witcher, 1995) and additional research and feasibility studies are likely required.

3.7.3 Mineral Materials:

The BLM uses the term "mineral materials" in reference to aggregate, fill, base coarse, building stone and other common-variety minerals not subject to claim under the 1872 mining law or leasing under the various mineral leasing laws. Federal agencies dispose of mineral materials from Federal mineral estate through competitive or negotiated sales or through free use permits to government or non-profit organizations. The BLM may also designate Community Pits and Common Use Areas for the general disposal of mineral materials. There are currently no authorized mineral materials disposals within the proposed lease area. Past materials disposals occurred in a small (10 acre) site in the SW¼, SW¼ of section 4, T. 19 S. R. 2 W., which was active as both a sale area and a community use area between 1979 and 2002. Types of mineral materials produced were aggregate (sand and gravel) and specialty stone, and total reported production was less than 10,000 cubic yards.

3.8 Paleontology

Much of the proposed geothermal lease area consists of alluvial fill of the later Quaternary age Santa Fe Group. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented within the Santa Fe Group (Morgan et. al, 2008). In the BLM's Potential Fossil Yield Classification (PFYC) system, the Santa Fe group is ranked class 4; indicating a high potential occurrence of significant fossils, but the distribution and occurrence of fossils cannot be predicted. Local factors such as extensive soil or alluvial cover, small outcrop areas and topographic conditions tend to protect Paleontological resources from disturbance. Fossil resources in areas with little or no soil or vegetative cover or extensive (larger than two contiguous acres) outcrop areas may be particularly susceptible to adverse impacts from surface disturbing actions or unauthorized collecting activities. A portion (approximately 900 acres) of the proposed lease area is underlain by Tertiary aged igneous rocks (Seager et. al., 1982) and is not expected to host fossil resources.

3.9 Lands and Realty

The BLM has primary authority for issuing rights-of-way (ROW) across Federal lands for a variety of public purposes such as roads, pipelines, powerlines and communications infrastructure. The Agency may also apply restrictions on the issuance of new ROW's in designate areas in order to protect resources. Established right-of-way restrictions in the proposed action area are displayed in figure 3. Most of the Rincon North lease (NMNM125604) and small, irregular areas of the Rincon South lease (NMNM125605) are designated ROW avoidance. In ROW avoidance areas, the BLM will only grant future rights-of-way if no feasible alternative route or designated ROW corridor is available. Special ROW terms and conditions may also be required. The area within the Rincon ACEC is designated as ROW exclusion. In exclusion areas, future ROW's may only be granted if mandated by law.

The Bureau of Land Management also identifies lands for disposal for public purposes through various legislative initiatives. Within the boundaries of the proposed lease area, the E½ NE¼ of section 7 and the W½ NW¼ of section 8 are identified for disposal in the 1993 Mimbres RMP (figure 3). However, there are no current requests for disposals for this area.

3.10 Recreation

There are no developed recreational sites within the proposed lease area. In general, however the Federal Lands provide a variety of dispersed and unorganized recreational opportunities such as hiking, nature study, picnicking, primitive camping, and target shooting.

The proposed action is located in the vicinity (approximately 1.5 miles from) of the Camino Real de Tierra Adentro National Historic Trail (the Camino Real Trail). The Camino Real Trail is the historic (Spanish Colonial) route between Mexico City, Mexico and cities in northern New Mexico. Within the United States, approximately 400 miles of the Trail extends from El Paso, Texas, to Santa Fe, NM and crosses Federal, State, private and tribal lands. This route is a designated national historic trail and was added to the National Trail System by the Bureau of Land Management and the National Park Service in 2000. Specific management concerns associated with the Camino Real trail include preserving the visual experience, facilitating public access and educational activities, and preserving the historical legacy and significance of the Trail (Bureau of Land Management, 2004).

3.11 Soils

The following soils types are mapped within the majority (over 90%) of the proposed action area. (Natural Resource Conservation Service, 2011):

BP-Bluepoint-Caliza-Yturbide complex: Caliza and similar soils: 25 percent, *Bluepoint and similar soils:* 25 percent, *Yturbide and similar soils:* 20 percent. BP forms on valley sides and alluvial fans, 5 to 15 percent on wind-modified sandy alluvium. The Bluepoint-Caliza-Yturbide complex is somewhat excessively drained, not subject to frequent flooding or ponding and has a low available water capacity. The depth to water table exceeds 80 inches, maximum carbonate content is 40 percent and the maximum sodium adsorption ratio is 1.0.

NB-Nickel-Badland complex: Nickel and similar soils: 45 percent, *Badland:* 35 percent. NB forms on alluvial fans at 3 to 15 percent on wind-modified sandy alluvium on extremely gravelly coarse-loamy alluvium. This soil complex is well drained and not subject to frequent flooding or ponding. The depth to water table exceeds 80 inches, water availability is low, maximum carbonate content is 40 percent and the maximum sodium adsorption ratio is 1.0.

Bn-Bluepoint loamy sand, 5 to 15 percent slopes: Formed on valley sides and alluvial fans at 5 to 15 percent slopes, parent material consists of wind-modified sandy alluvium. This soil is somewhat excessively drained and depth to water table exceeds 80 inches. Water availability is low, maximum carbonate content is 5 percent and the maximum sodium adsorption ratio is 13.

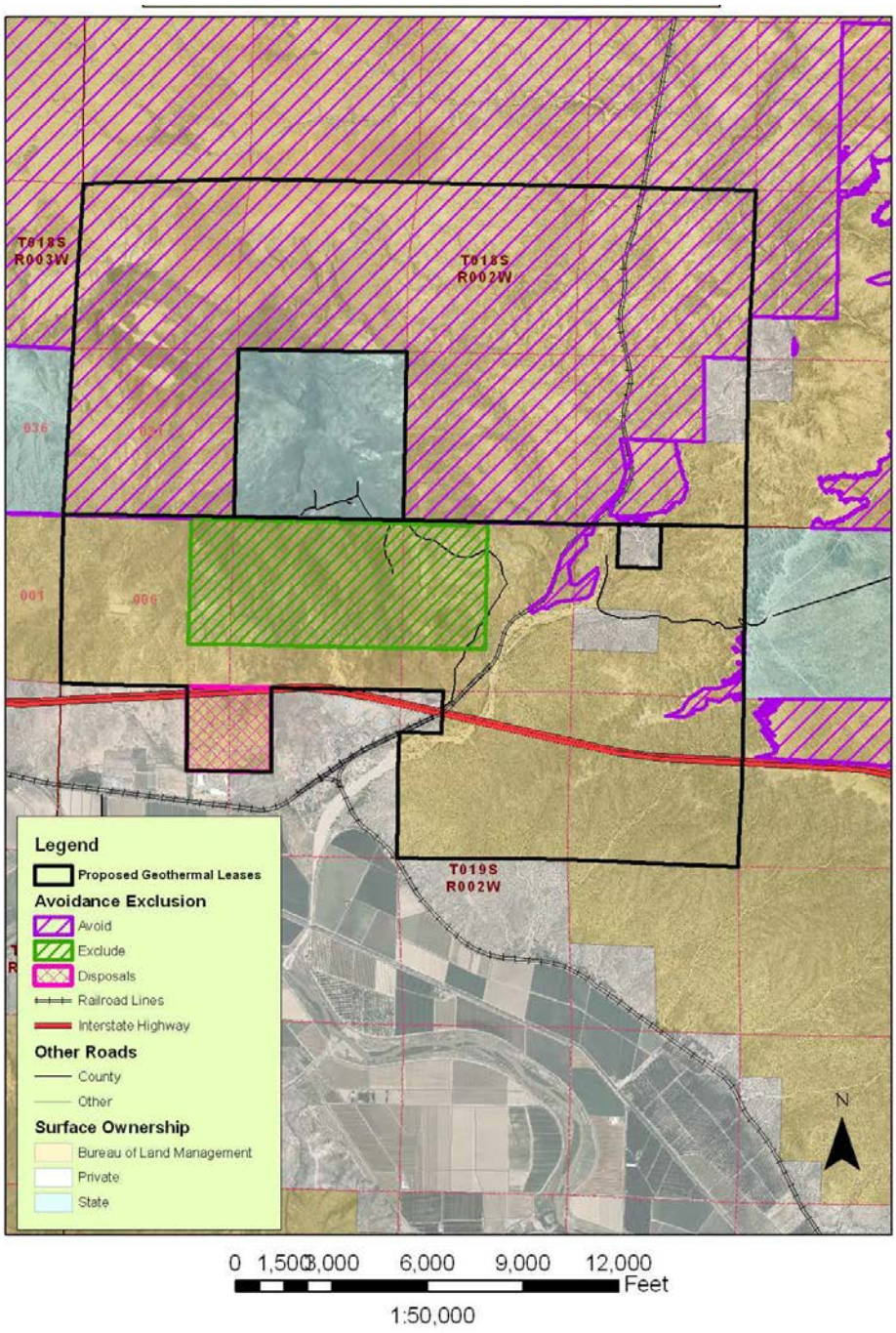

FIGURE 3ROW AVOIDANCE AND EXCLUSION AREAS AND DISPOSAL AREAS.

RT-Rock outcrop-Torriorthents association: *Rock outcrop:* 40 percent *Torriorthents and similar soils:* 30 percent. Rock outcrops consist of basalt on hills and footslopes. The Torriorthent soils form in calcareous very gravelly loamy residuum on hillslopes and mountain flanks, are well drained with a low sodium absorption capacity (1.0) and low water availability.

3.12 Special Status Species

Special Status Species (SSS) are: Federally Endangered, Threatened, Proposed, Candidate, Critical Habitat Designated, Species of Concern, New Mexico Endangered, New Mexico Threatened, and BLM Sensitive.

3.12.1 Special Status Plants

Presence of special status plant species and their habitats in Dona Ana County was considered using LCDO species occurrence/habitat records and New Mexico Natural Heritage species records. Species descriptions and distributions were derived from LCDO office records and New Mexico Rare Plant Technical Council [NMRPTC. 1999. New Mexico Rare Plants. Albuquerque, NM: New Mexico Rare Plants Home Page. http://nmrareplants.unm.edu (Latest update: 18 January 2006)].

Based on evaluation of the above information, 35 special status plant species potentially occur in Dona Ana and Sierra Counties. Of the 35 species listed, only three potentially occur or have habitat present within the proposed action area (table 3).

TABLE 3 SPECIAL STATUS PLANTS POTENTIALLY OCCURRING OR HAVING HABITAT PRESENT

Species	Scientific Name	Status
Night Blooming Cereus Cactus	*Peniocereus greggii var. greggii*	NM Endangered, BLM Sensitive
Castetter's Milkvetch	*Astragalus castetteri*	NM Sensitive
Nodding Rock Daisy	*Perityle cernua*	Federal Species of Concern, NM Sensitive, BLM Sensitive

Night-blooming cereus: This cactus species is a widespread but rare species in the Chihuahuan desert. The cactus often occurs in the canopy of supporting creosote bush or mesquite plants, but may occur in open spaces. Potential habitat for the night-blooming cereus occurs in creosote rolling upland, mesquite rolling upland, half-shrub rolling upland, and mixed shrub rolling upland standard habitat sites. Soil is typically silty to sandy grading into rocky igneous or limestone substrates. There are no known occurrences of this species near the Rincon Hills (Rincon Mountains).

Castetter's Milkvetch: This is a rhizomatous perennial with 10-20 spreading or declined pea-like flowers. It is found on dry, rocky slopes in montane scrub and open juniper woodland from 5,000-7,050 ft. elevation. This plant occupies rocky slopes in remote desert mountain ranges where it occasionally colonizes road cuts and hardrock mine spoils.

Nodding Cliff Daisy: This species occurs on igneous cliffs, primarily on rhyolite but occasionally on andesite, at 5,000-8,800 ft. elevation. This is a cliff dwelling species and, therefore, its habitats are relatively inaccessible. Hot fires up the canyons are a potential threat to habitats with high fuel loads.

3.12.2 Special Status Animals

Special Status animal species lists for Dona Ana County were compiled from: www.wildlife.state.nm.us/conservation/threatened_endangered_species/index.htm and www.fws.gov/. There are 47 special status animal species known to occur or could potentially within Dona Ana County. Based on an analysis of known geographic distribution and habitat requirements for each species in comparison with habitat types within the proposed action area, only 11 species are known to occur or could potentially occur as shown in table 4.

TABLE 4 SPECIAL STATUS ANIMALS WITH POTENTIAL TO OCCUR WITHIN THE PROPOSED ACTION AREA

Common Name	Scientific Name	Status
Texas Horned Lizard	*Phrynosoma cornutum*	NM Sensitive, BLM Sensitive
Varied Bunting	*Passerina versicolor*	NM Threatened
Bald Eagle	*Haliaeetus leucocephalus*	ESA Delisted, NM Threatened
Common Ground-Dove	*Columbina passerina*	NM Endangered
Loggerhead Shrike	*Lanius ludovicianus*	NM Sensitive, BLM Sensitive
Townsend's Pale Big-eared Bat	*Corynorhinus townsendii pallescens*	Federal Species of Concern, NM Sensitive, BLM Sensitive
Fringed Myotis Bat	*Myotis thysanodes thysanodes*	NM Sensitive, BLM Sensitive
Long-legged Myotis Bat	*Myotis volans interior*	NM Sensitive, BLM Sensitive
W. Small-footed Myotis Bat	*Myotis ciliolabrum*	NM Sensitive, BLM Sensitive
Desert Pocket Gopher	*Geomys arenarius arenarius*	Federal Species of Concern, NM Sensitive, BLM Sensitive
Desert Bighorn Sheep	*Ovis canadensis mexicana*	NM Threatened, BLM Sensitive

Habitat descriptions for these special status wildlife species are available from the Bureau of Land Management, LCDO and can be found at www.wildlife.state.nm.us/conservation/threatened_endangered_species/index.htm.

Desert bighorn sheep were a state-listed endangered species in New Mexico 1980 to 2008, at which time they were down-listed to threatened status. Bighorn are identified as a Species of Greatest Conservation Need in the Comprehensive Wildlife Conservation Strategy for New Mexico (New Mexico Department of Game and Fish, 2006). Overlap between bighorn sheep habitat and the proposed geothermal lease area is displayed in figure 4, and considerable overlap between bighorn sheep habitat and proposed lease NMNM125605 is evident. Approximately 64 percent of the 3,930.6 acres comprising this proposed lease is classified as bighorn sheep habitat.

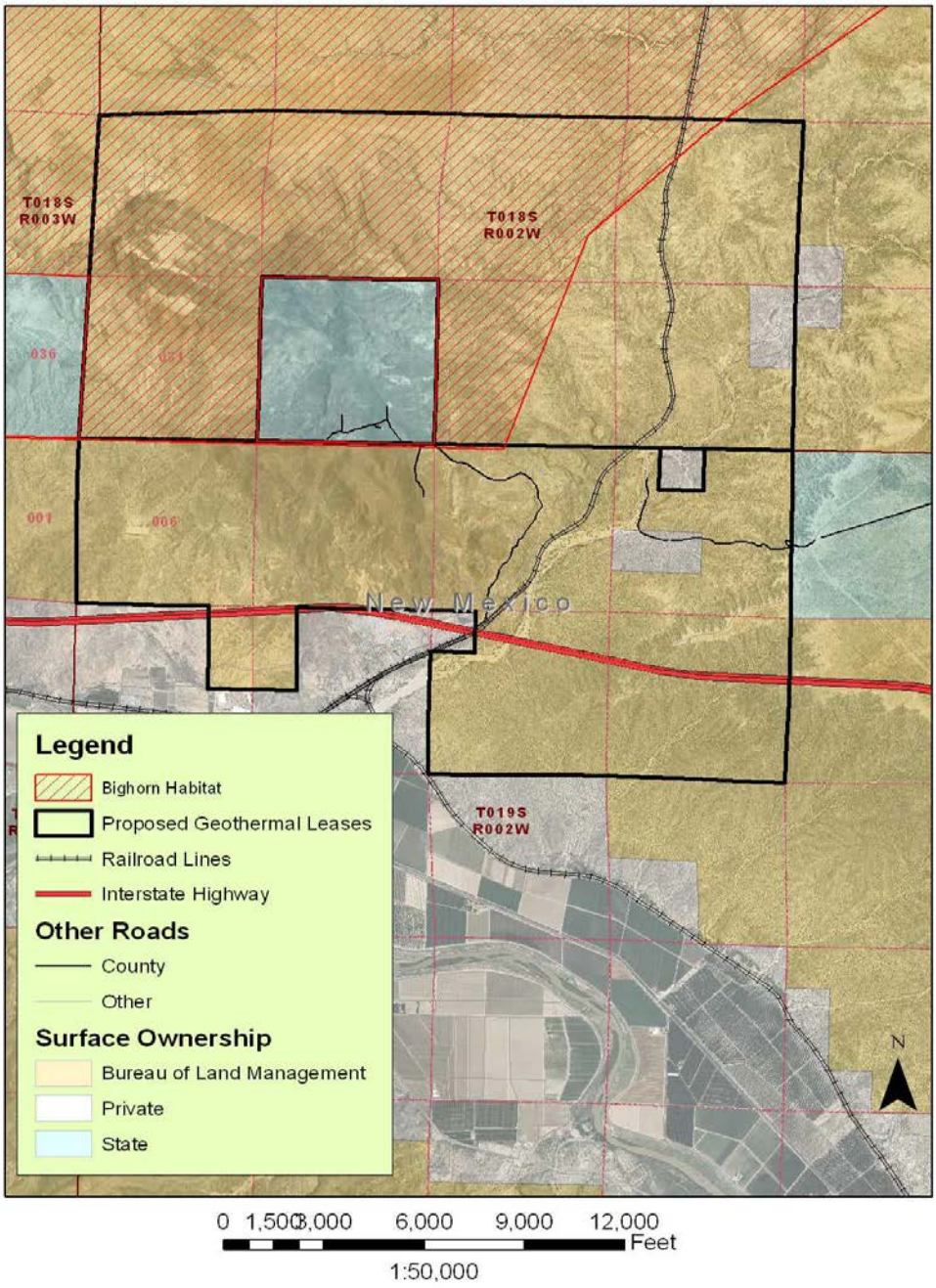

FIGURE 4BIGHORN SHEEP HABITAT RELATIVE TO PROPOSED GEOTHERMAL LEASE BOUNDARIES.

3.13 Vegetation

The proposed geothermal lease area is within a Southern Desertic Basins, Plains and Mountains (SD-2) gravelly-sand site. The historic vegetation community is characterized by mixed shrub-grassland with moderate grass cover comprised of co-dominant dropseeds, bush muhly (*Muhlenbergia porteri*) and threeawn (*Aristida* L.). Snakeweed (*Gutierrezia sarothrae*) is also abundant, and creosotebush and mesquite are subdominant. Grazing-induced retrogression from this community is characterized by a

reduction in the cover of black grama, bush muhly and then dropseeds, and an increase in the proportional representation creosotebush, fluffgrass (*Dasyochloa pulchella*) and snakeweed.

Upland areas of the Rincon Hills have features diagnostic of the Southern Desertic Basins, Plains and Mountains (SD-2) hills site; including complex soils, rolling to steep slopes, and variable slope direction. Black grama is typically dominant and bush muhly, blue grama, and sideoats grama are subordinates. On heavier soils, tobosa may be dominant. Succulents are also common subordinate plants, including banana yucca (*Yucca bacata*), sotol (*Dasylirion spp*.) and ocotillo (*Fouquieria splendens*). Cool season grasses, such as New Mexico feathergrass (*Hesperostipa neomexicana*) may also be present. Creosotebush (*Larrea tridentata*) may also be present. Heavy grazing or drought disturbance within this state leads to increasing bare ground and/or increases in the representation of threeawns , hairy grama (*Bouteloua hirsuta*), fluffgrass, and snakeweeds. Drier, south-facing slopes tend to have a greater representation of succulents and shrubs, more bare ground, and less grass cover even when currently ungrazed. Abundant rocks and very shallow soils may also restrict grass cover.

3.14 Visual Resources

The visual resource inventory process provides BLM managers with a means for considering visual values in the resource management planning (RMP) process. The inventory consists of a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. Based on these three factors, BLM-administered lands are placed into one of four visual resource inventory classes. These inventory classes represent the relative value of the visual resources. Classes I and II being the most valued, Class III representing a moderate value, and Class IV being of least value. The inventory classes provide the basis for considering visual values in the resource management planning (RMP) process.

The entire area nominated for the proposed competitive geothermal lease is classified as Visual Resource Management (VRM) class II. The management objective in areas rated as VRM class II is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

3.15 Wastes, Hazardous and Solid

In 1969, the BLM issued a Recreation and Public Purposes (R&PP) leases (NMNM9850) to Dona Ana County for a ten acre parcel in the NW¼NW¼SE¼ of section 4, T. 19 S. R. 2 W. to be used as a sanitary landfill (figure 5). The Rincon landfill was permanently closed in January 1989 and has since been covered and restored. During its operation, the site accepted solid municipal wastes, sanitary (septic tank) wastes and dead animals. Although the original R&PP lease expired in December of 1991, the lease has been extended pending completion of final landfill closure plans.

Illegal dumping of household and municipal wastes remains a problem in parts of the proposed lease area near Interstate 25. Most of this illegal dumping occurs on BLM land near the Rincon exit and west of the railroad tracks.

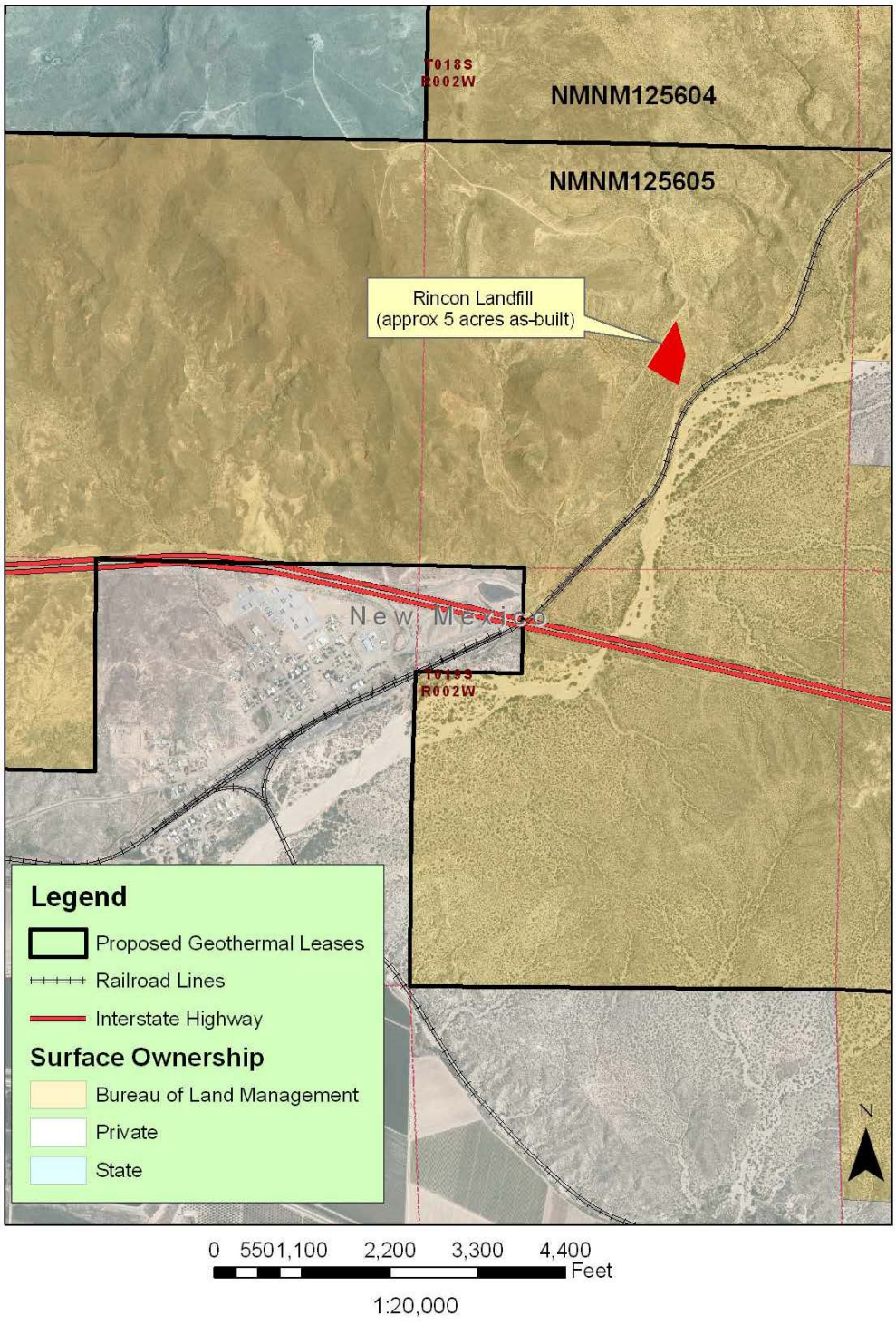

FIGURE 5LOCATION OF CLOSED RINCON LANDFILL WITHIN THE BOUNDARIES OF THE PROPOSED LEASE.

3.16 Water Quality

The intermittent arroyos and channels within the nominated lease area only flow during and immediately after precipitation events. During such flow events, sediment can be mobilized and carried to the Rio Grande River. The amount of sediment mobilized during precipitation events is affected by vegetation cover, slope and rainfall intensity. In the Rio Grande, evapoconcentration causes salinity to increases downstream and during the summer months. Nitrate and phosphate loads reach maximums during winter and summer, and dissolved organic carbon (DOC) loads are relatively stable throughout the year (Zeglin and Dahm, 2006). Pesticides have been detected in surface waters, stream sediments and whole-body fish samples from the Rio Grande, but not at concentrations that exceed applicable Federal or State standards or guidelines. Reaches of the Rio Grande and some of its tributaries have been impaired by elevated concentrations of trace elements (arsenic, cadmium, copper, lead, zinc and other metals); however, concentrations tend to decrease downstream from the source. A combination of natural conditions and human activities appears to be associated with elevated trace-element concentrations (Levings et. al. 1998).

Limited information regarding ground water quality in the Rincon area has been obtained. A sample from a well in the northeast part T.18 S. R. 2 W. had a total dissolved solids (TDS) content of 1171mg/l (Ikelman and Theberge, 1980) the depth from which this sample was collected was not recorded.

3.17 Watershed Hydrology

Most of the proposed action area drains into first order tributaries of the Rio Grande (Rincon Arroyo and Ralph Arroyo). These are intermittent drainages that flow during or immediately after precipitation events and generally do not have a permanent base flow component to their discharge. High flow events are most frequently expected during the monsoon season from late June through July. The nominated leasing area drains into the Rio Grande; a major source of water for irrigation, municipal and recreational purposes. The Rio Grande has a permanent base-flow component to discharge, but river discharge is lower during the dry summer months and is strongly affected by depletions for agricultural irrigation (Zeglin and Dahm, 2006).

Limited geohydrologic information for the proposed action area is available (Witcher, 1990; New Mexico State Engineer's Office, 2011). Records from the New Mexico State Engineer's Office (NMSEO) for a municipal well on private land in section 3 of T. 19 S. R. 2 W indicate groundwater at a depth of 124 feet from the surface. This 260' deep well is emplaces in Upper Santa Fe group sediments consisting of mixed sand and gravels to approximately 200' depth and thin sand and clay beds from 200 to 260 feet. Water levels in nine domestic and irrigation wells in sections 7 and 8 of T. 18 S. R. 2 W. range between 8 and 19 feet below the surface, with an average depth of 13 feet (New Mexico State Engineer's Office, 2011). A previously drilled continuous-core borehole in the Rincon area encountered a highly fractured reservoir consisting of silicified Rio Grande sediments at 300-600' depth (Witcher, 1995). Between 600 and 1218' depth, relatively unaltered clayey siltstone was recorded, which was interpreted by Witcher (1995) to form an aquitard between the upper reservoir and a deep, possibly fault-driven flow system.

3.18 Wilderness/Special Management Areas

The proposed action is not within and does not overlap any designated wilderness areas or wilderness study areas. As shown in figure 2, the area nominated in geothermal lease NMNM125605 includes the entire Rincon Area of Critical Environmental Concern (ACEC). The 840 acre Rincon ACEC is

designated in the 1993 Mimbres RMP in order to protect petroglyph sites over an approximately 1.0 mile by 0.75 mile area. This area meets the BLM ACEC relevance criteria because it contains significant cultural resources, and it meets agency ACEC importance criteria because these cultural resources are fragile, irreplaceable and threatened.

3.19 Wildlife

The proposed action area is characterized by Chihuahuan desert scrub and semi-desert grassland biotic communities. The area provides habitat for approximately 10 species of amphibians, 56 species of reptiles, 77 species of mammals, and 291 species of birds.

Standard Habitat Sites (SHS) are ecological sites with similar components such as vegetation, soil, landform, and climate, forming suitable habitat for specific wildlife species. SHS descriptions are available from the LCDO. The SHS that occur within the proposed action area include:

- Creosote rolling uplands
- Creosote breaks
- Mixed shrub hills
- Mixed desert shrub
- Mesquite sand dune
- Arroyo

Vertebrate species lists for each SHS are available from the Integrated Habitat Inventory Classification System (IHICS) database on file in the LCDO. The IHICS database is a companion product to the inventory mapping completed for the District Office in the late 1970's and provides a listing of species use and occurrence in various habitats. Tables of wildlife, by habitat type, have also been developed utilizing the Biota Information System of New Mexico (BISON-M) http://www.bison-m.org/databasequery.aspx

4 ENVIRONMENTAL EFFECTS

4.1 Impacts of Proposed Action on Air Quality

Any potential effects to air quality from sale of lease parcels would occur if and when the leases were developed. Potential impacts of development could consist of increased loading of airborne particulate matter (dust) due to surface disturbing activities such as road improvements, well pad construction, or facilities development. Development activities could also temporarily increase exhaust emissions from internal combustion engines associated with drilling equipment, compressor engines, and vehicles.

Mitigations for air quality: Specific mitigation measures will be developed and applied during all stages of development, including exploration, reservoir evaluation, facilities development and reclamation. Specific mitigations will be attached as conditions of approval (COAs) to Notices of Intent, Geothermal Drilling Permits and Sundry notices and would include, but not be limited to:

- Meeting all applicable state and federal air quality standards through the use of the best available technology to control emissions

- Applying water to roads or drill pads when necessary to suppress dust

- Observing prudent speed limits on unpaved roads throughout the project area in order to reduce dust emissions.

- Maintaining access roads, project area roads, and other traffic areas on a regular basis to minimize dust and provide for safe travel conditions.

- Utilizing best-management practices for dust control as described in the Dona Ana County NEAP when applicable.

4.2 Impacts of Proposed Action on Climate Change

Any climate change impacts resulting from issuance of the proposed geothermal leases would depend on the nature and extent of lease development. During development activities such as well drilling, and construction, greenhouse gases (GHG) would be emitted from internal combustion engines, however, these would only be temporary sources for the duration of project development. If the geothermal reservoir is sufficient to operate a power generation facility, the project may result in a net reduction of GHG emissions if the generation facility replaces or precludes electric power generation by fossil fuels. A direct use application may also result in a net savings in GHG emissions over a facility powered by fossil fuels.

4.3 Impacts of Proposed Action on Cultural Resources

While implementing the proposed action (i.e. leasing all or part of the nominated area for geothermal energy) would not immediately affect cultural resources, subsequent development activities could adversely affect cultural resources unless appropriate mitigations are applied. Exploratory activities such as geophysical prospecting, road building and well drilling all require varying degrees of surface disturbance which could damage or obliterate archeological sites. If exploration demonstrates the presence of a viable geothermal resource, developmental activities including facilities and power-line construction would expand the total area of surface impacts. Consequences of these affects could include the loss of important archeological sites and their associated scientific information and interpretive opportunities.

Mitigations for Cultural Resources: The 2008 Programmatic Environmental Impact Statement (PEIS) for geothermal development prescribes a no-surface occupancy (NSO) stipulation for areas containing important cultural or archeological resources, or that are eligible or potentially eligible for the National Register of Historic Places. The Rincon ACEC meets both of these criteria, and the NSO stipulation will be applied to the entire 840 acre ACEC within lease NMNM125605. The remaining areas of lease NMNM125605 and the entire area of lease NMNM125604 will be subject to the cultural resource stipulation required by the PEIS and BLM instruction memorandum 2005-003:

““This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any

activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.”.”

In addition, archeological mitigations shall be added to all geothermal notices of intent, drilling permits, sundry notices, and utilization plans as enforceable Conditions of approval (COAs). Such mitigation measures would include, but not be limited to:

- Pre-disturbance archeological surveys and recovery
- Monitoring of operations by a qualified archeological monitor
- Strict protocols for the preservation and reporting of previously undetected sites

4.4 Impacts of Proposed Action on Invasive and non-native species

All actions on public lands that involve surface disturbance or rehabilitation present a potential risk of introducing invasive non-native species into uninfested sites. The establishment and spread of invasive species can adversely affect native species by outcompeting them for resources such as water, space and nutrients. During geothermal development, invasive plants could be introduced by unwashed construction equipment, imported fill materials, or contaminated mulch used during reclamation.

Mitigations for invasive and non-native species: will be incorporated as specific conditions of approval (COAs) attached to Notices of Intent, Geothermal Drilling Permits and sundry notices. The COAs would be tailored to specific activities and locations within the leasehold and could include, but would not be limited to:

- Requiring that all equipment be cleaned and inspected prior to mobilization
- Requiring the use of seed, mulch and straw that has been certified weed-free by the New Mexico State University Cooperative Extension Office.
- Monitoring authorized sites for invasive or noxious weed infestation
- Mandatory BLM prescribed treatments in the event of infestation

4.5 Impacts of Proposed Action on Livestock Grazing

The proposed action is issuance of a geothermal lease, which in itself does not authorize ground disturbing activities. Affects to livestock access and grazing only occur if a lease operator initiates exploration and development activities. The actual affects to livestock will depend on the proposed activities. Geophysical exploration (earth resistivity, magnetotelluric, etc.) are temporary activities that can usually be completed using existing roads and with minimal surface disturbance. Seismic exploration may require the use of explosives as a seismic wave source, which may temporarily disturb cattle. Exploratory well drilling requires development of access roads and well pads, which could cause forage to be lost on grazing allotments. The magnitude of impacts to the forage resource is dependent on acres of disturbance. Depending on the number of AUMs lost, this may require adjustments to the grazing permits for this allotment.

There could be incidental livestock injuries or deaths due to accidents such as collisions with vehicles, falling into mud pits or other excavations, and ingesting plastic or other materials present at the work site. Construction activities can damage range improvements such as fences and pipelines. Vehicle use and exploration and development activities could also impede access to base waters (section 3.5) for the affected allotments. Certain activities in support of exploration or development, such as road building and

creating new access routes through existing fences, could increase opportunities for cattle to stray outside of allotment boundaries

Mitigations for Livestock Grazing: A variety of measures shall be implemented in authorizations for exploration or development in order to mitigate or minimize conflicts between lease development and grazing. Fencing the well pad to exclude livestock, speed limits to minimize collision occurrences, and strict requirements to preserve or repair allotment improvements shall be added as enforceable COA's to geothermal notices of intent, drilling permits, sundry notices, and utilization plans. Access roads to drilling pads and other facilities will be kept to a minimum length, and reclaimed when no longer needed, and the LCDO will require cattle guards and temporary gates as needed to control cattle movement. Production wells and facilities, if constructed, will be fenced to prevent accidents. If conflicts arise with livestock as a result of construction of the well pad, measures will be taken as necessary to mitigate those conflicts in coordination with the range allottee and the BLM Authorized Officer. In the event exploration or production activities are proposed in any geothermal lease, it is standard BLM practice to allow range permitees to participate in the review of proposed activities through the standard NEPA process.

4.6 Impacts of Proposed Action on Migratory Birds

Issuance of the geothermal lease will not authorize any ground disturbing activity, and is not expected to have any immediate effects on migratory birds. Exploration and development activities subsequent to lease issuance could create situations which may compromise migratory bird populations. Reserve pits created during drilling operations can contain geothermal brines, drilling mud, barium sulfate, and other chemicals that could be harmful to migratory birds (Ramirez, 2000; U.S. Fish and Wildlife Services, 2009). During well drilling, reserve pits probably do not attract aquatic migratory birds and waterfowl due to human activity and noise. However, once the drilling rig and other equipment are removed from the well pad, the reserve pit is attractive to birds because it is mistaken for a natural water body (U.S. Fish and Wildlife Services, 2009). Traffic and construction associated with development activities could also result in bird mortality.

Mitigations for Migratory Birds: Appropriate conditions of approval (COA's) will be applied to all proposed geothermal drilling permits and development plans in order to protect migratory birds. Leaving unclaimed reserve pits increases the risk of avian mortality (U.S. Fish and Wildlife Services, 2009), so all operators will be required to promptly reclaim reserve pits within 30 days or less of completing drilling operations. During drilling operations, mitigations such as netting, floating barriers ("bird balls") and fencing will be used to prevent migratory birds from accessing reserve pits. Migratory bird populations can be protected during resource development by COAs requiring the operator to maintain drainage (to minimize pooling of water that may attract birds), installing and maintaining bird protection on cooling vents, and installing appropriate bird protection on power lines. The limits of the proposed lease area are located at least one mile from the channel of the Rio Grande; so although noise and human activity may displace some migratory birds, ample suitable habitat is present in surrounding areas.

4.7 Impacts of Proposed Action on Minerals

There are no approved or pending mining plans of operation (MPO) associated with any of the mining claims identified in the limits of the proposed action. Therefore, the issuance of this lease will not interfere with any mining operations or non-competitive lease applications. There are no active mineral

leases or mineral materials disposals within the proposed action area. Therefore, no affects to mineral activities are expected from the action alternative.

4.8 Impacts of Proposed Action on Paleontology

Within the area of the proposed geothermal lease areas, fossil resources are most susceptible to surface disturbing activities where the Santa Fe group is exposed at the near surface. The most susceptible areas include the channel of the Rincon Arroyo and the pediment area immediately north of Interstate 25.

Mitigations for Paleontology: Will be applied to any surface disturbing activities associated with future exploration notices, geothermal drilling permits or other development plans. The most practical mitigation measures are monitoring during construction and operations, protection of discoveries, and reporting to the BLM discoveries of all fossil resources. Specific Conditions of Approval (COA's) for permits and notices will require the operator to leave any fossil discoveries intact, cease operations in the affected area, and immediately notify the Las Cruces BLM. The discovery site will be protected until BLM staff can evaluate the discovery and recommend appropriate mitigation or recovery measures.

4.9 Impacts of Proposed Action on Lands and Realty

The BLM-administered parcels in sections 7 and 8 of T. 19 S. R. 2 W. (NMNM125605 – proposed Rincon South lease) are identified for disposal in the 1993 Mimbres R.M.P. (figure 3). If the proposed action is carried out, it is possible that future development of the geothermal resource could encumber the surface with infrastructure such as production wells, power lines, and use facilities. Placement of this infrastructure on lands identified for disposal would create a significant impediment to future transfers of such lands for public purposes..

Most of the area included in lease NMNM125604 is identified as ROW avoidance in the 1993 Mimbres R.M.P (figure 3). In ROW avoidance areas, new rights-of-way are only granted if no feasible alternative route or designated ROW corridor is available. If proposed lease NMNM125604 is issued, it is possible that a new ROW may be granted in the ROW avoidance area outside of the lease boundary in order to access this leasehold. However, the leaseholder would have to conclusively demonstrate that such a new ROW is absolutely necessary, since access is also possible from unrestricted areas.

Mitigations for Lands and Realty: The parcels in sections 7 and 8 of T. 19 S. R. 2 W. (NMNM125605 – proposed Rincon South lease) identified for disposal in the 1993 Mimbres R.M.P. should be eliminated from consideration from leasing at this time. This will assure that future ownership adjustments will not be encumbered by a conflicting right or interest, and the transferred lands would remain available for future recreational and pubic purposes. The total area eliminated from the lease proposal is 160 acres, or less than two percent of the total area under consideration for leasing, which would not detract from the development of geothermal resources.

4.10 Impacts of Proposed Action on Recreation

There are no developed recreation sites within the proposed lease area. Affects will primarily be to dispersed-recreational activities such as hunting, hiking, camping and OHV use. Access to future operational areas, such as drill pads or generating facilities, will probably be limited for safety and

security reasons. Recreational activities would possibly be precluded within operational areas, but not within undeveloped or inactive areas of the leasehold.

The proposed action and subsequent development (if it occurs) will not affect access to or utilization of the Camino Real National Historic Trail because of the distance (over 1.5 miles) from the trail. Lease development could, however, impact the visual experience from the Camino Real Trail. For analysis of these possible impacts and an inventory of mitigation measures, please refer to section 4.14

Mitigations for Recreation: Although geothermal development could preclude most dispersed recreation activities within specific areas, opportunities for dispersed recreation would remain available at surrounding public lands. To mitigate possible safety concerns, the operator will be required to post warning signs and fence operations if necessary to protect public safety. Wire gates would be prohibited to protect OHV users.

4.11 Impacts of Proposed Action on Soils

Development of a geothermal lease will result in surface disturbing activities that can adversely affect soils; generally increasing the potential for erosion and loss of soil productivity. Vehicle traffic could also compact soils resulting in decreased permeability and increased runoff. Soil compaction can create areas devoid of vegetation; resulting in a loss of cover and forage. Precipitation runoff also accelerates over compacted areas which may exacerbate soil erosion.

Mitigations for Soils: Although issuing a geothermal lease will not authorize surface disturbing activities that would affects soils, specific COA's will be applied to drilling permits and development plans. Soil compaction would have to be mitigated through disk tilling or mechanical ripping during reclamation. Long-term impacts to soils and the loss of soil productivity will be addressed through reclamation activities that will reduce compaction and restore soil permeability (tilling), contribute to organic matter content (straw and mulch application) and re-establish vegetative communities (seeding).

4.12 Impacts of Proposed Action on Special Status Species

4.12.1 Impacts to Special Status Plants

Exploration and development activities create surface disturbances which, if unmitigated, can adversely affect special status species (SSS) plants by either damaging or killing individual specimens or by degrading habitat. Installation of geophysical equipment requires digging with hand tools and laying connecting line overland; which can adversely affect individual plant specimens. Wide area exploration and development activities including shallow-gradient tests, well drilling, road building and facility construction could affect large numbers of specimens, and may degrade SSS plant habitat by fragmentation and vegetation removal.

Mitigations for Special Status Plants: Surveys or biological monitors will be required of any proposed disturbance areas to avoid or mitigate impacts to night-blooming cereus, castetter's milkvetch and nodding rock daisy. If plant surveys determine that individual specimens are likely to be affected by

development activities, BLM will begin by working with the applicant to modify or move the proposed activities to mitigate impacts. The operator will also be responsible for transplanting individual specimens to a BLM approved location, if modifying or relocating the proposed activity is not feasible. Surveying, monitoring and transplanting requirements will be applied to geothermal notices of intent, drilling permits, sundry notices, and utilization plans as enforceable COA's.

Indirect impacts to SSS plants from dust and noxious weeds will be mitigated through air quality mitigations and invasive species mitigation measures outlined in sections 4.1 and 4.4, respectively.

4.12.2 Impacts to Special Status Animals

Affects to SSS animals will not occur unless the proposed action (issuance of a geothermal lease) is implemented, and if an operator begins exploration and development activities. These activities can affect SSS animals by degrading and fragmenting habitat. Seismic exploration, vehicle travel and other exploratory activities can disrupt feeding or mating activities of SSS animals. Surface disturbing activities such as road building, well construction, and facility development would reduce the total acres of potential SSS animal habitat and cause habitat fragmentation. Direct consequences to SSS animal populations would include decreased ecosystem carrying capacity and loss of genetic diversity. Incidental morality due to accidents with vehicles or reserve pits could also result in the loss of individual SSS animal specimens.

Mitigations for Special Status Animals: If the proposed action is implemented, all subsequent proposals related to development of the lease will be evaluated to determine if there will be effects to SSS animals. The 2008 Geothermal PEIS specifies a controlled surface-use (CSU) stipulation to protect important habitat and migration corridors. This CSU can be applied to the identified Big Horn Sheep habitat within proposed lease NMNM125604 (figure 4) in order to protect this species during sensitive periods, such as breeding season. Mitigations measures and best management practices defined for wildlife protection during oil and gas development (Jankowitz, 2007) are also applicable to geothermal development. These mitigation measures include, but are not limited to:

- Conduct pre-development surveys for SSS animals to establish baseline reference data for future comparison.
- Limit the total area of disturbed ground, number of well pads, and the linear distance of roads per section.
- During drilling, reserve pits will be fenced, bermed, and/or netted to exclude SSS animals and other wildlife.
- Establish speed limits on access and drilling roads to minimize the potential for vehicle accidents.
- Plan facilities in order to maintain existing blocks of undeveloped habitat.
- Minimize the construction of new roads and require closure and reclamation of obsolete roads.
- Prohibit nighttime exploration and drilling activities to protect bat species.
- Install housing around noisy equipment that may cause disturbance to sensitive wildlife.

In general, geothermal development is not as aerially extensive as oil and gas development, because it is inefficient to transport geothermal waters long distances through pipelines. Production wellfields, injection wells and use facilities would likely be co-located in a limited area.

4.13 Impacts of Proposed Action on Vegetation

Issuing the proposed geothermal leases will not authorize any immediate surface disturbance and will not immediately affect vegetation. The impact of the proposed action on vegetation will occur after lease development begins. The primary effects of development activities such as road building, well drilling, power plant construction, and transmission line installation will be vegetation removal from the area of activity. If left unmitigated, this could subsequently result in accelerated soil erosion, increased weed competition, degradation of soil quality and increased airborne particulate loading. Airborne dust could also impact vegetation productivity in surrounding undisturbed areas (Farmer, 1993).

Mitigations for Vegetation: The immediate effects of vegetation loss during lease development will be mitigated through best management practices (BMPs) to control noxious weed infestation and soil erosion. These BMP's are described in section 4.4 and 4.14, respectively, and will be incorporated in development plans, notices, and permits as enforceable Conditions of Approval. The BLM will require a variety of dust control measures in the Conditions of Approval to reduce the impacts of airborne particulate matter on vegetation (see section 4.1). Over the long-term, effects to vegetation will be mitigated through reclamation of areas disturbed during lease operations. Reclamation activities will be designed to mitigate specific actions and will generally include actions that stabilize soil and prevent erosion, restore organic matter, re-introduce native grasses and shrubs to the disturbed area.

4.14 Impacts of Proposed Action on Visual Resources

Both proposed geothermal leases are located in areas classified as VRM II, which requires minimum changes to the characteristic landscape, and that management activities should not attract the attention of casual observers. The proposed action (issuance of the geothermal leases) would not authorize any surface disturbing activities, and will not have any direct effects on visual resources. Such effects would occur only after lease development activities begin.

The extent of affects to visual resources during the development phase will depend on the type of development activities that occur. Large drilling rigs could be visible at considerable distance from the worksite, but they would only create a temporary change in visual conditions. Geophysical exploration methods also only create temporary disturbance and usually only at ground level. The most significant visual effects would likely occur if exploration identifies a significant geothermal resource and commercial development commences. Road building in support of drilling operations would alter the visual characteristics of the landscape, while power generation facilities, transmission lines and other support facilities could create significant, long-term changes in the visual character of the area. Of particular concern would be the affect that visual impacts would have on the experience of visitors to the Camino Real National Historical Trail. The 2004 Record of Decision for the Camino Real Trail management plan identifies preserving the historic and scenic resources as a resource goal. Long term development of a geothermal lease could potentially detract from the trail visitor's visual and historic experience.

Mitigations for Visual Resources: The geothermal Programmatic EIS applies a Controlled Surface Use (CSU) to areas designated as VRM II and VRM III, which requires that any future activity of development be modified or relocated from the proposed location if necessary to achieve visual resource protection. Project applicants will be required to submit a plan to meet the visual management objectives through special design, construction, operation, or reclamation measures, and/or relocation.

To mitigate adverse impacts to visual resources during geothermal development, specific mitigation measures will be applied to all geothermal Notices of Intent, Drilling Permits, and Site Licenses. Mitigations measures will be incorporated as enforceable Conditions of Approval (COAs) and will have to be developed based on the location and specific details of the proposed development activities. Operation and reclamation standards described in the surface operating Standards and Guidelines for Oil and Gas Exploration and Development (Bureau of Land Management, 2007) can be applied as required. The primary visual mitigation measure will be working with operators to identify and preventing unnecessary surface disturbance during proposal evaluation. Other visual mitigation measures in the COA's will include, but will not be limited to:

- Minimizing drill pad footprints and requiring interim reclamation to minimize disturbance at completed wellheads.
- Painting facilities to blend into the background.
- Utilization of low-profile or below ground pumping facilities.
- Utilization of low-profile tanks.
- Optimizing facility placement to reduce visual impacts.

4.15 Impacts of Proposed Action on Wastes, Hazardous and Solid

The previously described Rincon landfill (section 3.15) was permanently closed in January 1989 and has been capped and restored. Surface disturbing activities associated with geothermal development could disturb this abandoned landfill and possibly expose the isolated solid wastes. This would create potential public health hazard or cause land and water contamination if activities in the abandoned landfill are not prohibited.

The proposed action is not expected to increase dumping or illicit disposal of solid wastes in the proposed leaseholds because such actions are strictly prohibited in geothermal Notices of Intent, Drilling Permits, and Site Licenses. It is possible that development of the lease may decrease the amount of illegal dumping in the area if a presence is created by new geothermal operations.

Mitigations for Wastes, Hazardous and Solid: To avoid damage and possible re-exposure of the Rincon landfill, any proposed surface disturbing activities will be strictly regulated within the landfill and a buffer area totaling 40 acres. Operators will be encouraged to avoid surface disturbing activities within the landfill and buffer area, and any proposed activities would be strictly evaluated and possibly denied if the proponent cannot demonstrate adequate mitigation of impacts.

4.16 Impacts of Proposed Action on Water Quality

Issuing the proposed geothermal leases will not authorize any immediate surface disturbance and will thus not immediately affect water quality. Exploration activities are likely to commence after lease issuance,

and could include geophysical prospecting (earth resistivity or seismic) and exploratory well drilling. Water quality impacts from exploration activities would result from surface disturbance which would increase sediment loading to streams (see section 4.11, Soils).

During the resources development stage, well testing will be necessary to determine aquifer properties and whether resource development is feasible. During well tests, significant quantities of geothermal waters will need to be discharged to the surface. Although well tests are temporary operations (generally not more than three or four weeks), the impact on water quality will depend on the chemistry of the water retrieved from the geothermal reservoir.

Mitigations for Water Quality: In a reasonable exploration scenario, geophysical exploration is not likely to affect water quality because most techniques used in geothermal exploration can be completed without new roads or vegetation removal. Should an operator demonstrate a definite need to create new roads or remove vegetation for geothermal exploration, their activities would be subject to mitigations defined in the impacts sections for Soils (4.11) and Watershed Hydrology (4.17). The same mitigations will be applied during the drilling of exploratory wells and supporting activities such as road building or well pad construction. All of these mitigations will be included in Notices of Intent and Geothermal Drilling Permits as enforceable Conditions of Approval (COA's).

Water quality mitigations during the development phase will ultimately depend on the chemical composition of ground water retrieved from the geothermal reservoir. The BLM, in cooperation with State of New Mexico agencies, will require water quality sampling and testing prior to the initiation of any discharge tests, and monitoring of water-quality during the discharge test. The results of this testing and monitoring will be used to develop appropriate water quality mitigations. Low total dissolved solids (TDS) waters could possibly be discharged in a controlled manner to existing drainages (subject to State of New Mexico and U.S. Army Corps of Engineers permitting requirements). Waters with concentrated TDS levels may have to be temporarily stored on site, and subsequently disposed offsite at an approved facility (which is also subject to New Mexico State permitting requirements). It is also possible that onsite treatment may be necessary in order to meet water quality standards and State regulatory requirements. Other water quality mitigation measures that can be applied to Geothermal Drilling Permits in general include isolating fuel or storage tanks with liners and berms; casing well intervals to isolate them from aquifers; and closing and sealing abandoned wells to State of New Mexico Standards.

4.17 Impacts of Proposed Action on Watershed Hydrology

Affects to watershed hydrology would occur only if a development proposal is received after lease issuance. Alterations to watershed hydrology would result from surface disturbances during road building, well pad construction, and facility construction and development. These surface disturbances would result in vegetation removal, soil compaction and surface alterations (such as applying caliche during well construction) which decrease infiltration and increase runoff. Discharge of geothermal waters during well testing could also increase runoff and discharge to existing drainages, but this affect would be temporary and would probably not exceed a few weeks. Geothermal development activities would not alter existing drainage patterns or divert water from the Rio Grande watershed.

Impacts to ground water resources could occur if exploration and aquifer testing leads to the development of a geothermal power plant or direct use facility. Such facilities usually re-inject geothermal waters after

heat extraction, so impacts to the ground-water flow system will be localized. Witcher (1995) did recognize an apparent impermeable barrier aquitard between the upper aquifer (300-600' depth) and a deeper ground-water flow system (approximately 1200' depth).

Mitigations for Watershed Hydrology: The BLM will apply a wide variety of best management practices (BMPs) to mitigate runoff, erosion and other hydrological effects of any proposed development activities. These BMP's will be incorporated into development applications as enforceable Conditions of Approval (COA's) as required. BMP's and mitigations will emphasis identifying and reducing unnecessary surface disturbance during project evaluation, and mitigating affects from required development activities. Specific BMPs can include, but are not limited to:

- Minimizing drill pad footprints and requiring interim reclamation for completed wells.
- Crown-and ditch construction of roads to disperse runoff.
- Interim reclamation of roads, including ripping seeding with native grasses.
- Removal of caliche, pea gravel, or other surfacing materials after well completion.

Should development lead to the construction of future operation facilities, advanced BMPs such as stormwater retention or complimentary grassland and wetland restoration can be implemented if needed.

4.18 Impacts of Proposed Action on Wilderness/Special Management Areas

There are no Wilderness Areas or Wilderness Study Areas associated with the proposed geothermal leases. The Rincon Area of Critical Environmental Concern (ACEC) is centered within the proposed leasing area (figure 1). If lease development activities are permitted in the Rincon ACEC, this could potentially damage or destroy the petroglyphs and other artifacts resulting in the loss of valuable cultural and scientific resources.

Mitigations for Wilderness/Special Management Areas: The archeological issues in the Rincon ACEC require application of the No Surface Occupancy (NSO) stipulation over the entire ACEC area (section 4.3). This NSO stipulation is required in the 2008 PEIS and will protect the archeological, cultural and scientific resources in the ACEC from activities associated with geothermal development.

4.19 Impacts of Proposed Action on Wildlife

Issuance of the proposed geothermal leases would not have immediate effects on wildlife, because it would not authorize any surface-disturbing activity. Effects to wildlife will not occur until an operator begins exploration and development activities. Seismic exploration, vehicle travel and other exploratory activities can disrupt wildlife feeding or mating activities. Surface disturbing activities such as road building, well construction, and facility development would reduce the total acres of wildlife habitat and cause habitat fragmentation. Direct consequences to wildlife would include decreased ecosystem carrying capacity and loss of genetic diversity. Incidental morality due to accidents with vehicles or reserve pits could also result in the loss to wildlife populations.

Mitigations for Wildlife:

If the proposed action is implemented, all subsequent proposals related to development of the lease will be evaluated to determine if there will be effects to wildlife. Enforceable COAs will be applied to

geothermal notices of intent, drilling permits, sundry notices, and utilization plans in order to minimize habitat loss and fragmentation. Mitigations measures and best management practices defined for the oil and gas industry (Jankowitz, 2007) are also applicable to geothermal development. These mitigation measures include, but are not limited to:

- Conduct pre-development wildlife surveys to establish baseline reference data for future comparison.
- Limiting the total area of disturbed ground, number of well pads, and the linear distance of roads per section
- Establish speed limits on access and drilling roads to minimize the potential for vehicle accidents
- During drilling, reserve pits will be fenced, bermed, and/or netted to exclude wildlife.
- Plan facilities in order to maintain existing blocks of undeveloped habitat.
- Minimize the construction of new roads and require closure and reclamation of obsolete roads.
- Install housing around noisy equipment that may cause disturbance to sensitive wildlife.
- Plan development during non-breeding or lambing periods to avoid bighorn sheep impacts.

4.20 Impacts of the No Action Alternative

Impacts of the No Action Alternative on Climate Change: If the No Action Alternative is implemented, then there would be no development of the geothermal resource in the Rincon area. This alternative, however, would not affect demand for electricity in the community, and this demand would have to be satisfied by another source, most likely one powered by fossil fuels. The no action alternative would therefore forego an opportunity to possible reduce local Green House Gas emissions.

Impacts of the No Action Alternative on Local Economic Development and Federal Revenues: If the No Action Alternative is implemented, there will be no opportunity to develop a known geothermal source. This could possibly affect opportunities for investment and employment in local communities such as Hatch and Rincon. Furthermore, the U.S. Treasury Department would not receive lease rental payments (43 CFR 3211.11) and may forego future royalty payments from development of the geothermal resource.

4.21 Cumulative Impacts

Issuing a geothermal lease does not immediately authorize surface disturbing activities. Although not all mineral leases are developed, it is reasonable to assume that some development would occur in the area of the propose action because the area includes a known but uncharacterized geothermal source. The nature and extent of cumulative impacts will therefore depend on future exploration and development of the resource.

Geothermal development follows a deliberate and logical to quantify the nature and potential of the resource, and each stage in this sequence is characterized by increasing resource impacts. The first phase of development is exploration, in which a proponent tries to determine the occurrence and spatial extent of the resource. At the beginning of the exploration phase, geophysical techniques are often applied to identify possible temperature anomalies at depth. This commonly involves earth-resistivity measurement,

but seismic exploration techniques are sometimes used if additional geologic information is needed. Surface geophysical techniques create minimal surface disturbance, such as brush clearing, associates with extending cables or geophones over the surface. Equipment associated with geophysical techniques is commonly carried overland on foot, although temporary roads are occasionally required depending on the terrain.

Geothermal exploration can also include drilling exploratory wells in order to determine bottom-hole temperatures and temperature gradients. Well drilling will usually require a significantly greater degree of surface disturbance than surface-geophysical methods; this would include land clearing for pads, development of access roads, digging reserve pits, and additional noise and traffic associated with drilling operations. Increases in noise and traffic will be temporary affects, as it generally takes less than six months to complete an exploratory well. Surface disturbances created by well development could result in an increase in soil erosion and vegetation loss in addition to the effects caused by cattle grazing, unless BMPs and interim reclamation requirements are attached to geothermal NOIs and drilling permits.

If exploration demonstrates the presence of a possibly feasible geothermal resource, then the lease area enters into the characterization phase. Characterization involves a series of tests to determine the sustainable rate at which the geothermal reservoir can be used, and inevitably involves well tests. New well drilling will cause the previously described environmental effects. Well testing generally involves pumping and discharging large volumes of water from the geothermal reservoir. Depending on the temperature and composition of the well discharge, these activities can present a safety hazard to humans and wildlife, and could introduce salinity into surface waters and soils. Reservoir tests are temporary in nature, generally not exceeding several weeks, so affects from reservoir characterization activities would be temporary, and can be largely mitigated through best management practices. Such practices would be based on the physical and chemical nature of the well discharge, and can include wildlife protection measures; erosion control at discharge points; disposal of reservoir fluids down State of New Mexico permitted waste injection wells; and, in extreme cases, onsite treatment of well discharge.

The final phase of geothermal development can be considered a resource development and utilization phase. If reservoir characterization determines the presence of a sustainable geothermal source, the operator will make determinations of the most profitable use of the reservoir (i.e. direct use or electricity generation) and develop appropriate facilities. As permanent facilities and supporting infrastructure are necessary, it is during the development phase that environmental effects are most extensive; however, not all geothermal leases will reach the development phase, and possible reservoir production rates at the Rincon lease area are currently unknown (Witcher, 1995).

Should the Rincon lease be issued and developed, the extent of surface disturbance will depend on the type of facility, which cannot be known at this time. It’s reasonable to anticipate, however, that development will involve some form of generating or direct-use facility; production and injection wells; supporting infrastructure such as roads, parking lots and short pipelines; and possibly power line to supply electricity to the grid. It is at this stage when the most extensive and persistent affects to wildlife, visual resources, hydrology, groundwater, air quality, range use and public recreation could occur.

Prior to using Federal land to develop geothermal resource facilities, Federal regulations (43 CFR 3271) require the leaseholder or operator to submit application for a site license and construction permits. These same regulations (43 CFR 3271.12) establish environmental protection measures required of the

proponent prior to receiving BLM approval of the application. During this process, the BLM will complete the appropriate level of NEPA analysis to identify environmental affects and develop mitigation measures appropriate for the proposed action.

5 TRIBES, INDIVIDUALS, ORGANIZATIONS OR AGENCIES CONSULTED

The public had the opportunity to contact the LCDO and provide input on this project. On October 21, 2010, the project was listed on the New Mexico BLM Website NEPA Log at:

http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html

This project has remained listed on the site for the duration of the environmental analysis.

The LCDO identified sixteen potentially interested parties for project scoping. Letters requesting comment were mailed to these parties on February 4, 2011 and comments were accepted until March 14, 2011. Three letters were received during this period; two from the current range permit holders and one from the Village of Hatch, New Mexico.

6 LIST OR PREPARERS

ID Team Member	Title	Organization
Mohammad Nash	Soil Scientist	BLM-LCDO
Corey Durr	Hydrologist	BLM-LCDO
Oz Gomez	Landscape Architect	BLM - LCDO
Margie Guzman	Wildlife Biologist	BLM - LCDO
Dave Legare	Archeologist	BLM - LCDO
Jennifer Montoya	NEPA Coordinator	BLM-LCDO
Lorraine Salas	Realty Specialist	BLM - LCDO
Joe Sanchez	Recreation Specialist	BLM - LCDO
Michael Smith	Geologist	BLM - LCDO
Chris Teske	HAZMAT Coordinator	BLM - LCDO
Marcia Whitney	Range Specialist	BLM -LCDO

7 REFERENCES

Bureau of Land Management, 2004, El Camino Real de Tierra Adentro National Historical Trail: Record of Decision.

Bureau of Land Management, 2007, Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (the Gold Book). Fourth edition, 76 p.

Bureau of Land Management, 2007, Manual H8410-1 – Visual Resource Inventory: http://www.blm.gov/nstc/VRM/index.html.

Bureau of Land Management and U.S. Forest Service, 2008, Record of Decision for the Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States. BLM-WO-GI-09-003-1800, FES 08-44.

Farmer, A.M., 1993. The effects of dust on vegetation- a review: Environmental Pollution. Vol. 79, p. 63-75.

Ikelman, J. A. and Theberge, A. E., 1980, Geothermal Resources of New Mexico: New Mexico Energy Institute at New Mexico State University, 1:500,000.

Fleischmann, D.J., 2006, Geothermal resource development needs in New Mexico, U.S. Department of Energy, 30 p.

Jankowitz, R., 2007, Oil and gas development guidelines: Conserving New Mexico's Wildlife Habitat and Wildlife. New Mexico Department of Game and Fish, 39 p. http://www.wildlife.state.nm.us/conservation/habitat_handbook/index.htm

Levings, G. W., Healy, D. F., Richey, S. F. and Carter, L. F., 1998, Water Quality in the Rio Grande Valley, Colorado, New Mexico, and Texas, 1992-95: U.S. Geological Survey Circular 1162, 39 p.

Morgan, G. S., Lucas, S. G. and Estep, J. W., 1998, Pliocene (Blancan) vertebrate fossils from the camp Rice formation near Tonuco Mountain, Dona Ana County, southern New Mexico: *in* New Mexico Geological Society Guidebook, 49th Field Conference, Las Cruces Country II p. 237-249.

Natural Resource Conservation Service, 2011, http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

New Mexico Department of Game and Fish., 2006. Comprehensive Wildlife Conservation Strategy for New Mexico. New Mexico Department of Game and Fish, Santa Fe, NM 87504.

New Mexico Department of Game and Fish, 2011, Biota Information System of New Mexico: http://www.bison-m.org/

New Mexico State Engineer's Office, 2011, http://www.ose.state.nm.us/waters_db_index.html

Pew Center on Global Climate Change, 2010: http://www.pewclimate.org/technology/factsheet/geothermal

Ramirez, P., 2000, Wildlife Contaminant Risk in Oil Field Waste Pits: U.S. Fish and Wildlife Service Region 6 Contaminants Information Bulletin.

Seager, W. R., Clemons, R. E., Hawley, J. W., and Kelley, R. E., 1982, Geology of northwest part of Las Cruces 1° x 2° sheet, New Mexico. New Mexico Bureau of Mines and Mineral Resources Geologic Map 53, 1:125,000.

U.S. Fish and Wildlife Service, 2009, Reserve pits: Mortality risks to birds: http://www.fws.gov/mountain-prairie/contaminants/contaminants1d.html

Williams, E., Lotstein, R., Galik, C. and Knuffman, H., 2007 (eds), A convenient guide to climate change policy and technology: Duke University, 420 p. (http://www.nicholas.duke.edu/ccpp/convenientguide/)

Witcher, J.C., 1995, Geothermal resource database for New Mexico: Southwest Technology Development Institute, New Mexico State University, 38 p.

Zeglin, L.H. and Dahm, C.N., 2006. Water Quality along the middle Rio Grande of New Mexico, Final Technical Report for New Mexico Water Resources Research Institute: http://wrri.nmsu.edu/research/rfp/studentgrants05/reports/Zeglin.pdf