

ENVIRONMENTAL ASSESSMENT
DOI-BLM-NM-P010-2014-15-EA
July 2014 Competitive Oil and Gas Lease Sale

Bureau of Land Management, Roswell Field Office



Department of the Interior
Bureau of Land Management
Roswell Field Office

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EA Log Number: DOI-BLM-NM-P010-2014-15-EA

Location: Various Locations in Chaves, Guadalupe, and Roosevelt Counties, New Mexico

Finding of No Significant Impact

Based on the analysis of potential environmental impacts contained in the attached environmental assessment (EA), I have determined the Preferred Alternative (Alternative C) is not expected to have significant impacts on the environment. The impacts of leasing fluid mineral estate in the areas described with this EA have been previously analyzed in the 1997 Roswell Resource Management Plan and the 2008 Special Status Species Resource Management Plan Amendment; and the lease stipulations and notices that accompany the tracts proposed for leasing would mitigate the impacts of future development on these tracts. Therefore, preparation of an Environmental Impact Statement is not warranted.

Prepared by:

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Approved by:

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**Department of the Interior,
Bureau of Land Management, Roswell Field Office**

**Environmental Assessment for July 2014
Competitive Oil and Gas Lease Sale, DOI-BLM-NM-P010-2014-15-EA**

CHAPTER 1: INTRODUCTION

It is the policy of the Bureau of Land Management (BLM) as derived from various laws, including the Mineral Leasing Act of 1920 (MLA), as amended [30 U.S.C. 181 *et seq.*] and the Federal Land Policy and Management Act of 1976 as amended, to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs.

The BLM New Mexico State Office (NMSO) conducts an annual competitive lease sale to offer available oil and gas lease parcels in New Mexico, Oklahoma, Texas, and Kansas. A Notice of Competitive Lease Sale (NCLS), which lists lease parcels to be offered at the auction, is published by the BLM NMSO at least 90 days before the auction is held. Lease stipulations applicable to each parcel are specified in the Sale Notice. The decision as to which public lands and minerals are open for leasing and what leasing stipulations may be necessary, based on information available at the time, is made during the land use planning process. Surface management of non-BLM administered land overlaying federal minerals is determined by BLM in consultation with the appropriate surface management agency or the private surface owner.

In the process of preparing a lease sale the NMSO sends a draft parcel list to each field office where the parcels are located. Field Office staff then review the legal descriptions of the parcels to determine if they are in areas open to leasing; if any new information has become available which might change any analysis conducted during the planning process; if appropriate consultations have been conducted; with appropriate stipulations should be included; and if there are special resource conditions of which potential bidder should be made aware. The parcels nominated for this sale, along with the appropriate stipulations from the 1997 Roswell Resource Management Plan (RMP) and the 2008 Special Status Species Resource Management Plan Amendment (RMPA) are posted online for a two week public scoping period. Comments received are reviewed and incorporated into the Environmental Assessment (EA)

Once the draft parcel review is completed and returned to the NMSO, a list of nominated lease parcels with specific, applicable stipulations is made available online to the public through the NCLS. On occasions, additional information obtained after the publication of the NCLS may result in deferral of certain parcels prior to the lease sale.

This EA documents the Roswell Field Office (RFO) review of 16 parcels nominated for the July 2014 Competitive Oil and Gas Lease Sale that are under the administration of the RFO. It serves to verify conformance with the approved land use plan and provides the rationale for deferring or removing parcels from a lease sale as well as providing rationale for attaching additional lease stipulations to specific parcels.

The parcel and applicable stipulations were posted online for a two-week public scoping period starting on December 30, 2013. No comments were received. In addition, this EA is made available for public review and comment for 30 days beginning February 10, 2014. One parcel was added to the Carlsbad Field Office parcels being considered on February 18, 2014 due to a recommendation from the BLM NMSO fluid geologist who documented that drainage of the lease parcel was

occurring. Therefore, the public comment period for both the Carlsbad and Roswell EAs has been extended an additional 8 days and will conclude on March 19, 2014. Any comments provided prior to the lease sale will be considered and incorporated into the EA as appropriate.

1.1 Purpose and Need

The purpose is to consider opportunities for private individuals or companies to explore for and develop oil and gas resources on public lands through a competitive leasing process. The need of the action is established by the BLM's responsibility under the MLA, as amended, to promote the exploration for and development of oil and gas on public lands. The MLA also establishes that deposits of oil and gas owned by the United States are subject to disposition in the form and manner provided by the MLA under the rules and regulations prescribed by the Secretary of the Interior, where consistent with the FLPMA, the National Environmental Policy Act (NEPA) of 1969, as amended (Public Law 91-90, 42 USC 4321 et seq.), and other applicable laws, regulations, and policies.

1.2 Conformance with Applicable Land Use Plan and Other Environmental Assessments

The applicable land use plan for this action is the 1997 Roswell RMP. The RMP designated approximately 7.84 million acres of federal minerals open for continued oil and gas development and leasing under Standard Terms and Conditions. The RMP along with the 2008 Special Status Species RMPA, also describes specific stipulations that would be attached to new leases offered in certain areas. Therefore, it is determined that the alternatives considered conform to fluid mineral leasing decisions in the 1997 Roswell RMP and subsequent amendment is consistent with the goals and objectives for natural and cultural resources.

Pursuant to 40 Code of Federal Regulations (CFR) 1508.28 and 1502.21, this EA tiers to and incorporates by reference the information and analysis contained in the 1997 Roswell RMP Final Environmental Impact Statement and the 2008 Special Status Species RMPA. While it is unknown precisely when, where, or to what extent well sites or roads would be proposed, the analysis of projected surface disturbance impacts, should a lease be developed, is based on potential well densities listed in the Reasonable Foreseeable Development (RFD) Scenario included in the RMP. While an appropriate level of site-specific analysis of individual wells or roads would occur when a lease holder submits an Application for Permit to Drill (APD), assumptions based on the RFD scenario may be used in the analysis of impacts in this EA.

FLPMA established guidelines to provide for the management, protection, development, and enhancement of public lands (Public Law 94-579). Section 103(e) of FLPMA defines public lands as any lands and interest in lands owned by the U.S. For split-estate lands where the mineral estate is an interest owned by the U.S., the BLM has no authority over use of the surface by the surface owner; however, the BLM is required to declare how the federal mineral estate will be managed in the RMP including identification of all appropriate lease stipulations (43 CFR 3101.1 and 43 CFR 1601.0-7(b); BLM Manual Handbook 1601.09 and 1624-1).

1.3 Federal, State or Local Permits, Licenses or Other Consultation Requirements

Purchasers of oil and gas leases are required to comply with all applicable federal, state, and local laws and regulations, including obtaining all necessary permits required should lease development occur.

RFO biologists reviewed the proposed action and determined it would be in compliance with threatened and endangered species management guidelines. No further consultation with the U.S. Fish and Wildlife Service (USFWS) is required at this stage.

In April 2008, the BLM Pecos District Special Status Species RMPA amended the 1997 RFO RMP in portions of the RFO with references to the Planning Area, as described in that document, to ensure continued habitat protection of two special status species, the lesser prairie-chicken (*Tympanuchus pallidicinctus*) (LPC) and the dunes sagebrush lizard (*Sceloporus arenicolus*) (DSL). This action is in compliance with threatened and endangered species management outlined in the September 2006 (Cons. #22420-2007-TA-0033) Biological Assessments and in accordance with the requirements of the Federal Land Policy and Management Act (FLMPA) of 1976 and the National Environmental Policy Act (NEPA) of 1969.

Federal regulations and policies require the BLM to make its public land and resources available on the basis of the principle of multiple-use. At the same time, it is BLM policy to conserve special status species and their habitats, and to ensure that actions authorized by the BLM do not contribute to the need for the species to become listed as threatened or endangered by the USFWS.

Compliance with National Historic Preservation Act (NHPA) Section 106 responsibilities are adhered to by following the Protocol Agreement between New Mexico BLM and New Mexico State Historic Preservation Officer (Protocol Agreement), authorized by the National Programmatic Agreement between BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers, and other applicable BLM handbooks. When draft parcel locations are received by RFO, cultural resource staff reviews the locations to determine if any are within known areas of concern.

Native American consultation is conducted by certified mail regarding each lease sale activity. If Traditional Cultural Properties (TCP) or heritage-related issues are identified, such parcels are withheld from the sale while letters requesting information, comments, or concerns are sent to the Native American representative. If the same draft parcels appear in a future sale, a second request for information is sent to the same recipients and the parcels will be held back again. If no response to the second letter is received, the parcels are allowed to be offered in the next sale.

If responses are received, BLM cultural resources staff will discuss the information or issues of concern with the Native American representative to determine if all or portions of a parcel need to be withdrawn from the sale, or if stipulations need to be attached as lease stipulations. Native American consultation letters were sent out for the July 2014 Lease Sale.

In Section 1835 of the Energy Policy Act of 2005 (43 U.S.C. 15801), Congress directed the Secretary of the Interior to review current policies and practices with respect to management of federal subsurface oil and gas development activities and their effects on the privately owned surface. The Split Estate Report, submitted in December 2006, documents the findings from consultation on the split estate issue with affected private surface owners, the oil and gas industry, and other interested parties.

In 2007, the Legislature of the State of New Mexico passed the Surface Owners Protection Act. This Act requires operators to provide notice to the surface owner, at least five business days prior to initial entry upon the land for activities that do not disturb the surface; and provide notice at least 30 days prior to conducting actual oil and gas operations. At the New Mexico Federal Competitive Oil and Gas Lease Sale conducted on October 17, 2007, the BLM announced the implementation of this policy. Included in this policy is the implementation of a Notice to Lessees (NTL), a requirement of lessees and operators of onshore federal oil and gas leases within the State of New Mexico to provide the BLM with the names and addresses of the surface owners of those lands where the Federal Government is not the surface owner, not including lands where another federal agency manages the surface.

The BLM NMSO would then contact the surface owners and notify them of the expression of interest and the date the oil and gas rights would be offered for competitive bidding. The BLM would provide the surface owners with its website address so they may obtain additional information related to the oil and gas leasing process, the imposition of any stipulations on that lease parcel, federal and state regulations, and best management practices (BMPs). The surface owners may elect to protest the leasing of the minerals underlying their surface.

If the BLM receives a protest, the parcel would remain on the lease sale; however, the BLM would resolve any protest prior to issuing an oil and gas lease for that parcel. If the protest is upheld, the BLM would return the payments received from the successful bidder for that parcel. After the lease sale has occurred, the BLM would post the results on its website and the surface owner may access the website to learn the results of the lease sale.

1.4 Identification of Issues

An initial internal review of the Proposed Action was conducted by an interdisciplinary team (IDT) of RFO resource specialists on December 11, 2013 to identify and consider potentially affected resources and associated issues. During the meeting, and in later discussions, the IDT addressed stipulations needed to protect resources.

The ID Team identified the following issues that may be impacted by the proposed action:

How will the proposed action impact air quality?
How will the proposed action impact greenhouse gas emissions and climate change?
How will the proposed action impact cultural resources and Native American religious concerns?
How will the proposed action impact paleontological resources?
How will the proposed action impact water quality and quantity, and watershed hydrology?
How will the proposed action impact soil resources and topography?
How will the proposed action impact vegetation communities?
How will the proposed action impact the spread of noxious and invasive weeds?
How will the proposed action impact special status species?
How will the proposed action impact wildlife?
How will the proposed action impact livestock grazing?
How will the proposed action impact visual resources?
How will the proposed action impact recreation?
How will the proposed action impact cave and karst resources?
How will the proposed action impact socioeconomics and environmental justice?
How will the proposed action impact rights-of-way?
How will the proposed action impact Land with Wilderness Characteristics?

The parcels included in the Proposed Action, along with the appropriate stipulations from the RMP, were posted online for a two-week public scoping period beginning December 30, 2013 at this website: http://www.blm.gov/nm/st/en/prog/energy/oil_and_gas/oil_and_gas_lease.html

CHAPTER 2: PROPOSED ACTIONS AND ALTERNATIVES

2.0 Alternatives Including the Proposed Action

2.1 Alternative A - No Action

The BLM NEPA Handbook (H-1790-1) states that for EAs on externally initiated proposed actions, the No Action Alternative generally means that the proposed action would not take place. In the case of a lease sale, this would mean that an expression of interest to lease (parcel nomination) would be deferred, and the parcel(s) would not be offered for lease during the January 2014 Competitive Oil and Gas Lease Sale.

Surface management would remain the same and ongoing oil and gas development would continue on surrounding federal, private, and state leases. Selection of the No Action Alternative would not preclude these parcels from being nominated and considered in a future lease sale.

2.2 Alternative B – Proposed Action

The Proposed Action is to lease twelve (12) parcels of federal minerals nominated by the public, covering 6,520.36 acres administered by the RFO in Chaves County, for exploration and development. Four (4) parcels were nominated for lease but were eliminated from analysis under the Proposed Action. The rationale for not leasing these parcels is described in Section 2.4, Alternatives Eliminated from Detailed Analysis.

Standard terms and conditions as well as stipulations (as required by Title 43 CFR 3101.1-3) listed in the RMP and RMPA would apply as appropriate to the oil and gas leases being offered. In addition, site specific mitigation measures and Best Management Practices would be attached as Conditions of Approval (COAs) for each proposed exploration and development activity authorized on a lease. A complete description of the parcels, including any stipulations, is provided in Appendix 1 and the table below. The parcels contain a special cultural resources lease notice stating all development activities proposed under the authority of these leases are subject to compliance with Section 106 of the NHPA and Executive Order (EO) 13007.

Once sold, the lease purchaser would have the exclusive right to use as much of the leased lands as would be necessary to explore and drill for all of the oil and gas within the lease boundaries, subject to: stipulations attached to the lease; restrictions deriving from specific, nondiscretionary statutes; and such reasonable measures as may be required by the authorized officer to minimize adverse impacts to other resource values, land uses or users not addressed in the lease stipulations at the time operations are proposed (43 CFR 3101).

Oil and gas leases are issued for a ten (10)-year period and continue for as long thereafter as oil or gas is produced in paying quantities. If a lease holder fails to produce oil and gas, does not make annual rental payments, does not comply with the terms and conditions of the lease, or relinquishes the lease, exclusive right to develop the leasehold reverts back to the federal government and the lease can be re-offered in another sale.

Drilling of wells on a lease would not be permitted until the lease owner or operator meets the site specific requirements specified in 43 CFR 3162. A permit to drill would not be authorized until site-specific NEPA analysis is conducted.

The following parcels are recommended for leasing with the following stipulations as presented below to address site specific concerns or new information not identified in the land use planning process:

	PROPOSED ACTION	
Parcel	Stipulations	Acres
NM-201407-005 (Parcels 3, 4 and 5 were combined into Parcel 5)	Lease with the following Stipulations	
T. 0080N, R. 0240E NMPM Section 024, SWNE, Section 022, SWSE, Section 023, NWSE, Guadalupe County	SENM-S-48-CSU Paleontology SENM-S-18 Streams, Rivers and Floodplains - Section 022, SWSE, Section 023, NWSE; SENM-S-20 Springs, Seeps and Tanks - Section 023, NWSE; SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice	120.00
NM-201407-016	Lease with the following Stipulations	
T. 0140S, R. 0270E NMPM Section 035, N2, Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area - All SENM-S-21 Controlled Surface Use Caves And Karst – All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice	320.00
NM-201407-017	Lease with the following Stipulations	
T. 0140S, R. 0280E, NMPM Section 021, N2, NESW, SE; Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area – All SENM-S-19 Playas and Alkali Lakes – Section 021, SWNE, NWSE; SENM-S-21 Controlled Surface Use Caves And Karst – All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice	520.00
NM-201407-018	Lease with the following Stipulations	
T. 0150S, R. 0280E NMPM Section 003, SW; Section 004, Lots 1-4; Section 004, SENE, SWNW, SW, W2SE, SESE; Section 009, N2NE, NW. Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area – All SENM-S-19 Playas and Alkali Lakes – Section 03, E2SW; Section 04, NESW; Section 09, NWNE, NENW; SENM-S-21 Controlled Surface Use Caves And Karst – All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice	920.36
NM-201407-019	Lease with the following stipulations	
T. 0150S R. 0280E NMPM Section 010, SENE, NWNE, NW Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area - All SENM-S-21 Controlled Surface Use Caves And Karst – All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice	240.00
NM-201407-020	Lease with the following Stipulations	
T. 0150S, R 0280E NMPM Section 010 S2S2; Section 015, All. Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area - All SENM-S-21 Controlled Surface Use Caves And Karst – All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice	800.00
NM-201407-021	Lease with the following Stipulations	
T. 0150S, R 0280E NMPM Section 026, NW; Section 027, N2NE, W2, SE. Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area – All SENM-S-19 Playas and Alkali Lakes – Section 27, NWNE, NENW, N2SE; SENM-S-21 Controlled Surface Use Caves And Karst - All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice	720.00
NM-201407-022	Lease with the following Stipulations	
T. 0140S, R 0290E NMPM Section 022, NE, NENW, S2NW, S2; Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area – All SENM-S-19 Playas and Alkali Lakes – Section 22, SENE;	600.00

	SENM-S-21 Controlled Surface Use Caves And Karst – All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice SENM-39- Plan of Development (POD) Required	
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NM-201407-056	Lease with the following Stipulations	
T. 0140S, R 0290E NMPM Section 027, All, Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area - All SENM-S-21 Controlled Surface Use Caves And Karst – All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice SENM-39 -Plan of Development (POD) Required	640.00

NM-201407-055	Lease with the following Stipulations	
T. 0140S, R. 0280E, NMPM Section 22, All; Section 027, NE, N2NW, SENW, N2SE Chaves County	SENM-LN-1 Lease Notice - Potential Cave or Karst Occurrence Area – All SENM-S-19 Playas and Alkali Lakes – Section 22, NENE; SENM-S-21 Controlled Surface Use Caves And Karst – All SENM-S-25 Visual Resource Management NM-11 LN Special Cultural Resource Lease Notice	1,000.00

<u>NM-201407-032</u>	Deferred	
T. 0060S, R. 0330E NMPM Section 014, SW; Section 023, NW County	Roosevelt Parcel 32 occurs within occupied lesser prairie-chicken habitat and within Category 1 of the Crucial Habitat Assessment Tool (CHAT). The BLM will defer a decision to lease this tract pending the decision from the US Fish and Wildlife Service (USFWS) regarding the status of the species as threatened under the Endangered Species Act in order to avoid possible future resource conflicts. BLM will review this deferment after the USFWS has issued their decision. Parcel has active LPC leks.	320.00
<u>NM-201407-033</u>	Deferred	
T. 0060S, R 0330E, NMPM Section 022, S2; Roosevelt County	Parcel 33 occurs within occupied lesser prairie-chicken habitat and within Category 1 of the Crucial Habitat Assessment Tool (CHAT). The BLM will defer a decision to lease this tract pending the decision from the US Fish and Wildlife Service (USFWS) regarding the status of the species as threatened under the Endangered Species Act in order to avoid possible future resource conflicts. BLM will review this deferment after the USFWS has issued their decision. Parcel has active LPC leks.	320.00

Total Acres 6,520.36

2.3 Alternative C – Preferred Alternative

The Preferred Alternative is to lease ten (10) parcels as nominated of federal minerals with lease stipulations and notices. The ten (10) nominated parcels total 5,880.36 acres. The Preferred Alternative is in conformance with the 1997 Roswell RMP and Amendments.

Four (4) parcels were nominated for lease but were eliminated from analysis under the Proposed Action. The rationale for not leasing these parcels is described in Section 2.4, Alternatives Eliminated from Detailed Analysis. In addition to the four (4) parcels not analyzed, the BLM would defer two (2) parcels covering 640 acres administered by the RFO. Below is the rationale for deferring these two (2) parcels:

Parcels -032, -033, are located within occupied lesser prairie-chicken habitat and Category 1 of the Crucial Habitat Assessment Tool (CHAT). In order to avoid

possible future resource conflicts, the BLM will defer a decision to lease this tract pending the decision from the US Fish and Wildlife Service (USFWS) regarding the status of the species as threatened under the Endangered Species Act. BLM will review this deferment after the USFWS has issued their decision. Parcel has active LPC leks.

A complete description of the parcels, including any stipulations, is provided in Appendix 1 and the table below. Standard terms and conditions as well as stipulations would apply. Lease stipulations (as required by Title 43 CFR 3101.3) would be added to the ten (10) parcels to address site specific concerns.

Other than differences noted here, the preferred alternative is the same as the proposed alternative.

2.3 Reasonably Foreseeable Development under Alternatives B and C

At the leasing stage, it is uncertain if Applications for Permit to Drill on leased parcels would be received, nor is it known if or to what extent development would occur. Such development may include constructing a well pad and access road, drilling a well using a conventional pit system or closed-loop system, hydraulically fracturing the well, installing pipelines and/or hauling produced fluids, regularly monitoring the well, and completing work-over tasks throughout the life of the well. In Roswell, typically all of these actions are undertaken during development of an oil or gas well; it is reasonably foreseeable that they may occur on leased parcels. See Appendix 2 for a complete description of the phases of oil and gas development.

Drilling of wells on a lease would not be permitted until the lease owner or operator secures approval of a drilling permit and a surface use plan as specified under Onshore Oil and Gas Orders (43 CFR 3162). A permit to drill would not be authorized until site-specific NEPA analysis is conducted.

Standard terms and conditions, stipulations listed in the Carlsbad RMP, and any new stipulations would apply as appropriate to each lease. In addition, site specific mitigation measures and BMPs would be attached as Conditions of Approval (COAs) for each proposed exploration and development activity authorized on a lease.

2.4 Alternatives Considered but Eliminated from Detailed Analysis

This alternative contains parcels eliminated from detailed analysis because leasing these parcels will not be in conformance with the current land use plans. Therefore the leasing of these parcels will not be carried through the remainder of this environmental assessment. The table below identifies these nominated parcels and describes why these parcels were not carried forward into the proposed action. In the case of the 6 parcels that are being eliminated from detailed analysis, the reason is associated with Core Management Areas and occupied and suitable habitat within the Primary Population Area for the lesser prairie-chicken.

PARCEL	COMMENTS	ACRES

<u>NM-201407-034</u>	Deleted	
T. 0070S, R 0330E NMPM Section 13, W2NE.	No new leasing is allowed in the Core Management Area and occupied or suitable lesser prairie-chicken habitat within the Primary Population Area. This parcel is within the Primary Population Area and is considered occupied lesser prairie-chicken habitat.	80.00
<u>NM-201407-052</u>	Deleted	
T. 0080S, R 0360E NMPM Section 026, W2; Section 027, NE; Section 034, N2; Section 035, All.	No new leasing is allowed in the Core Management Area and occupied or suitable lesser prairie-chicken habitat within the Primary Population Area. This parcel is within the Primary Population Area and is considered occupied lesser prairie-chicken habitat.	1440.00
<u>NM-201407-053</u>	Deleted	
T. 0080S, R. 0370E NMPM Section 033, NW, W2SW.	No new leasing is allowed in the Core Management Area and occupied or suitable lesser prairie-chicken habitat within the Primary Population Area. This parcel is within the Primary Population Area and is considered occupied lesser prairie-chicken habitat.	240.00
<u>NM-201407-054</u>	Deleted	
T. 0080S, R 0370E NMPM Section 033, SE, Section 034, SW.	No new leasing is allowed in the Core Management Area and occupied or suitable lesser prairie-chicken habitat within the Primary Population Area. This parcel is within the Primary Population Area and is considered occupied lesser prairie-chicken habitat.	320.00
	Total Acreage removed	2,080.00

CHAPTER 3: AFFECTED ENVIRONMENT

3.0 Introduction

This section describes the environment that would be affected by implementation of the alternatives described in Section 2. Elements of the affected environment described in this section focus on the relevant resources and issues. Only those elements of the affected environment that have potential to be significantly impacted are described in detail.

3.1 Air Resources

Air quality and climate are components of air resources which may be affected by BLM applications, activities, and resource management. Therefore, the BLM must consider and analyze the potential effects of BLM and BLM-authorized activities on air resources as part of the planning and decision making process. Much of the information referenced in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development

in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as Air Resources Technical Report, USDI BLM 2013). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

3.1.1 Air Quality

The state of New Mexico has divided the state into 12 air quality regions. The Roswell Field Office planning area lies in region 155 (New Mexico Environment Department--Air Quality Bureau, 2010). The Pecos-Permian Basin Intrastate Air Quality Control Region 155 (AQCR 155) is composed of Quay, Curry, De Baca, Roosevelt, Chaves, Lea, and Eddy Counties. Generally, it includes the areas known as the Southern High Plains and the Middle Pecos River drainage basin (New Mexico Environment Department--Air Quality Bureau, 2010).

The Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality nationwide, including six “criteria” air pollutants. These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM₁₀ & PM_{2.5}), sulfur dioxide (SO₂) and lead (Pb). EPA has established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The NAAQS are protective of human health and the environment. EPA has approved New Mexico’s State Implementation Plan and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands and within Bernalillo County. The Roswell area attains all national ambient air quality standards.

The area of the analysis is considered a Class II air quality area by the EPA. There are three classifications of areas that attain national ambient air quality standards, Class I, Class II and Class III. Congress established certain national parks and wilderness areas as mandatory Class I areas where only a small amount of air quality degradation is allowed. All other areas of the US are designated as Class II, which allow a moderate amount of air quality degradation. No areas of the US have been designated Class III, which would allow more air quality degradation. The primary sources of air pollution are dust from blowing wind on disturbed or exposed soil, exhaust emissions from motorized equipment, oil and gas development, agriculture, and industrial sources.

Air quality in a given region can be measured by its Air Quality Index value. The air quality index (AQI) is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI<50), moderate (50-100), unhealthy for sensitive groups (100-150), unhealthy (>150), very unhealthy and hazardous. The AQI is a national index, the air quality rating and the associated level of health concern is the same everywhere in the country. The AQI is an important indicator for populations sensitive to air quality changes.

Current Pollution concentrations

AQCR 155 is classified as an attainment area for all criteria pollutants, indicating that the area satisfies all NAAQS. There is no monitoring conducted for lead and carbon monoxide in southeastern New Mexico; however concentrations of these pollutants are expected to be low in rural areas and are therefore not monitored. The New Mexico Environment Department discontinued monitoring for SO₂ in Eddy County due to very low monitored concentrations. Monitoring data for PM₁₀ and PM_{2.5} in southeastern New Mexico are not available due to incomplete data collection.

“Design Concentrations” are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2011 design concentrations of criteria pollutants are listed below.

2011 Design Concentrations of Criteria Pollutants in Southeastern NM (EPA, 2012)				
Pollutant	Design Value	Averaging period	NAAQS	NMAAQs
O ₃	0.069 ppm (Lea County)	8-hour	0.075 ppm ¹	
	0.061 ppm (Eddy County)			
NO ₂	6 ppb (Lea County)	Annual	53 ppb	50 ppb
	3 ppb (Eddy County)			
NO ₂	42 ppb	1-hour	100 ppb ²	
¹ Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years				
² 98 th percentile, averaged over 3 years				

Mean AQI values for the Roswell area were generally in the good range (AQI<50) in 2011. In Chaves County, 95% of the days in 2011 were classified as “good”. The median AQI in Chaves County was 20 or “good” and the maximum AQI was 71 or “moderate” during 2011. In the past decade, there was only 1 day in 2003 that reached the level of “unhealthy for sensitive groups” (EPA, 2012a).

Hazardous Air Pollutants

The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (USDI/BLM, 2013). The EPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities. USEPA has identified 187 toxic air pollutants as HAPs.

3.1.2 Climate

The planning area is located in an arid to semiarid continental climate regime typified by mild winters, windy conditions, limited rainfall, and hot summers (1994 Roswell Draft RMP EIS). The following table summarizes components of climate that could affect air quality in the region.

Climate	
Climate Component	Temperature
Mean maximum summer temperatures	92°F
Mean minimum winter temperatures	28°F
Mean annual temperature	62°F
Mean annual precipitation	12.5 inches
Mean annual snowfall	8.6 inches
Mean annual wind speed	12 mile per hour (mph)
Prevailing wind direction	West

In addition to the air quality information 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.

Greenhouse gases that are included in the US Greenhouse Gas Inventory are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). CO₂ and methane (CH₄) are typically emitted from combustion activities or are directly emitted into the atmosphere. On-going scientific research has identified the potential impacts of greenhouse gas emissions (including CO₂; CH₄; nitrous oxide (N₂O), and several trace gasses) on global climate. Through complex interactions on regional and global scales, these greenhouse gas emissions cause a net warming effect of the atmosphere (which makes surface temperatures suitable for life on Earth), primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although greenhouse gas levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO₂ concentrations to increase dramatically, and are likely to contribute to overall climatic changes. Increasing CO₂ concentrations may also lead to preferential fertilization and growth of specific plant species.

In 2007, 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 lease parcels and subsequent actions of oil and gas development.

Mean annual temperatures have risen across New Mexico and the southwestern U.S. since the early 20th century. When compared to baseline information, periods between 1991 and 2005 show temperature increases in over 95% of the geographical area of New Mexico. Warming is greatest in the northwestern, central, and southwestern parts of the state. Recurrent research has indicated that predicting the future effects of climate change and subsequent challenges of managing resources in the Southwest is not feasible at this time (IPCC, 2007, CCSP, 2008). However, it has been noted that forests at higher elevations in New Mexico, for example, have been exposed to warmer and drier conditions over a ten year period. Should the trend continue, the habitats and identified drought sensitive species in these forested areas and higher elevations may also be affected by climate change (Enquist and Gori, 2008).

A number of activities contribute to the phenomenon of climate change, including emissions of GHGs (especially carbon dioxide and methane) from fossil fuel development, large wildfires, activities using combustion engines, changes to the natural carbon cycle, and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs will have a sustained climatic impact over different temporal scales due to their differences in global warming potential (described above) and lifespans in the atmosphere.

3.2 Heritage Resources

3.2.1 Cultural Resources

Once the decision is made by the lessee to develop a lease, area specific cultural records review would be done to determine if there is a need for a cultural inventory of the areas that could be affected by the subsequent surface disturbing activities. Generally, a cultural inventory will be required and all historic and archeological sites that are eligible for listing in the National Register of Historic Places or potentially eligible to be listed would be either avoided by the undertaking or have the information in the sites extracted through archeological data recovery prior to surface disturbance.

The project falls within the Southeastern New Mexico Archaeological Region. This region contains the following cultural/temporal periods: Paleoindian (ca. 12,000 - 8,999 B.C.), Archaic (ca. 8000 B.C. – A.D. 950), Ceramic (ca. A.D. 600 – 1540), Protohistoric and Spanish Colonial (ca. A.D. 1400 – 1821), and Mexican and American Historical (ca. A.D. 1822 – early 20th century). Sites representing any or all of these periods are known to occur within the region. A more complete discussion can be found in *Living on the Land: 11,000 Years of Human Adaptation in Southeastern New Mexico, An Overview of Cultural Resources in the Roswell District*, Bureau of Land Management, published in 1989 by the U.S. Department of the Interior, Bureau of Land Management. A cultural resource inventory shall be conducted of the affected area for the proposed project prior to any ground disturbing activities.

3.2.2 Native American Religious Concerns

Traditional Cultural Prosperities (TCPs) is a term that has emerged in historic preservation management and the consideration of Native American religious concerns. TCPs are places

that have cultural values that transcend, for instance, the values of scientific importance that are normally ascribed to cultural resources such as archaeological sites.

Native American communities are most likely to identify TCPs, although TCPs are not restricted to those associations. Some TCPs are well known, while others may only be known to a small group of traditional practitioners, or otherwise only vaguely known. A review of existing information indicates the proposed actions are outside any known TCP.

3.2.3 Paleontological Resources

Parcels proposed for the July 2014 lease sale may contain vertebrate fossils and the same cultural reviews would apply for the Paleontology Resources. The BLM uses the Potential Fossil Yield Classification (PFYC) system to identify areas with a high potential to produce significant fossil resource (IM 2008-009). Five PFYC classes were developed, ranging from PFYC 1 to PFYC 5; Class 1 has very low potential for containing fossils while Class 5 has very high potential. Lease sale Parcel 5 is designated as Class 4, a paleontological survey will be required before any surface disturbing activities are authorized. All other parcels included on the July 2014 oil and gas lease sale are designated as Class 2 PFYC. Ground disturbing activities will not require mitigation except in rare circumstances.

3.3 Water Resources

3.3.1 Water Quality – Surface/Ground

Surface water within the area is affected by geology, precipitation, and water erosion. Being in a semi arid climate rainfall is approximately 12 inches per year. Factors that currently affect surface water resources include livestock grazing management, oil and gas development, recreational use and brush control treatments. No perennial surface water is found on public land in the proposed lease areas. Intermittent streams and rivers are located within the area of the proposed lease sale. Ephemeral surface water within the area may be located in tributaries, playas, alkali lakes and stock tanks.

Useable groundwater for stock has been reported in the Quaternary Alluvium in the area of the northern parcels. In the area of the southern parcels useable water occurs in the Quaternary alluvium and the Artesia Group. Generally useable water occurs above 200 ft. in both areas. Below the Rustler top within a few tens of feet, salt stringers commonly occur precluding any useable water below 200 ft. In some instances it may be necessary to drill to 650 ft. in order to keep severe lost circulation intervals behind casing. Although there are no water wells for livestock use located within the nominated parcels, there are a few wells used for livestock located near several of the parcels.

The proposed parcels are located within the Fort Sumner declared underground water basin and the Roswell declared underground water basin, according to the New Mexico Office of the State Engineer. However there are no named aquifers in either area. The aquifers in these areas are limited both in the vertical and lateral extent.

According to New Mexico Environment Department data, there are no drinking water sources within 10 miles of the proposed parcels.

3.3.2 Watershed - Hydrology

The watershed and hydrology in the area is affected by land and water use practices. The degree to which hydrologic processes are affected by land and water use depends on the location, extent, timing and the type of activity. Factors that currently cause short-lived alterations to the hydrologic regime in the area include livestock grazing management, recreational use activities, groundwater pumping and also oil and gas developments such as well pads, permanent roads, temporary roads, pipelines, and power lines. The parcels are located in the Pecos watershed.

3.4 Soil

The Soil Conservation Service, now the Natural Resource Conservation Service (NRCS), has surveyed the soils in Chaves County. Complete soil information is available in the Soil Survey of Chaves County, New Mexico, Southern Part (USDA Soil Conservation Service 1980) and online at <http://websoilsurvey.nrcs.usda.gov/app/>. The soil map units represented in the project area are:

Berino-Pintura complex, 0 to 15 percent slopes (Bf) Runoff of the Berino soil is very slow and the hazard of water erosion is slight and the hazard of soil blowing is moderate. Runoff of the Cacique soil is slow and the hazard of water erosion is slight and the hazard of soil blowing is moderate.

Holloman-Gypsum-land complex, 30 to 50 percent slopes (HSE) Runoff is rapid and the hazard of water erosion is severe and the hazard of soil blowing are moderate.

Holloman-Gypsum land complex, 3 to 5 percent slopes (HrC) The gently sloping Holloman soils are in depressions. The undulating Gypsum land is on small very low knolls. Runoff of the Holloman unit soil is medium and the hazard of water erosion and soil blowing are moderate. Runoff is rapid, the hazard of water erosion is moderate, and the hazard of soil blowing is severe for the Gypsum land.

Pajarito loamy fine sand, 0 to 5 percent slopes (Pa) Runoff is medium or slow and the hazard of water erosion is moderate and soil blowing is severe.

Pajarito-Pintura complex, 1 to 15 percent slopes (Pb) Runoff is medium to slow and the hazard of water erosion is moderate and soil blowing is severe.

Simona fine sandy loam, 0 to 5 percent slopes (Sm) Runoff of the Berino soil is very slow and the hazard of water erosion is slight and the hazard of soil blowing is severe.

Sotim fine sandy loam, 0 to 3 percent slopes (So) Runoff of the soil is medium and the hazard of water erosion and the hazard of soil blowing is moderate.

Tencee gravelly loam, 1 to 9 percent slopes (Te) Runoff of the unit soil is medium and the hazard of water erosion is moderate and the hazard of soil blowing is slight.

Torriorthents, Very Steep, 30 to 80 percent slopes (TOF) Runoff is very rapid. The hazard of water erosion is severe.

Tencee-Sotim association, 0 to 9 percent slopes (TS) The hazard of water erosion is moderate and the hazard of soil blowing is slight for Tencee soils. The hazards of water erosion and soil blowing are moderate for Sotim soils. Runoff is medium.

Reeves Holloman association, 0 to 5 percent slopes (RI) Runoff is medium and the hazard of water erosion and soil blowing are moderate.

The Soil Survey of Guadalupe County, New Mexico, (USDA Soil Conservation Service 1973) was used to describe and analyze impacts to soil from the proposed action. Complete soil information is available in the Soil Survey of Guadalupe County, New Mexico, (USDA Soil Conservation Service 1973) and online at <http://websoilsurvey.nrcs.usda.gov/app/>. The soil map units represented in the project area are:

Montoya-San Jon –Hassell (2): Dominant slope range is 0 to 10 percent slopes. The permeability of these soils is very slow to slow. The soils range from shallow to deep and are forming dominantly in material weathered from red bed formations. Erosion and gully erosion is a problem on these soils where there is a concentration of surface runoff.

Redona-Bascom association (12): Dominant slope range is 0 to 10 percent slopes. The permeability of these soils is slow, moderate, to moderate to rapid. These soils range from shallow to deep.

3.4.1 General Topography/Surface Geology

All the proposed lease sale parcels are within the Great Plains physiographic province of the United States. Some of the larger subdivisions in this area are the Pecos Slope or Pecos section, the Mescalero Pediment, the Llano Estacado, and the Canadian River section. Various buttes, mesas, and lowlands representing further subdivisions are scattered about these features.

The Pecos Slope lies west of the Pecos River and it includes all the area between the central mountain region and the Pecos River extending from Roswell north to the Glorieta Mesa. It is primarily a bedrock surface (erosional) with scattered relatively thin residual deposits of granular materials and local, rather flat topped constructional surfaces. The most prominent of these constructional surfaces are located at Yeso; at Ramon southeast of Vaughn; and west of Santa Rosa, northwest of the junction of U.S. 84 and I-40. Relatively thin sheets of caliche cover much of the bedrock surface.

The Mescalero Pediment lies east of the Pecos River and represents the area between the Pecos River and the Llano Estacado. It extends from Santa Rosa southeasterly to the border of Texas

and New Mexico. It is characterized by an evaporate on redbed surface with local shallow bolson deposits, windblown sand, and local caliche crusts.

The Llano Estacado in New Mexico extends from the Canadian River section or watershed on the north, southerly to the southeast corner of the state and from the Mescalero Pediment or Pecos River watershed on the west, easterly to the Texas, New Mexico border. In New Mexico the Llano is bordered on the north and west by a rather abrupt escarpment which is prominent at Ragland, Quay County, on the north. Regionally the Llano resembles a plateau with an easterly dipping, rather featureless surface. It is a huge constructional apron that formed during late Tertiary time and once extended from the central mountain region in New Mexico far into Texas. Pecos River dissection divided it from the central mountain piedmont during the Quaternary Period. Sand, gravel, silt, and clay of the Ogallala Formation are the primary materials of the Llano but these materials have a relatively thick soil cover and several cycles of soil genesis are apparent across this plain.

The Canadian River section lies in the northeast part of central-eastern New Mexico. It is limited on the south by the Llano Estacado and on the north by the central High Plains. It begins on the west at the drainage divide of the Pecos and Canadian watershed and extends easterly beyond the Texas- New Mexico border. This section is primarily an erosional surface cut on Jurassic and Triassic rocks with a thin soil cover and scattered caliche crusts. Near San Jon a relatively large deposit of aeolian sand covers this surface. Scattered buttes and mesas are common throughout the Canadian River section.

3.5 Vegetation

The parcels indicate portions of the following Plant Communities; the Grassland Community with Ecological Sites- Sandy SD-3 and Loamy SD-3; and the Mixed Desert Shrub Community with Shallow SD-3. The description for these ecological sites was developed by the Soil Conservation Service (now referred to as the Natural Resource Conservation Service) in their ecological site guides. Ecological site descriptions are available for review at the Roswell BLM office, any Natural Resources Conservation Service office or accessed at www.nm.nrcs.usda.gov.

3.5.1 Vegetative Communities

Lease parcels are within the Grassland, Shinnery Oak Dune or Mixed Desert Shrub vegetative community as identified in the Roswell Resource Management Plan/Environmental Impact Statement (RMP/EIS). Appendix 11 of the RMP/EIS describes the Desired Plant Community (DPC) concept and identifies the components of each community. The primary consideration in listing range sites under this community type is the flat to moderately rolling topography with 75 percent and higher composition of grasses in the description of potential plant community.

Grassland is the climax vegetative aspect for large portions of the resource area. The grassland community type is the most widespread. It can be further subdivided into grass rolling upland, grass hill, grass flat, and mesquite grassland subtypes, depending on topographic relief or seral

stage. In many areas the subtypes may overlap. For the purpose of the RMP, the subtypes are grouped into the grassland community type. Vegetation is primarily dominated by warm season short- and midgrasses. Large areas of grassland climax communities have dropped in successional stage due to misuse and have become a dis-climax mixed shrub community. Of the 1,490,000 Surface acres in the Roswell Field Office, 33% of the vegetation consist of the Grassland Community.

The grass rolling uplands is the predominant shortgrass habitat subtype in the resource area. It is found on broad, nearly level or gently undulating plains to rolling hills at elevations between 3800 feet to 5000 feet. Slopes are 0 to 9 percent. Vegetation is dominated by blue grama, black grama, galleta, tobosa, sideoats grama, dropseeds, muhlys, threeawns, burrograss and fluffgrass.

Woody shrub species are scarce but include mesquite, fourwing saltbush, wolfberry, sumac, and cactus species such as yucca and cholla. Invasions of broom snakeweed, a halfshrub, is common in some areas. Forbs are a minor component of the subtype except following periods of rainfall. Ground cover may be too sparse in much of this subtype to provide the cover requirements of certain small mammals or ground-nesting birds.

Grass hills are found primarily on hills, low mountains, or lower foot slopes of higher mountains. Slopes are rolling to steep and average about 25 percent. Elevations range from 4500 feet to 6000 feet. Short- and mid-grasses dominate this subtype, including hairy grama, fluffgrass, three-awn, and red lovegrass. Shrubs, halfshrubs and cacti include little leaf sumac, beargrass, ocotillo, hedgehog cactus, cholla and broom snakeweed. The structured diversity of the vegetation in this subtype provides more diverse bird nesting habitat than adjacent grasslands. This is the preferred habitat for mule deer, which also use the brushy draws for browse and cover.

The grass flats subtype occurs on nearly level to gently sloping upland plains as broad swales between uplands, or as isolated pockets in shallow depressions, playas, along drainages or in sinks. These areas receive significant runoff from adjacent sites, which produces more dense and taller vegetation. Vegetation is dominated by mid- and tall-grasses with occasional shrubs or half shrubs. The primary grasses are tobosa and galleta, which may occur on large expanses between upland sites, and alkali and giant sacaton, which usually are found along drainages or in depressions. Shrubs sparsely associated with the sacaton type are mesquite and fourwing saltbush. A few scattered yuccas or cholla may be interspersed in the tobosa swales. Forb diversity and abundance is low due to the density of the grass cover.

The mesquite grassland type could best be described as a dis-climax stage in a desert shortgrass climax. The mesquite invasion results from disturbance of natural successional processes. The type is generally located between the grassy plains and the Pecos River, including the breaks adjacent to the floodplain. Terrain is level to gently undulating with slopes generally less than 5 percent, or hummocky with numerous sand dunes scattered throughout the area. The elevation varies from 3,000 feet to 6,000 feet.

Mesquite is found on most soil types, but the main invasion occurs on sandy soils. The predominant shrub is honey mesquite, which has invaded what at one time was a shortgrass dominated type. Few other shrub species are associated with mesquite, although some creosote, yucca and Opuntia occur.

Vegetation is dominated by black grama, blue grama, dropseed, muhly, tobosa and galleta, fluffgrass, and alkali sacaton on undulating terrain, with higher percentages of dropseed, three-awn and muhly on sandy sites. Halfshrubs include sand sage and broom snakeweed. Forbs may be abundant following periods of rainfall.

The primary consideration in listing range sites under this community type is topography influenced by drainages, fans, and mesas with shrubs and halfshrubs comprising from 10 to 35 percent of the potential plant community.

The Shinnery Oak Dune Community's primary consideration in listing range sites under this community type is topography influenced by aeolian and alluvial sedimentation on upland plains forming hummocks, dunes, sand ridges and swales, and the presence of shinnery oak in the description of potential plant community.

This is a unique community type found primarily below the Llano Estacado, or Staked Plains, in an area known as Mescalero Sands. It lies in the southern desert plains ecosystem between the elevations of 4,100 feet and 4,300 feet. The topography is gently sloping and undulating sandy plains, with moderate to very steep hummocky dunes of up to ten feet and more in height scattered throughout the area. Some of the dunes are stabilized with vegetation, while a number of them are unstable and shifting. Dunes blowouts with shinnery oak and bluestem, either isolated or in dune complexes, characteristic of the sand country.

The aspect vegetation is shinnery oak and bluestem. The deep sand community is a unique ecological area dominated by tall and mid grasses in a shortgrass ecosystem. The southern desert plains is characterized by such grasses as black grama, tobosa or galleta, and dropseed, but due to the sandy medium that occurs throughout the shinnery oak community, the dominant grasses are sand bluestem, little bluestem and three awn.

In many areas, the shinnery oak community has shifted from a dominant sand bluestem/little bluestem/hairy grama grassland with varying amounts of shinnery oak, sand sage and yucca. Composition is now dominated by sand dropseed, red and purple three awn and hairy grama, with increasing annual forbs, shinnery oak mesquite, sand sage and yucca.

Approximately 15 percent (74) of the wildlife species in the resource area use this community type. The shinnery oak/dune community provides crucial habitat for the state endangered dune sagebrush lizard and the lesser prairie chicken.

The Mixed Desert Shrub Community occurs from gently sloping, undulating terrain to breaks and escarpments which are rough, broken and dissected by drainages. Elevations range from 2,500 feet to 4,100 feet. This type is found scattered throughout the resource area intermingled with a short- or mid-grass habitat type. Of the 1,490,000 Surface acres in the Roswell Field

Office, 22% of the vegetation consists of the Mixed Desert Shrub Community.

Vegetation in this community is somewhat sparse and is comprised of desert grasses, shrubs and cacti. Forbs can become abundant following periods of rainfall. The predominant shrub species include creosote, mesquite, tarbush, saltbush, little leaf sumac, and sage. Common cacti encountered are claret cup, cholla, prickly pear and eagle claw. Forbs include plantain, globe mallow, and buckwheat. Grasses include fluffgrass, sideoats grama, black grama, dropseed and galleta.

3.5.2 Invasive, Non-native Species and Noxious Weeds

Once the decision is made to develop a lease area specific Invasive and Non- native species (Weed) inventory review is done to determine if there is a need for a weed inventory of the areas to be affected by surface disturbing activities. Generally, an Invasive and Non- native species (Weed) inventory would be required. While there are no known populations of invasive or non-native species on the proposed parcel, infestations of noxious weeds can have a disastrous impact on biodiversity and natural ecosystems. Noxious weeds affect native plant species by out-competing native vegetation for light, water and soil nutrients. Noxious weeds cause estimated losses to producers \$2 to \$3 billion annually. These losses are attributed to: (1) Decreased quality of agricultural products due to high levels of competition from noxious weeds; (2) decreased quantity of agricultural products due to noxious weed infestations; and (3) costs to control and/or prevent the noxious weeds.

Furthermore, noxious weeds can negatively affect livestock and dairy producers by making forage either unpalatable or toxic to livestock, thus decreasing livestock productivity and potentially increasing producers' feed and animal health care costs. Increased costs to operators are eventually borne by consumers. Noxious weeds also affect recreational uses, and reduce realty values of both the directly influenced and adjacent properties.

Recent federal legislation has been enacted requiring state and county agencies to implement noxious weed control programs. Monies would be made available for these activities from the federal government, generated from the federal tax base. Therefore, all citizens and taxpayers of the United States are directly affected when noxious weed control prevention is not exercised.

3.6 Special Status Species

3.6.1 Threatened or Endangered Species

Under Section 7 of the Endangered Species Act of 1973 (as amended), the BLM is required to consult with the U.S. Fish and Wildlife Service on any proposed action which may affect Federal listed threatened or endangered species or species proposed for listing. RFO reviewed and determined the proposed action is in compliance with listed species management guidelines outlined in the Biological Opinions Cons. #2-22-96-F-102, Cons. #22420-2006-I-0144, and Cons. #22420-2007-TA-0033. No further consultation with the U.S. Fish and Wildlife Service is required.

3.7.2 Special Status Species

In accordance with BLM Manual 6840, BLM manages certain sensitive species not federally listed as threatened or endangered in order to prevent or reduce the need to list them as threatened or endangered in the future. Included in this category are State listed endangered species and Federal candidate species which receive no special protections under the Endangered Species Act.

3.8 Wildlife

The entire area provides a myriad of habitat types for terrestrial and aquatic wildlife species. The diversity and abundance of wildlife species in the area is due to the presence Grasslands, Mixed Desert Shrub and Shinnery Oak Dunes, a mixture of grassland habitat and mixed desert shrub vegetation, and escarpments which divides the uplands from the Pecos River valley.

Common bird species are mourning dove, mockingbird, white-crowned sparrow, black-throated sparrow, blue grosbeak, northern oriole, western meadowlark, Crissal thrasher, western kingbird, northern flicker, common nighthawk, loggerhead shrike, and roadrunner. Raptors include northern harrier, Swainson hawk, American kestrel, and occasionally golden eagle and ferruginous hawk.

Common mammal species using the area include mule deer, pronghorn, coyote, gray fox, bobcat, striped skunk, porcupine, raccoon, badger, jackrabbit, cottontail, white-footed mouse, deer mouse, grasshopper mouse, kangaroo rat, spotted ground squirrel, and woodrat.

A variety of herptiles also occur in the area such as yellow mud turtle, box turtle, eastern fence lizard, side-blotched lizard, horned lizard, whiptail, hognose snake, coachwhip, gopher snake, rattlesnake, and spadefoot toad.

3.9 Livestock Grazing

The parcels as described in the Preferred Alternative are located within the grazing allotments 65084, 65075 and 62011. These allotments are authorized yearlong grazing with cow/calf herds. A range trend study plot is associated with each of the parcels contained within a grazing allotment. Mitigation is included in reference to any possible impacts to these BLM study areas.

3.10 Visual Resources

The setting represents a winter gray color pattern and in warm months, with foliage, a gray to gray-green color pattern. Wide-area landscape tends to be horizontal in line and flat in form, with a smooth texture. The Proposed Action is in a Class IV area for visual resources management. The objective of Class IV is to: "Provide for management activities which require major modification of the existing landscape character... Every attempt, however, should be made to reduce or eliminate activity impacts through careful location, minimal disturbance, and repeating the basic landscape elements." Visual Resource Management (VRM) on public lands is conducted in accordance with BLM Handbook 8410 and BLM Manual 8411. The nominated lease parcels are located in an area designated Visual Resource

Management (VRM) Class IV. VRM on public lands is conducted in accordance with BLM Handbook 8410 and BLM Manual 8411.

3.11 Recreation

The lease area is primarily used by recreational visitors engaged in hunting, wildlife watching, and camping. Non-recreation visitors include oil and gas industrial workers and ranchers.

3.12 Cave/Karst

Under the Proposed Action parcels to be offered for sale are located in areas of *Low, Medium and High Karst Potential*.

3.13 Socioeconomics and Environmental Justice

Executive Order 12898, issued on 11 February 1994, addresses concerns over disproportionate environmental and human health impacts on minority and low-income populations. The impetus behind environmental justice is to ensure that all communities, including minority, low-income, or federally recognized tribes, live in a safe and healthful environment and the July 2014 oil and Gas Lease Sale will not be out of conformance with this executive order.

3.14 Land with Wilderness Characteristics

An Area may be considered “Land with Wilderness Characteristics” if it has a defined minimum 5,000 contiguous acres of public land managed by one federal agency in which the area is road less, the land is considered to be natural, and it contains outstanding opportunities for recreation or solitude. An analysis was conducted on each parcel and the surrounding area to determine if any parcel met the definition of Land with Wilderness Characteristics.

CHAPTER 4: ENVIRONMENTAL IMPACTS

4.1 Assumptions for Analysis

The act of leasing parcels would, by itself, have not impact any resources in the RFO. All impacts would be linked to as yet undetermined future levels of lease development. If lease parcels were developed, short-term impacts would be stabilized or mitigated within five years; long-term impacts are those that would substantially remain for more than five years. Potential impacts and mitigation measures are described below.

Cumulative impacts include the combined effect of past projects, specific planned projects and other reasonably foreseeable future actions such as other infield wells being located within these leases. Potential cumulative effects may occur should an oil and gas field be discovered if these parcels are drilled and other infield wells are drilled within these leases or if these leases become part of a new unit. All actions, not just oil and gas development may occur in the area, including foreseeable non-federal actions.

4.2 Analysis of the No Action Alternative

Under the No Action Alternative, the proposed parcels would be deferred and not offered for sale. Analysis of the No Action alternative is presented in the following sections. There would be no subsequent impacts from oil and/or gas construction, drilling, and production activities. The No Action Alternative would result in the continuation of the current land and resource uses in the proposed lease areas.

4.2.1 Mineral Resources

There would be no new impacts from oil and gas production on the proposed parcel land. Oil and gas development of federal, state, private, and Indian minerals would continue on the land surrounding the proposed parcels. No additional natural gas or crude oil from the proposed parcels would enter the public markets and no royalties would accrue to the federal or state treasuries. An assumption is that the No Action Alternative (no lease option) would not affect current domestic production of oil and gas. However, this may result in reduced Federal and State royalty income, and the potential for Federal land to be drained by wells on adjacent private or state land. Oil and gas consumption is driven by a variety of complex interacting factors including energy costs, energy efficiency, availability of other energy sources, economics, demography, and weather or climate. If the BLM were to forego leasing and potential development of the proposed parcels, the assumption is that the public's demand for the resource would not be expected to change. Instead, the mineral resource foregone would be replaced in the short- and long-term by other sources that may include a combination of imports, using alternative energy sources (e.g. wind, solar), and other domestic production. This offset in supply would result in a no net gain for oil and gas domestic production.

4.2.2 Environmental Justice

By not leasing the proposed parcels under the No Action Alternative, there may be negative effects on the overall employment opportunities related to the oil and gas and service support industry, as well as a loss of the economic benefits to state and county governments related to royalty payments and severance taxes. However, there would be no increase in activity and noise associated with these proposed leases unless the land is used for other purposes.

4.2.3 All Other Resources

No other resources would be affected under the No Action Alternative, as there would be no surface disturbance that could detrimentally affect these resources. The No Action Alternative would result in the continuation of the current land and resource uses on the parcels. However, the selection of the no action alternative would not preclude these parcels from being nominated and considered in a future lease sale, which would result in impacts as described under the action alternatives.

4.3 Analysis of Action Alternatives

4.3.1 Air Resources

Methodology and assumptions for calculating air pollutant and greenhouse gas emissions are described in the Air Resources Technical Document (USDI BLM, 2013). This document incorporates the sections discussing the modification of calculators developed by the BLM to address emissions for one well. The calculators give an approximation of criteria pollutant, HAP and GHG emissions to be compared to regional and national levels (USDI BLM 2013). Also incorporated into this document are the sections describing the assumptions that the FFO used in developing the inputs for the calculator (USDI BLM 2013).

4.3.1.1 Air Quality

Leasing the subject tracts would have no direct impacts to air quality. Any potential effects to air quality from sale of lease parcels would occur at such time that the leases were developed. Potential impacts of development would include increased air borne soil particles blown from new well pads or roads, exhaust emissions from drilling equipment, compressor engines, vehicles, flares, and dehydration and separation facilities, and volatile organic compounds during drilling or production activities.

The reasonable and foreseeable development scenario developed for the Roswell RMP demonstrated 60 wells would be drilled annually for Federal minerals. However, it is unknown whether the petroleum resources specific to these leases in the Proposed Action are gas or oil or a combination thereof, as well as the actual potential for those resources. In addition, oil wells are on a tighter spacing than gas wells, therefore the specific number of wells that would be drilled as a result of issuing the leases is unknown. Current APD permitting trends within the field office also confirm that these assumptions are still accurate.

Therefore, in order to reasonably quantify emissions associated with well exploration and production activities, certain types of information are needed. Such information includes a combination of activity data such as the types of equipment needed if a well were to be completed successfully (e.g. compressor, separator, dehydrator), the technologies which may be employed by a given company for drilling any new wells, area of disturbance for each type of activity (e.g. roads, pads, electric lines, compressor station), number of days to complete each kind of construction, number of days for each phase of drilling process, type(s), size, number of heavy equipment used for each type of construction (backhoe, dozer, etc.), number of wells of all types (shallow, deep, exploratory, etc.), compression per well (sales, field booster), or average horsepower for each type of compressor. The degree of impact will also vary according to the characteristics of the geologic formations from which production occurs. Since this type of data is unavailable at this time, including scenarios for oil and gas development, it is unreasonable to quantify emissions. What can be said is that exploration and production would contribute to incremental increases in overall air quality emissions associated with oil and gas exploration and production into the atmosphere.

The most significant criteria pollutants emitted by oil and gas development and production are VOCs, particulate matter and NO₂. VOCs and NO_x contribute to the formation of ozone, which is the pollutant of most concern in southeastern New Mexico. The additional NO_x and VOCs emitted from any new oil and gas development on this lease is likely too small to have a

significant effect on the overall ozone levels of the area.

Although the fracking of wells within a lease parcel is hard to predict, it is anticipated that with more wells being drilled, there will be an increase in the amount of wells being fracked and completed. Volatile organic compounds are emitted during the completion of hydraulically fractured wells. There is a higher probability of dust particulates in the atmosphere from the increase in vehicular traffic due to hydraulically fracturing wells (see Appendix 2).

Potential Mitigation: The BLM encourages industry to incorporate and implement BMPs, which are designed to reduce impacts to air quality by reducing emissions, surface disturbances, and dust from field production and operations. Typical measures include: adherence to BLM's NTL 4(a) concerning the venting and flaring of gas on Federal leases; for natural gas emissions that cannot be economically recovered, flare hydrocarbon gases at high temperatures in order to reduce emissions of incomplete combustion; water dirt roads during periods of high use in order to reduce fugitive dust emissions; collocate wells and production facilities to reduce new surface disturbance; implementation of directional drilling and horizontal completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores; require that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored; and perform interim reclamation to re-vegetate areas of the pad not required for production facilities and to reduce the amount of dust from the pads.

In October 2012, USEPA promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds during gas well completions.

4.3.1.2 Climate

The assessment of GHG emissions, their relationship to global climatic patterns, and the resulting impacts is an ongoing scientific process. It is currently not feasible to know with certainty the net impacts from the proposed action on climate—that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. The BLM does not have the ability to associate a BLM action's contribution to climate change with impacts in any particular area. The science to be able to do so is not yet available. The inconsistency in results of scientific models used to predict climate change at the global scale coupled with the lack of scientific models designed to predict climate change on regional or local scales, limits the ability to quantify potential future impacts of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing science. When further information on the impacts to climate change is known, such information would be incorporated into the BLM's planning and NEPA documents as appropriate.

Leasing the subject tracts would have no direct impacts on climate as a result of GHG emissions. There is an assumption, however, that leasing the parcels would lead to some type of development that would have indirect effects on global climate through GHG emissions.

However, those effects on global climate change cannot be determined. (Refer to the cumulative effects section, Chapter 4 for additional information.) It is unknown whether the petroleum resources specific to these leases in the Proposed Action are gas or oil or a combination thereof.

Oil and gas production in New Mexico is concentrated in the northwest corner, the San Juan Basin, and the southeast corner, the Permian Basin. Production in the San Juan Basin is mostly natural gas while production in the Permian Basin is mostly oil. Production statistics developed from EPA and New Mexico Oil Conservation Division for 2010 are shown in the following table for the US, New Mexico and for wells on federal leases in each basin.

In order to estimate the contribution of federal oil and gas leases to greenhouse gases in New Mexico it is assumed that the percentage of total U.S. production is comparable to the percentage of total emissions. Therefore, emissions are estimated based on production starting with total emissions for the United States from EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010* (EPA, 2012b), and applying production percentages to estimate emissions for the Permian Basin. It is understood that this is a rather simplistic technique and assumes similar emissions in basins that may have very different characteristics and operational procedures, which could be reflected in total emissions. This assumption is adequate for this level of analysis due to the unknown factors associated with eventual exploration and development of the leases. However, the emissions estimates derived in this way, while not precise will give some insight into the order of magnitude of emissions from federal oil and gas leases administered by BLM, and allow for comparison with other sources in a broad sense.

2010 Oil and Gas Production				
Location	Oil (bbl)	% U.S. Total	Gas (MMcf)	% U.S. Total
United States	1,999,731,000	100	26,836,353	100
New Mexico	65,380,000	3.27	1,341,475	5.00
Federal leases in New Mexico	31,533,000	1.58	824,665	3.07
Federal leases in San Juan Basin	1,468,000	0.07	630,060	2.35
Federal leases in Permian Basin	30,065,000	1.5	194,065	0.73

The table below shows estimated greenhouse gas emissions for oil and gas field production for the U.S., New Mexico, and federal leases by basin. Because oil and gas leaves the custody and jurisdiction of the BLM after the production phase and before processing or refining, only emissions from the production phase are considered here. It should also be remembered that following EPA protocols, these numbers do not include fossil fuel combustion which would include such things as truck traffic, pumping jack engines, compressor engines and drill rig engines. Nor does it include emissions from power plants that generate the electricity used at well sites and facilities.

The table below also provides an estimate of direct emissions occurring during exploration and production of oil and gas, a small fraction of overall emissions of CO₂e from the life cycle of

oil and gas. For example, acquisition (drilling and development) for petroleum is responsible for only 8% of the total CO₂e emissions, whereas transportation of the petroleum to refineries represents about 10% of the emissions, and final consumption as a transportation fuel represents fully 80% of emissions (U.S.DOE, NETL, 2010).

2010 Oil and Gas Field Production Potential Emissions						
Location	Oil (Metric tons of CO₂e)		Gas (Metric tons of CO₂e)		Total O&G Production (Metric tons CO₂e)	%U.S. Total GHG emissions
	CO₂	CH₄	CO₂	CH₄		
United States	300,000	30,600,000	10,800,000	126,000,000	167,700,000	2.6
New Mexico	9,810	1,000,620	540,000	6,300,000	7,850,430	0.12
Federal leases in New Mexico	4,740	483,480	331,560	3,868,200	4,687,980	0.07
Federal leases in San Juan Basin	210	21,420	253,800	2,961,000	3,236,430	0.05
Federal leases in Permian Basin	4,500	459,000	78,840	919,800	1,462,140	0.03

To estimate the potential emissions from the proposed lease sale, an estimate of emission per well is useful. To establish the exact number of federal wells in the Permian Basin is problematic due to the ongoing development of new wells, the abandonment of unproductive wells, land sales and exchanges, and incomplete or inaccurate data bases. To determine the most transparent and publicly accessible method of estimating the number of active federal wells in the New Mexico portion of the Permian Basin, RFO utilized BLM New Mexico Geographic Information System (GIS) and the New Mexico Conservation Division ONGARD Data Search Page. ONGARD was searched for all active and new wells in New Mexico, then the search was refined to include only Chaves and Roosevelt counties and finished the search by limiting the results to federal wells.

The table below shows estimated total emissions from 2010 Permian Basin federal leases at 3,175,830 metric tons CO₂e. Therefore, the estimate of emission per well is 283.1 metric tons CO₂e annually. In the unlikely event that 10 separate wells (five wells per lease parcel) were drilled on the proposed leases, the maximum emissions resulting from the lease sale would be 2831.5 metric tons CO₂e per year.

Potential Greenhouse Gas Emissions Resulting from Proposed Lease Sale		
Potential Greenhouse Gas Emissions Resulting from Proposed Lease Sale Referenced to Latest Available Estimates from 2010.		
Total U.S. GHG Emissions From All Sources	6,372,900,000 metric tons	100.00 %
Total U.S. GHG Emissions From Oil & Gas Field Production	167,700,000 metric tons	2.6%
Total New Mexico Emissions From Oil & Gas Field Production	7,850,430 metric tons	.12%
Total San Juan Basin Emissions From Oil & Gas Field Production (15,811 wells)	4,384,230 metric tons	.07%
Total Permian Basin Emissions From Oil & Gas Field	3,175,830 metric tons	.05%

Production (11,216 wells)		
Total Potential GHG Emissions From Oil & Gas Field Production at Full Development For Proposed Action (10 Wells)	2831.5 metric tons	0.00004%

Environmental impacts of GHG emissions from oil and gas consumption are not effects of the proposed action as defined by the Council on Environmental Quality, and thus are not required to be analyzed under NEPA. Greenhouse gas emissions from consumption of oil and gas are not direct effects under NEPA because they do not occur at the same time and place as the action. They are also not indirect effects because oil and gas leasing and production would not be a proximate cause of greenhouse gas emissions resulting from consumption.

Potential Mitigation: The EPA’s inventory data describes “Natural Gas Systems” and “Petroleum Systems” as the two major categories of total US sources of GHG gas emissions. The inventory identifies the contributions of natural gas and petroleum systems to total CO₂ and CH₄ emissions (natural gas and petroleum systems do not produce noteworthy amounts of any of the other greenhouse gases). Within the larger category of “Natural Gas Systems”, the EPA identifies emissions occurring during distinct stages of operation, including field production, processing, transmission and storage, and distribution. “Petroleum Systems” sub-activities include production field operations, crude oil transportation and crude oil refining. Within the two categories, the BLM has authority to regulate only those field production operations that are related to oil and gas measurement, and prevention of waste (via leaks, spills and unauthorized flaring and venting).

The EPA data show that improved practices and technology and changing economics have reduced emissions from oil and gas exploration and development (Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006). One of the factors in this improvement is the adoption by industry of the BMPs proposed by the EPA's Natural Gas Energy Star program. The Field Office will work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy. While EPA data shows that methane emissions increased from oil and gas exploration and development from 1990-2010, reductions in methane emissions from oil and gas exploration and development should occur in future years as a result of EPA’s recently finalized oil and gas air emissions regulations.

4.3.2 Heritage Resources

4.3.2.1 Cultural Resources

While the act of leasing a parcel would produce no impacts, subsequent development of the lease could have impacts on archaeological resources. Required archaeological surveys would be conducted upon all subsequent actions that are expected to occur from the lease sale to avoid disturbing cultural resources.

Potential threats to cultural resources from leasing are variable and dependent upon the nature of the cultural resource and the nature of the proposed development. Effects normally include

alterations to the physical integrity of a cultural resource. The greatest potential impact to cultural resources stems from the construction of associated lease related facilities such as pipelines, power lines, roads, and well locations. If a cultural resource is significant for other than its scientific information, effects may also include the introduction of audible, atmospheric, or visual elements that are out of character for the cultural site and diminish the integrity of those criteria that make the site significant.

A potential effect from the proposed action is the increase in human activity or access to the area with the increased potential of unauthorized removal or other alteration to cultural resources in the area. These impacts could include altering or diminishing the elements of a National Register eligible property and diminish an eligible property's National Register eligibility status. Conversely, cultural resource investigations associated with development potentially adds to our understanding of the prehistory/history of the area under investigation and discovery of sites that would otherwise remain undiscovered due to burial or omission during review inventories.

Potential Mitigation: Specific mitigation measures, including, but not limited to, possible site avoidance or excavation and data recovery would have to be determined when site-specific development proposals are received. Provided that Class III cultural resource inventories are conducted as lease development takes place and avoidance measures associated with the preservation of cultural resources are proposed and stipulated during development, there does not appear to be any adverse impacts to cultural resources from leasing. In the event that sites cannot be avoided, mitigating measures will be developed in consultation with Native American tribes that ascribe affiliation or historical relationships to those sites.

4.3.2.2 Native American Religious Concerns

The Proposed Action is not known to physically threaten any TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere or otherwise hinder the performance of traditional ceremonies and rituals pursuant to AIRFA or EO 13007. The Roswell Field Office individually invited nine tribes/bands/nations to consult if they have concerns for these parcels; three provided responses that the parcels do not conflict. There are currently no known remains that fall within the purview of NAGPRA or ARPA that are threatened by leasing. Use of lease notice NM-11-LN will help ensure that new information is incorporated into lease development. Additional consultation may be initiated at the APD stage of development if BLM professional staff determines it is necessary.

Potential Mitigation: No site-specific mitigation measures for Native American Religious Concerns have been recommended at this time for the parcels recommended to proceed for sale. All parcels recommended to proceed to sale will have the Special Cultural Resource Lease Notice NMLN- 11 attached to the lease. In the event that lease development practices are found in the future to have an adverse effect on Native American TCPs, the BLM, in consultation with the affected tribe, would take action to mitigate or negate those effects. Measures include, but are not limited to physical barriers to protect resources, relocation of practices responsible for the adverse effects, or other treatments as appropriate.

To be in conformance with the Native American Graves Protection and Repatriation Act of 1991 (Public Law 101-610), the terms and conditions of the lease should contain the following condition: —In the event that the lease holder discovers or becomes aware of the presence of Native American human remains within the lease, they shall immediately notify the Bureau of Land Management in writing.

4.3.2.3 Paleontological Resources

Surface disturbances associated with oil and gas exploration and development activities have the potential to affect paleontological resources in the areas known to contain or have the potential to contain paleontological resources, primarily the areas identified through the Potential Fossil Yield Classification (PFYC) system. Surface-disturbing activities could potentially alter the characteristics of paleontological resources through damage, fossil destruction, or disturbance of the stratigraphic context in which paleontological resources are located, resulting in the loss of important scientific data. Conversely, surface-disturbing activities could also potentially lead to the discovery of paleontological localities that would otherwise remain undiscovered due to burial or omission during review inventories, providing a better understanding of the nature and distribution of those resources.

Potential Mitigation: A pedestrian survey must be conducted for paleontological material, using a qualified paleontologist as identified in BLM Handbook 8270, and prior to any surface disturbing activity for Parcel 5. A report on the results of the paleontological survey must be submitted and approved by BLM as part of the permit application for the proposed lease activity. The survey and report will be used to determine the presence of paleontological material exposed on the surface, and if necessary, the appropriate treatments such as avoidance and/or project re-design during all phases of the proposed lease activity. Based on the recommendations of the paleontology survey report, monitoring of ground disturbing activities may be required.

For all other parcels in this oil and gas lease sale, the lessee shall immediately notify the BLM Authorized Officer of any paleontological resources discovered as a result of operations under this authorization. The lessee shall suspend all activities in the vicinity of such discovery until notified to proceed by the Authorized Officer and shall protect the discovery from damage or looting. The Authorized Officer will evaluate, or will have evaluated, such discoveries after being notified. Appropriate measures to mitigate adverse effects to significant paleontological resources will be determined by the Authorized Officer after consulting with the operator and the Regional Paleontologist. Upon approval of the Authorized Officer, the operator will be allowed to continue construction through the site, or will be given the choice of either (1) following the Authorized Officer's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the fossil resource, or (2) following the Authorized Officer's instructions for mitigating impacts to the fossil resource prior to continuing construction through the project area.

4.3.3 Water Resources

4.3.3.1 Water Quality: Surface and Groundwater

Direct and Indirect Impacts: While the act of leasing a parcel would produce no impacts, subsequent development of the lease would lead to surface disturbance from the construction of well pads, access roads, pipelines, and power lines can result in degradation of surface water quality and groundwater quality from non-point source pollution, increased soil losses, and increased gully erosion.

Potential direct impacts that would occur due to construction of well pads, access roads, pipelines, and power lines include increased surface water runoff and off-site sedimentation brought about by soil disturbance; increased salt loading and water quality impairment of surface waters; channel morphology changes due to road and pipeline crossings; and possible contamination of surface waters by produced water. The magnitude of these impacts to water resources would depend on the proximity of the disturbance to the drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration and time within which construction activity would occur, and the timely implementation and success or failure of mitigation measures.

Direct impacts would likely be greatest shortly after the start of construction activities and would likely decrease in time due to natural stabilization, and reclamation efforts.

Construction activities would occur over a relatively short period; therefore, the majority of the disturbance would be intense but short lived. Direct impacts to surface water quality would be minor, short-term impacts which may occur during storm flow events.

Groundwater within the area is affected by geomorphology, surface and subsurface geology and precipitation. Usage also affects groundwater resources in the area; livestock grazing management, oil and gas development, groundwater pumping, and possible impacts from brush control treatments. Most of the groundwater in the area is used for industrial, rural, domestic and livestock purposes.

Petroleum products and other chemicals accidentally spilled could result in surface and groundwater contamination. Similarly, possible leaks from sump pits, emergency pits, reserve pits, steel tanks and evaporation pits could degrade surface and ground water quality.

Potential Mitigation: Specific mitigation measures for the protection of surface and ground water will be addressed at the APD level. Mitigation may include the use of a plastic-lined reserve pits, steel tanks or steel tank closed systems, containment berms etc. to reduce or eliminate seepage of drilling fluid and/or HydroFrac flow back water into the soil, surface water and groundwater.

Both surface and usable ground water can be protected from drilling fluids and salt water zones by setting surface casing to isolate the aquifers from the rest of the borehole environment.

4.3.3.2 Watershed - Hydrology

While the act of leasing a parcel would produce no impacts, subsequent development of the lease would result in long term and short term alterations to the hydrologic regime. Peak flow and low flow of perennial streams, ephemeral, and intermittent rivers and streams would be directly affected by an increase in impervious surfaces resulting from the construction of the well pad and road. The potential hydrologic effects to peak flow is reduced infiltration where surface flows can move more quickly to perennial or ephemeral rivers and streams, causing peak flow to occur earlier and to be larger. Increased magnitude and volume of peak flow can cause bank erosion, channel widening, downward incision, and disconnection from the floodplain. The potential hydrologic effects to low flow is reduced surface storage and groundwater recharge, resulting in reduced baseflow to perennial, ephemeral, and intermittent rivers and streams. The direct impact would be that hydrologic processes may be altered where the perennial, ephemeral, and intermittent river and stream system responds by changing physical parameters, such as channel configuration. These changes may in turn impact chemical parameters and ultimately the aquatic ecosystem.

Long term direct and indirect impacts to the watershed and hydrology would continue for the life of wells and would decrease once all well pads and road surfacing material has been removed and reclamation of well pads, access roads, pipelines, and power lines has occurred. Short term direct and indirect impacts to the watershed and hydrology from access roads that are not surfaced with material would occur and would likely decrease in time due to reclamation efforts.

Potential Mitigation: The operator would stockpile the topsoil from the surface of well pads which would be used for interim and final reclamation of the well pads. Reserve pits may be capped, contoured and seeded as required, and described in attached COAs. Upon abandonment of the wells and/or when access roads are no longer in service the Authorized Officer would issue instructions and/or orders for surface reclamation/restoration of the disturbed areas as described in the attached COAs. During the life of the development, all disturbed areas not needed for active support of production operations should undergo “interim” reclamation in order to minimize the environmental impacts of development on other resources and uses. Earthwork for interim and final reclamation must be completed within 6 months of well completion or well plugging (weather permitting). The operator shall submit a Sundry Notices and Reports on Wells (Notice of Intent), Form 3160-5, prior to conducting interim reclamation.

4.3.4 Soil

While the act of leasing a tract would produce no direct impacts, subsequent development of the lease would physically disturb the topsoil and would expose the substratum soil on subsequent project areas. Direct impacts resulting from the oil and gas construction of well pads, access roads, and reserve pits include removal of vegetation, exposure of the soil, mixing of horizons, compaction, loss of top soil productivity and susceptibility to wind and water erosion. Wind erosion would be expected to be a minor contributor to soil erosion with the possible exception of dust from vehicle traffic. These impacts could result in increased indirect impacts such as runoff, erosion and off-site sedimentation. Activities that could cause these

types of indirect impacts include construction and operation of well sites, access roads, gas pipelines and facilities.

Contamination of soil from drilling and production wastes mixed into soil or spilled on the soil surfaces could cause a long-term reduction in site productivity. Some of these impacts can be reduced or avoided through proper design, construction and maintenance and implementation of best management practices.

Additional soil impacts associated with lease development would occur when heavy precipitation causes water erosion damage. When water saturated segment(s) on the access road become impassable, vehicles may still be driven over the road. Consequently, deep tire ruts would develop. Where impassable segments are created from deep rutting, unauthorized driving may occur outside the designated route of access roads.

Potential Mitigation: The operator would stockpile the topsoil from the surface of well pads in shallow rows which would be used for surface reclamation of the well pads. The impact to the soil would be remedied upon reclamation of well pads when the stockpiled soil that was specifically conserved to establish a seed bed is spread over well pads and vegetation re-establishes.

Reserve pits would be re-contoured and reseeded as described in attached COAs. Upon abandonment of wells and/or when access roads are no longer in service the Authorized Officer would issue instructions and/or orders for surface reclamation/restoration of the disturbed areas as described in attached COAs.

During the life of the development, all disturbed areas not needed for active support of production operations should undergo “interim” reclamation in order to minimize the environmental impacts of development on other resources and uses. Earthwork for interim and final reclamation must be completed within 6 months of well completion or well plugging (weather permitting). The operator shall submit a Sundry Notices and Reports on Wells (Notice of Intent), Form 3160-5, prior to conducting interim reclamation.

The use of a plastic-lined reserve pits would reduce or eliminate seepage of drilling fluid into the soil. The use of steel tanks or closed systems would reduce or eliminate seepage of drilling fluid into the soil. Spills or produced fluids (e.g., saltwater, oil, and/or condensate in the event of a breach, overflow, or spill from storage tanks) could result in contamination of the soils onsite or offsite.

Road constructions requirements and regular maintenance would alleviate potential impacts to access roads from water erosion damage. For the purpose of protecting slopes or fragile soils surface disturbance will not be allowed on slopes over 30 percent.

4.3.4.1 General Topography /Surface Geology

The general topography and surface geology of the lease parcels are generally impacted by the construction projects that are permitted as a result of subsequent APD actions.

Direct and Indirect Impacts: The direct impact from a lease sale is that the lands involved could fall within an environmental sensitive area and subsequent lease actions could impact the issues of environmental concern. Split estate is an issue of concern on a lease sale when and if a private surface landowner is not in agreement with the proposed project which could create an environmental sensitive area until the issues are resolved with the surface owner. Indirectly the proposed projects could fall within protected areas that would require changing the spacing requirements of a well by moving the location or road.

Potential Mitigation: The lease sale could have mitigation measures imposed on the proposed subsequent action when and if the concern involves the issuance of such mitigation measures that are deemed necessary to resolve the environmental predicament.

4.3.5 Vegetation

There would be no direct effects to vegetative resources from the sale of the lease parcels. Subsequent exploration/development of the proposed leases would have indirect impact to vegetation and would depend on the vegetation type, the vegetative community composition, soil type, hydrology, and the topography of the parcels. Oil and gas development surface-disturbing activities could affect vegetation by destroying the vegetation, churning soils, loss of substrates for plant growth, impacting biological crusts, disrupting seedbanks, burying individual plants, reduction of germination rates, covering of plants with fugitive dust, and generating sites for undesirable weedy species. In addition, development could reduce available forage or alter livestock distribution leading to overgrazing or other localized excess grazing impacts to palatable plant species. If these impacts occurred after seed germination but prior to seed set, both current and future generations could be affected.

Vegetation would be lost within the construction areas of pads, roads, and rights of ways. Those areas covered in caliche, such as pads and roads, would have no vegetation for the life of the well. Rights-of-ways could re-vegetate in one to two years with proper reclamation and adequate precipitation. Inadequate precipitation over several growing seasons could result in loss of vegetative cover, leading to weed invasion and deterioration of native vegetation.

Impacts to vegetation depend on development. These acres would produce no vegetation, due to caliche covered surfaces with each well in production. These acres should be in adequate vegetative cover in three to five growing seasons, if adequate precipitation is received after following interim or final reclamation.

Potential Mitigation: Mitigation would be addressed at the site-specific APD stage of exploration and development. Needed COAs would be identified and addressed during planning at the APD stage. Mitigation could potentially include re-vegetation with native plant species, soil enhancement practices, direct live haul of soil material for seed bank re-vegetation, reduction of livestock grazing, fencing of reclaimed areas, and the use of seeding strategies consisting of native grasses, forbs, and shrubs.

4.3.6 Invasive Non-native Species, and Noxious Weeds

While the act of leasing Federal minerals produces no impacts, subsequent development produces impacts in the form of surface disturbance. The construction of an access road and well pad may unintentionally contribute to the establishment and spread of noxious weeds. Noxious weed seed could be carried to and from the project areas by construction equipment, the drilling rig and transport vehicles.

The main mechanism for seed dispersion on the road and well pad is by equipment and vehicles that were previously used and or driven across or through noxious weed infested areas. The potential for the dissemination of invasive and noxious weed seed may be elevated by the use of construction equipment typically contracted out to companies that may be from other geographic areas in the region. Washing and decontaminating the equipment prior to transporting onto and exiting the construction areas would minimize this impact.

Based on an estimate of between two (2) and 16 wells could potentially be drilled on a 640 acre lease, and surface disturbance estimated at 9 acres per well, a range of 18 to 144 acres could potentially be directly affected by invasive or non- native species. Due to wind drift or rain flows, additional areas may be impacted by the spread or encroachment of noxious weeds.

Impacts by noxious weeds would be minimized due to requirements for the company to eradicate the weeds upon discovery. Multiple applications may be required to effectively control the identified populations.

Potential Mitigation: In the event noxious weeds are discovered during construction of any access roads and well pads, mitigation would be deferred to the site specific development at the APD stage. Best management practices would be incorporated into the Conditions of Approval of an approved APD.

4.3.7 Special Status Species

There are no known Special Status Species that occur within the preferred alternative. While the act of leasing Federal minerals would produce no direct impacts to special status species (should they occur in the project area), subsequent development of a lease may produce impacts. Impacts could result from increased habitat fragmentation, noise, or other disturbance during development. In addition, special status species may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. These impacts would be limited to the timeframe during which drilling operations associated with hydraulic fracturing occur, typically several weeks (see Appendix 2).

4.3.7.1 Threatened or Endangered Species

There are no known threatened or endangered species that occur within the proposed parcels. While the act of leasing Federal minerals would produce no direct impacts to threatened or endangered species (should they occur in the project area), subsequent development of a lease

may produce impacts. Impacts could result from increased habitat fragmentation, noise, or other disturbance during development. In addition, threatened or endangered species may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. These impacts would be limited to the timeframe during which drilling operations associated with hydraulic fracturing occur, typically several weeks (see Appendix 2).

4.3.7.2 Special Status Species RMPA

Parcels nominated in these areas are reviewed by the State Director for concurrence based on the Record of Decision and Approved Resource Management Plan Amendment of April 2008. The BLM will continue to require oil and gas lessees to conduct operations in a manner that will minimize adverse impacts to wildlife and special status species. To that end, the BLM will continue to apply reasonable measures to all oil and gas activities.

Leasing with requirements for Plans of Development (PODs) to ensure orderly development within a minimum of surface impact in lesser prairie-chicken and dunes sagebrush lizard habitats will be considered on a case-by-case basis, providing impacts from exploration and development will not cause unnecessary or undue impact to efforts to restore habitat. PODs may not be required for every existing lease on the Planning Area, but are required when requested by the BLM.

4.3.8 Wildlife

The types and extent of impacts expected from oil and gas development to wildlife species and habitats vary depending on the activity. Lease development would impact wildlife due to surface disturbance and habitat fragmentation. The magnitude of impacts would depend on the exact location and time of development in relation to the affected wildlife species and habitat. Although reclamation and restoration efforts for surface disturbance could provide for the integrity of other resources, these efforts may not always provide the same habitat values (e.g. structure, composition, cover, etc.) in the short or in some instance, the long-term in complex vegetative community types. The short-term negative impact to wildlife would occur during the construction phase of the operation due to noise and habitat destruction. In addition, wildlife may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. These impacts would be limited to the timeframe during which drilling operations associated with hydraulic fracturing occur, typically several weeks. In addition, wildlife may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. These impacts would be limited to the timeframe during which drilling operations associated with hydraulic fracturing occur, typically several weeks (see Appendix 2). In general, most wildlife species would become habituated to the new facilities. For other wildlife species with a low tolerance to these activities, the operations on the well pad would continue to displace them from the area due to ongoing disturbances such as vehicle traffic, noise and equipment maintenance. The conditions of approval would alleviate most losses of wildlife species, such as; fencing the reserve pits, netting storage tanks, installation or other

modifications of cones on separator stacks, and timing stipulations. The magnitude of above effects would be dependent on the rate and location of the oil and gas development, but populations could likely not recover to pre-disturbance levels until the activity was completed and the vegetative community restored.

Potential Mitigation: Impacts would be analyzed on a site specific basis prior to development. Stipulations and COAs would be applied at the APD level to minimize wildlife impacts

4.3.9 Livestock Grazing

The parcels proposed in this lease sale cover portions of grazing allotment #65075, 65084 and 62011. These allotments are authorized yearlong grazing with cow/calf herds. A range trend study plot is associated with each of the parcels contained within a grazing allotment. Mitigation is included in reference to any possible impacts to these BLM study areas. Oil and gas development could result in a loss of vegetation for livestock grazing (e.g., direct removal, introduction of unpalatable plant species, etc.), decrease the palatability of vegetation due to fugitive dust, disrupt livestock management practices, involve vehicle collisions, and decrease grazing capacity. These impacts could vary from short-term impacts to long-term impacts depending on the type of exploration or development, the success of reclamation, and the type of vegetation removed for the oil and gas activities.

Potential Mitigation: Measures would be taken to prevent, minimize, or mitigate impacts to livestock grazing from exploration and development activities. Prior to authorization, activities would be evaluated on a case-by-case basis, and the project would be subject to mitigation measures. Mitigation could potentially include controlling livestock movement by maintaining fence line integrity, fencing of facilities, re-vegetation of disturbed sites, installation of cattle guards, and fugitive dust control.

4.3.10 Visual Resources

Direct and Indirect Impacts:

Through color manipulation, by painting well facilities to blend with the rolling to flat vegetative and/or landform setting with a gray-green the view is expected to favorably blend with the form, line, color and texture of the existing landscape

Potential Mitigation: The flat color *Oil Green* from the Standard Environmental Colors Chart is to be used on all facilities to closely approximate the vegetation within the setting. All facilities, including the meter building, would be painted this color. If the proposed area is in a scenic corridor, low profile tanks less than eight feet in high may be recommended for the proposed action.

4.3.11 Recreation

While the act of leasing Federal minerals produces no direct impacts, however subsequent development of a lease would generate impacts to recreation activities. Oil and gas development on public lands have negative long term impacts on the visual quality of the natural landscape, semi-primitive recreational opportunities, and the quality of recreational experiences. Also oil and gas development negatively impacts recreational users who desire solitude. However, roads constructed for oil and gas development may improve recreational users' access to public land. In addition, any recreationists in the area may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. These impacts would be limited to the timeframe during which drilling operations associated with hydraulic fracturing occur, typically several weeks (see Appendix 2).

Overall the quality of the recreational experience would likely be diminished by subsequent oil and gas development. This can be measured in terms of acres lost to recreational opportunities. The potential impact of this action and subsequent development may constitute a total maximum loss of 5880.36 acres of recreation opportunity out of 1,504,520 acres managed by the Roswell Field Office. The maximum total number of acres that could be lost to recreational opportunities equals 5880.36 which is equivalent to 0.0039 percent of acres of public land managed by the Roswell Field Office.

Potential Mitigation: None

4.3.12 Cave/Karst

The tracts proposed for leasing are located in a low, medium and high karst potential area. If the lease is in a low karst potential area there may be very little challenges in producing petroleum products from this location. If the proposed lease is in a medium or high karst potential area there could be the potential of adverse impact to known cave entrances or karst features is present within the lease area.

While the act of leasing Federal minerals would produce no direct impacts to cave or karst resources, subsequent development of a lease may produce impacts. Cave and karst features provide direct conduits leading to groundwater. These conduits can quickly transport surface and subsurface contaminants directly into underground water systems and freshwater aquifers without filtration or biodegradation as a result of the development of oil and gas leases. In addition, contaminants spilled or leaked into or onto cave/karst zone surfaces and sub-surfaces may lead directly to the disruption, displacement, or extermination of cave species and critical biological processes. In extreme or rare cases, a buildup of hydrocarbons in cave systems due to surface leaks or spills could potentially cause underground ignitions or asphyxiation of wildlife or humans within the cave.

In cave and karst terrains, rainfall and surface runoff is directly channeled into natural underground water systems and aquifers. Changes in geologic formation integrity, runoff quantity/quality, drainage course, rainfall percolation factors, vegetation, surface contour, and other surface factors can negatively impact cave ecosystems and aquifer recharge processes.

Blasting, heavy vibrations, and focusing of surface drainages can lead to slow subsidence, sudden collapse of subsurface voids, and/or cave ecosystem damage.

The construction of roads, pipelines, well pads and utilities can impact bedrock integrity and reroute, impede, focus, or erode natural surface drainage systems. Increased silting and sedimentation from construction can plug downstream sinkholes, caves, springs, and other components of aquifer recharge systems and result in adverse impacts to aquifer quality and cave environments. Any contaminants released into the environment during or after construction can impact aquifers and cave systems. A possibility exists for slow subsidence or sudden surface collapse during construction operations due to collapse of underlying cave passages and voids. This would cause associated safety hazards to the operator and the potential for increased environmental impact. Subsidence processes can be triggered by blasting, intense vibrations, rerouting of surface drainages, focusing of surface drainage, and general surface disturbance.

Blasting fractures in bedrock can serve as direct conduits for transfer of contaminants into cave and groundwater systems. Blasting also creates an expanded volume of rock rubble that cannot be reclaimed to natural contours, soil condition, or native vegetative condition. As such, surface and subsurface disruptions from blasting procedures can lead to permanent changes in vegetation, rainfall percolation, silting/erosion factors, aquifer recharge, and freshwater quality and can increase the risk of contaminant migration from drilling/production facilities built atop the blast area.

During drilling, previously unknown cave and karst features could be encountered. If a void is encountered while drilling and a loss of circulation occurs, lost drilling fluids can directly contaminate groundwater recharge areas, aquifers, and groundwater quality. Drilling operations can also lead to sudden collapse of underground voids. Cementing operations may plug or alter groundwater flow, potentially reducing the water quantity at springs and water wells. Inadequate subsurface cementing, casing, and cave/aquifer protection measures can lead to the migration of oil, gas, drilling fluids, and produced saltwater into cave systems and freshwater aquifers.

Potential Mitigation: Onsite inspections and site-specific environmental assessment would address physical cave and karst aspects. Any cave or karst feature, such as a deep sinkhole, discovered by the operator or any person working on the operator's behalf, on BLM-managed public land shall be immediately reported to the authorized officer. An evaluation of the discovery will be made by the authorized officer to determine appropriate action(s). Any decision as to the further mitigation measures will be made by the Authorized Officer after consulting with the co-operator/contractor.

4.3.13 Socio-economics and Environmental Justice

No minority or low income populations would be directly affected in the vicinity of the proposed actions from subsequent proposed oil or gas projects. Indirect impacts could include impacts due to overall employment opportunities related to the oil and gas and service support industry in the region, as well as the economic benefits to State and County governments

related to royalty payments and severance taxes. Other impacts could include a small increase in activity and noise disturbance in areas used for grazing, wood gathering or hunting. However, these impacts would apply to all public land users in the project area.

In addition, any nearby residents may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. These impacts would be limited to the timeframe during which drilling operations associated with hydraulic fracturing occur, typically several weeks (see Appendix 2).

Potential Mitigation: None

4.3.14 Land with Wilderness Characteristics

An analysis was conducted to determine if any of the selected lease parcels or surrounding areas met the definition of Land with Wilderness Characteristics. Most parcels still under consideration for this lease did not meet the definition of Land with Wilderness Characteristics. Most parcels did not meet the definition because the parcels are surrounded by state and private land, and there is less than 5,000 acres of contiguous public land managed by the BLM. However, three parcels that are a part of this lease did initially meet the size criteria of a minimum of 5,000 contiguous acres managed by the BLM. These parcels are NM-201407-016 NM-201407-017, and NM201407-021. Next roads that are county roads, or roads that have Rights of Way and are maintained as well as in good standing with the BLM, were factored in as boundaries to the contiguous acres. After an in-depth analysis all the lease sale parcels failed to meet the definition of Land with Wilderness Characteristics. The boundaries listed below diminished the size of the area potentially impacted by the oil and gas lease sale below the 5,000 contiguous acres size criteria.

- NM-201407-016 has boundaries with state land, private land, Highway 249 and the road associate with NM114104 Right of Way.

- NM-201407-017 has boundaries with state land, private land, Highway 249, and oil and gas development roads NM72718 and NM110234.

- NM-201407-021 has boundaries with state land, private land and pipeline roads with Rights of Way NM106742 and NM000416.

With this addition road data, none of the parcels or surrounding areas met the required size criteria of a minimum of 5,000 contiguous acres. Therefore, this proposed action will have no impacts to Land with Wilderness Characteristics.

4.4 Cumulative Impacts

The NMSO manages approximately 41 million acres of Federal mineral estate. Of the 41 million acres, 35 million acres are available for oil and gas leasing. Approximately 16% of the 35 million acres is currently leased (73% of the leases are in production and 63% of the lease

acres are in production). The NMSO received 51 parcel nominations (23,247 acres) for consideration in the July 16, 2014 Oil & Gas Lease Sale, and is proposing to lease 31 (14,963 acres) of the 51 parcels. If these 31 parcels were leased, the percentage of Federal minerals leased would not change. The Carlsbad and Roswell Field Office parcels are analyzed under separate EAs.

Table 5A. Actual - Acres of Federal Minerals/Acres Available/Acres Leased:

State	Federal O&G Mineral Ownership	Acres Available	Acres Leased	Percent Leased
KS	744,000	614,586	125,091	20%
NM	34,774,457	29,751,242	4,839,255	16%
OK	1,998,932	1,668,132	324,072	19%
TX	3,404,298	3,013,207	425,511	14%
Totals/Average	40,921,687	35,058,167	5,713,929	16%

Table 5B. Parcels Nominated & Offered in the July 2014 Oil & Gas Lease Sale:

Field Office	No. of Nominated Parcels	Acres of Nominated Parcels	No. of Parcels to be Offered	Acres of Parcels to be Offered
Carlsbad	35	14,567	21	9,003
Roswell	16	8,680	10	5,960
Totals	51	23,247	31	14,963

Table 5C. Foreseeable - Acres of Federal Minerals/Acres Available/Acres Leased:

State	Federal O&G Mineral Ownership	Acres Available	Acres Leased	Percent Leased
KS	744,000	614,586	125,091	20%
NM	34,774,457	29,751,242	4,854,218	16%
OK	1,998,932	1,668,132	324,072	19%
TX	3,404,298	3,013,207	425,511	14%
Totals/Average	40,921,687	35,067,167	5,728,892	16%

There are about 4,500 wells in the Roswell Field Office. Federal wells are approximately 40 percent (1,800) of this total. Estimates of total surface disturbance for this lease sale action are based on full field development. Full field development assumes development of every spacing unit and has a total complement of roads, pads, power lines, gravel sources and pipelines. Exploration and development of hydrocarbon resources outside of well-developed areas increases the distance required for roads, pipelines, and power lines.

Surface disturbance acreage estimates in the following table, are based on associated oil and gas exploration and development drilling activities as follows:

- Access Roads: 3.0 acres disturbance per access road (14 feet travel way width).
- Drill Pads: 2.1 acres disturbance per average well pad (300 feet x 300 feet).
- Pipelines: 3.6 acres initial disturbance per producing well (30 feet right of way width)
- Power lines: 1.0 acre initial disturbance per producing well
- Total Surface disturbance: 9.7 acres/well.

Analysis of cumulative impacts for reasonably foreseeable development (RFD) of oil and gas wells on public lands in the Roswell Field Office was presented in the 1994 Draft Roswell Resource Management Plan (RMP). The RFD was validated in the 2006 Draft Special Status Species RMP Amendment. Potential development of all available federal minerals in the field office, including those in the proposed lease parcels, was included as part of the analysis.

Due to the variability of oil and gas activities on federal minerals and the lack of available information about how the lease parcels would be developed, it is not possible to accurately quantify potential GHG emissions in the affected areas as a result of making the proposed tracts available for leasing. Some general assumptions however can be made: leasing the proposed tracts may contribute to drilling new wells. (Refer to limitations of projecting actual number of wells as a result of the Proposed Action under direct/indirect effects.)

The New Mexico Greenhouse Gas Inventory and Reference Case Projection 1990-2020 (Inventory) estimates that approximately 17.3 million metric tons of GHGs from the natural gas industry and 2.3 million metric tons of GHGs from the oil industry are projected by 2010 as a result of oil and natural gas production, processing, transmission and distribution. As of 2008, there were 23,196 oil wells and 27,778 gas wells in New Mexico (NM well statistics).¹

An average of 50 wells per year is drilled for Federal minerals within the Roswell Field Office, 22 oil wells and 28 natural gas wells. An average of 22 new oil wells a year represent approximately less than 0.01 percent of the total number of oil wells in the State based on the Inventory above. The average number of 28 new gas wells drilled is also less than 0.01 percent of the total number of gas wells in the State based on Inventory data. Both are indicators of the level of activity in the field office.

The average number of oil and gas wells drilled annually in the Field Office and probable GHG emission levels, when compared to the total GHG emission estimates from the total number of oil and gas wells in the State, represent an incremental contribution to the total regional and global GHG emission levels. This incremental contribution to global GHG gases cannot be translated into effects on climate change globally or in the area of these site-specific actions. As oil and gas and natural gas production emissions control technology continues to improve in the future, one assumption is that it may be feasible to further reduce GHG emissions.

Regarding the linkage between climate change related warming and associated impacts, an assessment of the IPCC states that difficulties remain in attributing observed temperature changes at smaller than continental scales. Therefore, it is currently beyond the scope of existing science to predict climate change on regional or local scales resulting from specific sources of GHG emissions.

4.20.1 Climate Change

This section incorporates an analysis of the contributions of the proposed action to GHG emissions and a general discussion of potential impacts to climate. The EPA's Inventory of

US Greenhouse Gas Emissions and Sinks found that in 2009, total U.S. GHG emissions were almost 7 billion (6,639.7 million) metric tons and that total U.S. GHG emissions have increased by 7.4% from 1990 to 2009 (EPA, 2011). Emissions declined from 2008 to 2009 by 6.0% (422.2 million metric tons CO₂e). The primary causes of this decrease were the reduced energy consumption during the economic downturn and increased use of natural gas relative to coal for electricity generation (EPA, 2011).

On-going scientific research has identified the potential effects of anthropogenic GHG emissions such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and several trace gasses; changes in biological carbon sequestration; and other changes due to land management activities on global climate. Through complex interactions on a global scale, GHG emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although natural GHG atmospheric concentration levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and burning of fossil carbon sources have caused GHG concentrations to increase.

Analysis of cumulative impacts for reasonably foreseeable development (RFD) of oil and gas wells on public lands in the Roswell Field Office was presented in the 1997 Resource Management Plan (RMP) and associated amendments. Potential development of all available federal minerals in the field office, including those in the proposed lease parcels, was included as part of the analysis.

This incremental contribution to global GHG gases cannot be translated into effects on climate change globally or in the area of this site-specific action. As oil and gas production technology continues to improve, and because of the potential development of future regulation or legislation, one assumption is that reductions in the rate or total quantity of GHG emissions associated with oil and gas production are likely. As stated in the direct/indirect effects section under climate change, the assessment of GHG emissions and the resulting impacts on climate is an ongoing scientific process. It is currently not feasible to know with certainty the net impacts from the proposed action on global or regional climate—that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. Therefore, the BLM does not have the ability to associate an action's contribution in a localized area to impacts on global climate change. Further, an IPCC assessment states that difficulties remain in attributing observed temperature changes at smaller than continental scales. It is currently beyond the scope of existing science to predict climate change on regional or local scales resulting from specific sources of GHG emissions.

Currently, global climate models are inadequate to forecast local or regional effects on resources (IPCC, 2007; CCSP, 2008). However, there are general projections regarding potential impacts to natural resources and plant and animal species that may be attributed to climate change from GHG emissions over time; however these effects are likely to be varied, including those in the southwestern United States (Karl et al, 2009). For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased windblown dust from drier and less stable soils. Cool season plant

species' spatial ranges are predicted to move north and to higher elevations, and extinction of endemic threatened/endangered plants may be accelerated. Due to loss of habitat or competition from other species whose ranges may shift northward, the population of some animal species may be reduced or increased. Less snow at lower elevations would likely impact the timing and quantity of snowmelt, which, in turn, could impact water resources and species dependent on historic water conditions (Karl et al, 2009).

When compared to the total GHG emission estimates from the total number of oil and gas wells in the State, the average number of oil and gas wells drilled annually in the Field Office and associated GHG emission levels, represent an incremental contribution to the total regional and global GHG emission levels. The number of oil and gas wells that would eventually result from the proposed action would therefore likely represent an even smaller incremental contribution to GHGs emissions on a global scale.

CHAPTER 5: CONSULTATION/COORDINATION

5.0 Consultation/Coordination

This section includes individuals or organizations from the public, external agencies, the interdisciplinary team, and permittee's contacted during the development of this document.

5.1 Agencies, Persons and Organizations Consulted

Agencies

Clay Nichols, U.S. Fish and Wildlife Biologist.

Tribes Consulted

Apache Tribe of Oklahoma
Comanche Nation
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

5.2 Preparers

BLM Lease Staff

Glen Garnand, Environmental & Planning
Coordinator
Al Collar, Geologist
Helen Miller, Rangeland Management
Specialist
Jeremy Illif, Archaeologist

Michael McGee, Hydrologist
Michael Bilbo, Outdoor Recreation Planner
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Christopher J. Brown, Outdoor Recreation
Planner
John Simitz, Geologist

Randy Howard, Wildlife Biologist
Dan Baggao, Wildlife Biologist
Harley Davis, Natural Resource Spec.
Angel Mayes, Assistant Field Manager -
Lands & Minerals
Phil Watts, GIS Specialist
Tate Salas, Realty Specialist

Ruben Sanchez, Realty Specialist
Jerry Dutchover, Assistant Field Manager –
Resources
Howard Parman, Program Manager, Pecos
District
David Glass, Petroleum Engineer

On January 9, 2014 a briefing was held via WebEx and teleconference with the State Director Jesse Juen, members of the Fluid Minerals team including Marcos Molinar, Gloria Baca, Diane Ellenburg, Melanie Barnes, Jeannette Arquero, Bernadine Martinez, Jay Spielman, Angel Mayes, Julieann Serrano, Phil Watts, Glen Garnand, Al Collar, and Harley Davis.

5.3 Public Involvement

The parcel nominated for this sale, along with the appropriate stipulations were posted online for a two week review period beginning December 30, 2013. No comments were received. This EA will be made available for public review and comment for 30 days beginning February 10, 2014. One parcel was added to the Carlsbad Field Office parcels being considered on February 18, 2014 due to a recommendation from the BLM NMSO fluid geologist who documented that drainage of the lease parcel was occurring. Therefore, the public comment period for both the Carlsbad and Roswell EAs has been extended an additional 8 days and will conclude on March 19, 2014. Any comments received will be analyzed and reflected in this document where applicable.

CHAPTER 6: REFERENCES

CCSP, 2008: *Climate Models: An Assessment of Strengths and Limitations*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Bader D.C., C. Covey, W.J. Gutowski Jr., I.M. Held, K.E. Kunkel, R.L. Miller, R.T. Tokmakian and M.H. Zhang (Authors)]. Department of Energy, Office of Biological and Environmental Research, Washington, D.C., USA, 124 pp.

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EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006

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CHAPTER 7: AUTHORITIES

Code of Federal Regulations (CFR) 3100
40 CFR All Parts and Sections inclusive Protection of Environment,
Revised as of July 1, 2001.

43 CFR, All Parts and Sections inclusive - Public Lands: Interior.
Revised as of October 1, 2000.

U.S. Department of the Interior, Bureau of Land Management and Office of the Solicitor (editors). 2001. The Federal Land Policy and Management Act, as amended. Public Law 94-579.

APPENDIX 1

NM-201407-005 120.000 Acres

T.0080N, R.0240E, 23 PM, NM

Sec. 022 SWSE;

023 NWSE;

024 SWNE;

Guadalupe County

Roswell FO

NMNM 109721

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-S-18 Streams, Rivers, and Floodplains

Sec. 022 SWSE;

Sec. 023 NWSE

SENM-S-20 Springs, Seeps and Tanks

Sec. 023 NWSE

SENM-S-25 Visual Resource Management

SENM-S-48 CSU - Paleontology

NM-201407-016 320.000 Acres

T.0140S, R.0270E, 23 PM, NM

Sec. 035 N2;

Chaves County

Roswell FO

NMNM 100328

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-LN-1 Cave - Karst Occurrence Area

SENM-S-21 Caves and Karst

SENM-S-25 Visual Resource Management

NM-201407-017 520.000 Acres

T.0140S, R.0280E, 23 PM, NM

Sec. 021 N2,NESW,SE;

Chaves County

Roswell FO

NMNM 94599

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-LN-1 Cave - Karst Occurrence Area

SENM-S-19 Playas and Alkali Lakes

Sec. 021: SWNE, NWSE;

SENM-S-21 Caves and Karst

SENM-S-25 Visual Resource Management

NM-201407-018 920.360 Acres

T.0150S, R.0280E, 23 PM, NM

Sec. 003 SW;
 004 LOTS 1-4;
 004 SENE, SWNW, SW, W2SE, SESE;
 009 N2NE, NW;

Chaves County

Roswell FO

NMNM 102025, NMNM 102026, NMNM 102027

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-LN-1 Cave - Karst Occurrence Area

SENM-S-19 Playas and Alkali Lakes

Sec. 03: E2SW;

Sec. 04: NESW;

Sec. 09: NWNE, NENW;

SENM-S-21 Caves and Karst

SENM-S-25 Visual Resource Management

NM-201407-019 240.000 Acres

T.0150S, R.0280E, 23 PM, NM

Sec. 010 NWNE, SENE, NW;

Chaves County

Roswell FO

NMNM 103263

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-LN-1 Cave - Karst Occurrence Area

SENM-S-21 Caves and Karst

SENM-S-25 Visual Resource Management

NM-201407-020 800.000 Acres

T.0150S, R.0280E, 23 PM, NM

Sec. 010 S2S2;

 015 ALL;

Chaves County

Roswell FO

NMNM 103263

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-LN-1 Cave - Karst Occurrence Area

SENM-S-21 Caves and Karst

SENM-S-25 Visual Resource Management

NM-201407-021 720.000 Acres

T.0150S, R.0280E, 23 PM, NM

Sec. 026 NW;

027 N2NE,W2,SE;

Chaves County

Roswell FO

NMNM 90520, NMNM 103867, NMNM 105209

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-LN-1 Cave - Karst Occurrence Area

SENM-S-19 Playas and Alkali Lakes

Sec. 27: NWNE, NENW, N2SE;

SENM-S-21 Caves and Karst

SENM-S-25 Visual Resource Management

NM-201407-022 600.000 Acres

T.0140S, R.0290E, 23 PM, NM

Sec. 022 NE,NENW,S2NW,S2;

Chaves County

Roswell FO

NMNM 93474, NMNM 103265

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-S-19 Playas and Alkali Lakes

Sec. 22: SENE;

SENM-S-22 Prairie Chickens

SENM-S-25 Visual Resource Management

SENM-S-39 Plan of Development

NM-201407-032 320.000 Acres

T.0060S, R.0330E, 23 PM, NM

Sec. 014 SW;

023 NW;

Roosevelt County

Roswell FO

NMNM 056249-A, NMNM 23013

Formerly Lease No.

Stipulations:

DEFER

NM-201407-033 320.000 Acres

T.0060S, R.0330E, 23 PM, NM

Sec. 022 S2;

Roosevelt County

Roswell FO

NMNM 056249-A

Formerly Lease No.

Stipulations:

DEFER

NM-201407-034 80.000 Acres

T.0070S, R.0330E, 23 PM, NM

Sec. 013 W2NE;

Roosevelt County

Roswell FO

NMNM 81963, NMNM 83610

Formerly Lease No.

Stipulations:

DELETED

NM-201407-052 1440.000 Acres

T.0080S, R.0360E, 23 PM, NM

Sec. 026 W2;

027 NE;

034 N2;

035 ALL;

Roosevelt County

Roswell FO

NMNM 03283, NMNM 03431, NMNM 57708,

NMNM 94631, NMNM 96057, NMNM 96058,

NMNM 98204

Formerly Lease No.

Stipulations:

DELETED

NM-201407-053 240.000 Acres

T.0080S, R.0370E, 23 PM, NM

Sec. 033 NW,W2SW;

Roosevelt County

Roswell FO

NMNM 03283, NMNM 96064

Formerly Lease No.

Stipulations:

DELETED

NM-201407-054 320.000 Acres

T.0080S, R.0370E, 23 PM, NM

Sec. 033 SE;

034 SW;

Roosevelt County

Roswell FO

NMNM 0560413, NMNM 96064

Formerly Lease No.

Stipulations:

DELETED

NM-201407-055 1000.000 Acres

T.0140S, R.0280E, 23 PM, NM

Sec. 022 ALL;

027 NE, N2NW, SENW, N2SE;

Chaves County

Roswell FO

NMNM 106685, NMNM 107371

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-LN-1 Cave - Karst Occurrence Area

SENM-S-19 Playas and Alkali Lakes

Sec. 22: NENE;

SENM-S-21 Caves and Karst

SENM-S-25 Visual Resource Management

NOTE: NSO/LN STIP FOR ABANDONED MISSILE SILO:

Sec. 27: SWNWSWNE, W2W2SWSWNE,

SENESEENW, SESEENW, W2W2NWNWSE.

20.00 ACRES

NM-201407-056 640.001 Acres

T.0140S, R.0290E, 23 PM, NM

Sec. 027 ALL;

Chaves County

Roswell FO

NMNM 95633, NMNM 103265, NMNM 110830

Formerly Lease No.

Stipulations:

NM-11-LN Special Cultural Resource

SENM-S-22 Prairie Chickens

SENM-S-25 Visual Resource Management

SENM-S-39 Plan of Development

APPENDIX 2: PHASES OF OIL AND GAS DEVELOPMENT

Construction Activities

Clearing of the proposed well pad and access road would be limited to the smallest area possible to provide safe and efficient work areas for all phases of construction. First all new construction areas need to be cleared of all vegetation. All clearing activities are typically accomplished by cutting, mowing and/or grading vegetation as necessary. Cut vegetation may be mulched and spread on site or hauled to a commercial waste disposal facility.

Next, heavy equipment including but not limited to bulldozers, graders, front-end loaders, and/or track hoes are used to construct at a minimum the pad, but other features, as needed for development, may include, but is not limited to an access road, reserve pit, pipeline, and/or fracturing pond. Cut and fills may be required to level the pad or road surfaces. If a reserve pit is authorized, it would be lined using an impermeable liner or other lining mechanism (i.e. bentonite or clay) to prevent fluids from leeching into the soil. Access roads may have cattle guards, gates, drainage control, or pull-outs installed, among a host of other features that may be necessary based on the site specific situation. Long-term surfaces are typically dressed with a layer of crushed rock or soil cemented. Construction materials come from a variety of sources. Areas not needed for long-term development (i.e. portions of the pipeline or road right-of-way) are reclaimed by recontouring the surface and establishing vegetation.

If a pipeline is needed, the right-of-way would be cleared of all vegetation. The pipeline would be laid out within the cleared section. A backhoe, or similar piece of equipment, would dig a trench at least 36 inches below the surface. After the trench is dug, the pipes would be assembled by welding pieces of pipe together and bending them slightly, if necessary, to fit the contour of the pipeline's path. Once inspected, the pipe can be lowered into the trench and covered with stockpiled subsoil that was originally removed from the hole. Each pipeline undergoes hydrostatic testing prior to natural gas being pumped through the pipeline. This ensures the pipeline is strong enough and absent of any leaks.

Drilling Operations

When the pad is complete, the drilling rig and associated equipment would be moved onsite and erected. A conventional rotary drill rig with capability matched to the depth requirements of the proposed well(s) would be used. The well could be drilled as a vertical or horizontal well to target the desired formation. The depth of the well is entirely dependent on the target formation depth and could be several hundred feet vertical depth to over 20,000 feet vertical depth.

When a conventional reserve pit system is proposed, drilling fluid or mud is circulated through the drill pipe to the bottom of the hole, through the bit, up the bore of the well, and finally to the surface. When mud emerges from the hole, it enters into the reserve pit where it would remain until all fluids are evaporated and the solids can be buried.

A closed-loop system, operates in a similar fashion except that when the mud emerges from the hole, it passes through a series of equipment used to screen and remove drill cuttings (rock chips) and sand-sized solids rather than going into the pit. When the solids have been removed, the mud would be placed into holding tanks, and from the tank, used again.

In either situation the mud is maintained at a specific weight and viscosity to cool the bit, seal off any porous zones (thereby protecting aquifers or preventing damage to producing zone productivity), control subsurface pressure, lubricate the drill string, clean the bottom of the hole, and bring the drill cuttings to the surface. Water-based or oil-based muds can be used and is entirely dependent on the site-specific conditions.

Completion Operations

Once a well has been drilled, completion operations would begin once crews and equipment are available. Well completion involves setting casing to depth and perforating the casing in target zones.

Wells are often treated during completion to improve the recovery of hydrocarbons by increasing the rate and volume of hydrocarbons moving from the natural oil and gas reservoir into the wellbore. These processes are known as well-stimulation treatments, which create new fluid passageways in the producing formation or remove blockages within existing passageways. They include fracturing, acidizing, and other mechanical and chemical treatments often used in combination. The results from different treatments are additive and complement each other.

Hydraulic Fracturing

Hydraulic fracturing (HF) is one technological key to economic recovery of oil and gas that might have been left by conventional oil and gas drilling and pumping technology. It is a formation stimulation practice used to create additional permeability in a producing formation, thus allowing gas to flow more readily toward the wellbore. Hydraulic fracturing can be used to overcome natural barriers, such as naturally low permeability or reduced permeability resulting from near wellbore damage, to the flow of fluids (gas or water) to the wellbore (GWPC 2009). The process is not new and has been a method for additional oil and gas recovery since the early 1900s; however, with the advancement of technology it is more commonly used.

Hydraulic fracturing is a process that uses high pressure pumps to pump fracturing fluid into a formation at a calculated, predetermined rate and pressure to generate fractures or cracks in the target formation. For shale development, fracture fluids are primarily water-based fluids mixed with additives which help the water to carry proppants into the fractures, which may be made up of sand, walnut hulls, or other small particles of materials. The proppant is needed to “prop” open the fractures once the pumping of fluids has stopped. Once the fracture has initiated, additional fluids are pumped into the wellbore to continue the development of the fracture and to carry the proppant deeper into the formation. The additional fluids are needed to maintain the downhole pressure necessary to accommodate the increasing length of opened fracture in the formation.

Hydraulic fracturing of horizontal shale gas wells is performed in stages. Lateral lengths in horizontal wells for development may range from 1,000 feet to more than 5,000 feet. Depending on the lengths of the laterals, treatment of wells may be performed by isolating smaller portions of the lateral. The fracturing of each portion of the lateral wellbore is called a stage. Stages are fractured sequentially beginning with the section at the farthest end of the wellbore, moving uphole as each stage of the treatment is completed until the entire lateral well has been stimulated.

This process increases the flow rate and volume of reservoir fluids that move from the producing formation into the wellbore. The fracturing fluid is typically more than 99 percent water and sand, with small amounts of readily available chemical additives used to control the chemical and mechanical properties of the water and sand mixture (see discussion about Hazardous and Solid Wastes below). Because the fluid is composed mostly of water, large volumes of water are usually needed to perform hydraulic fracturing. However, in some cases, water is recycled or produced water is used.

Before operators or service companies perform a hydraulic fracturing treatment, a series of tests is performed. These tests are designed to ensure that the well, casing, well equipment, and fracturing equipment are in proper working order and will safely withstand the application of the fracture treatment pressures and pump flow rates.

To ensure that hydraulic fracturing is conducted in a safe and environmentally sound manner, the BLM approves and regulates all drilling and completion operations, and related surface disturbance on Federal public lands. Operators must submit Applications for Permit to Drill (APDs) to the agency. Prior to approving an APD, a BLM OFO geologist identifies all potential subsurface formations that would be penetrated by the wellbore. This includes all groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures.

Once the geologic analysis is completed, the BLM reviews the company's proposed casing and cementing programs to ensure the well construction design is adequate to protect the surface and subsurface environment, including the potential risks identified by the geologist and all known or anticipated zones with potential risks.

During drilling, the BLM is on location during the casing and cementing of the ground water protective surface casing and other critical casing and cementing intervals. Before hydraulic fracturing takes place, all surface casing and some deeper, intermediate zones are required to be cemented from the bottom of the cased hole to the surface. The cemented well is pressure tested to ensure there are no leaks and a cement bond log is run to ensure the cement has bonded to the casing and the formation. If the fracturing of the well is considered to be a "non-routine" fracture for the area, the BLM would always be onsite during those operations as well as when abnormal conditions develop during the drilling or completion of a well.

Production Operations

Production equipment used during the life of the well may include a 3-phase separator-dehydrator; flow-lines; a meter run; tanks for condensate, produced oil, and water; and heater treater. A pump jack may be required if the back pressure of the well is too high. Production facilities are arranged to facilitate safety and maximize reclamation opportunities. All permanent above-ground structures not subject to safety considerations are painted a standard BLM or company color or as landowner specified.

Workovers may be performed multiple times over the life of the well. Because gas production usually declines over the years, operators perform workover operations which involve cleaning, repairing and maintaining the well for the purposes of increasing or restoring production.

Hazardous or Solid Wastes Associated with Oil and Gas Development

Anticipated use or produced hazardous materials during the development may come from drilling materials; cementing and plugging materials; HF materials; production products (natural gas, condensates, produced water); fuels and lubricants; pipeline materials; combustion emissions; and miscellaneous materials. Appendix 2, Table 1 includes some of the common wastes (hazardous and non-hazardous) that are produced during oil and gas development.

Appendix 2, Table 1. Common wastes produced during oil and gas development.

Phase	Waste
Construction	<ul style="list-style-type: none">• Domestic wastes (i.e. food scraps, paper, etc.)• Excess construction materials• Used lubricating oils• Solvents• Woody debris• Paints• Sewage
Drilling	<ul style="list-style-type: none">• Drilling muds, including additives (i.e. chromate and barite) and cuttings• Well drilling, completion, workover, and stimulation fluids (i.e. oil derivatives such as polycyclic aromatic hydrocarbons (PAHs), spilled chemicals, suspended and dissolved solids, phenols, cadmium, chromium, copper, lead, mercury, nickel)• Equipment, power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, oil, tires, hoses, hydraulic fluids; paints; solvents)• Fuel and chemical storage drums and containers• Cementing wastes• Production testing wastes• Excess construction materials• Scrap metal• Sewage• Rigwash• Excess drilling chemicals• Processed water• Contaminated soil• Domestic wastes
HF	See below

Production	<ul style="list-style-type: none">• Power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, filters, tires, hoses, coolants, antifreeze; paints; solvents, used parts)• Discharged produced water• Production chemicals• Workover wastes (e.g. brines)• Tank or pit bottoms• Contaminated soil• Scrap metal
Abandonment/Reclamation	<ul style="list-style-type: none">• Construction materials• Decommissioned equipment• Contaminated soil• Insulating materials• Sludge

Hydraulic Fracturing

Chemicals serve many functions in hydraulic fracturing, from limiting the growth of bacteria to preventing corrosion of the well casing. Chemicals are needed to insure the hydraulic fracturing job is effective and efficient. The fracturing fluids used for shale stimulations consist primarily of water but also include a variety of additives. The number of chemical additives used in a typical fracture treatment varies depending on the conditions of the specific well being fractured. A typical fracture treatment will use very low concentrations of between 3 and 12 additive chemicals depending on the characteristics of the water and the shale formation being fractured. Each component serves a specific, engineered purpose. The predominant fluids currently being use for fracture treatments in the shale gas plays are water-based fracturing fluids mixed with friction-reducing additives, also known as slickwater (GWPC 2009).

The make-up of fracturing fluid varies from one geologic basin or formation to another.

Because the make-up of each fracturing fluid varies to meet the specific needs of each area, there is no one-size-fits-all formula for the volumes for each additive. In classifying fracture fluids and their additives it is important to realize that service companies that provide these additives have developed a number of compounds with similar functional properties to be used for the same purpose in different well environments. The difference between additive formulations may be as small as a change in concentration of a specific compound (GWPC 2009).

Typically, the fracturing fluids consist of about 99 percent water and sand and about 1 percent chemical additives. The chemical additives are essential to the process of releasing gas trapped in shale rock and other deep underground formation.

NORM

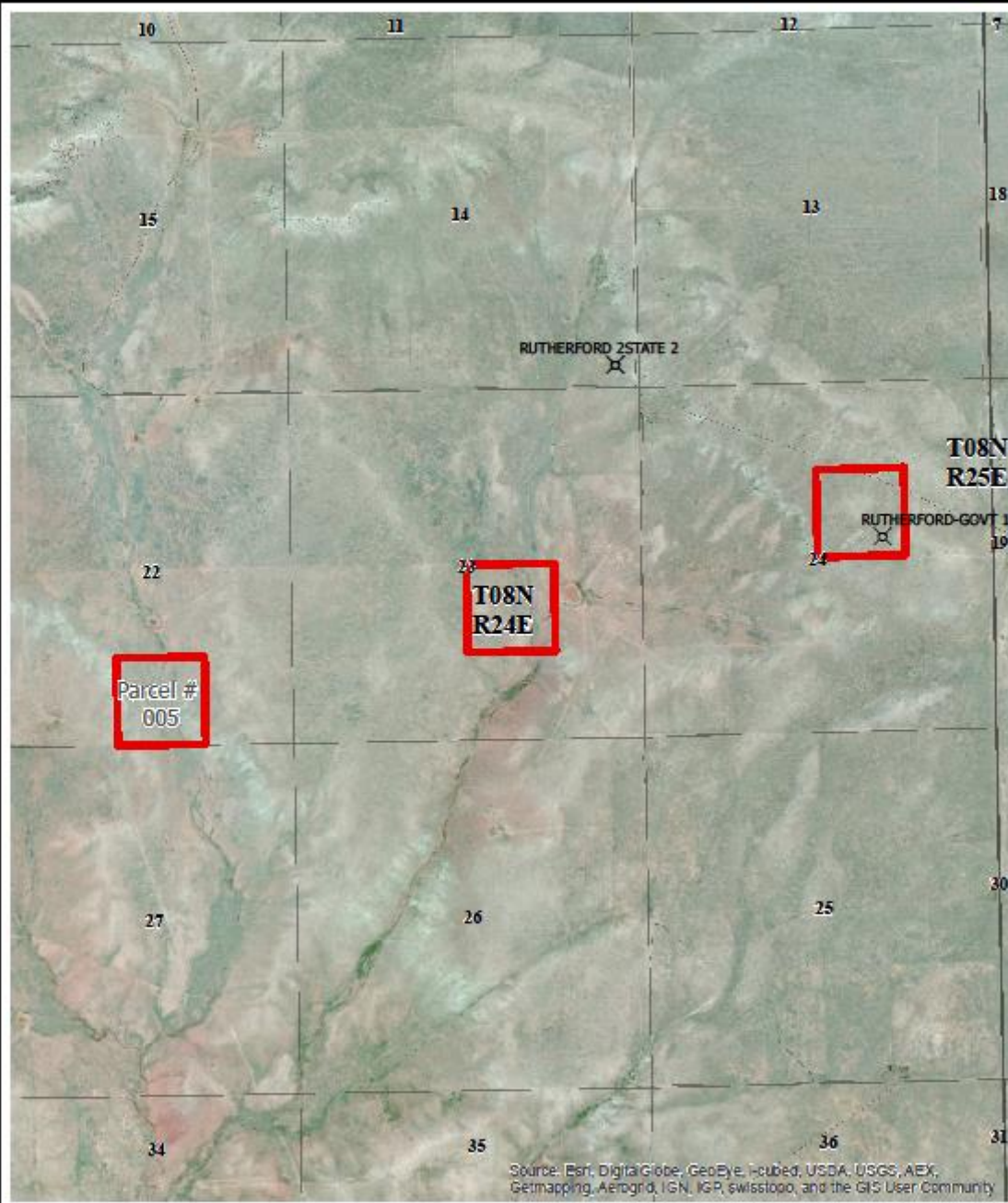
Some soils and geologic formations contain low levels of radioactive material. This naturally occurring radioactive material (NORM) emits low levels of radiation, to which everyone is exposed on a daily basis. When NORM is associated with oil and natural gas production, it begins as small amounts of uranium and thorium within the rock. These elements, along with some of their decay elements, notably radium₂₂₆ and radium₂₂₈, can be brought to the surface in drill cuttings and produced water. Radon₂₂₂, a gaseous decay element of radium, can come to the surface along with the shale gas. When NORM is brought to the surface, it remains in the rock pieces of the drill cuttings, remains in solution with

Figure 1. Typical Chemical Additives Used In Fracturing Fluids (GWPC 2009)

Compound	Purpose	Common application	
Acids	Helps dissolve minerals and initiate fissure in rock (pre-fracture)	Swimming pool cleaner	
Sodium Chloride	Allows a delayed breakdown of the gel polymer chains	Table salt	
Polyacrylamide	Minimizes the friction between fluid and pipe	Water treatment, soil conditioner	
Ethylene Glycol	Prevents scale deposits in the pipe	Automotive anti-freeze, deicing agent, household cleaners	
Borate Salts	Maintains fluid viscosity as temperature increases	Laundry detergent, hand soap, cosmetics	
Sodium/Potassium Carbonate	Maintains effectiveness of other components, such as crosslinkers	Washing soda, detergent, soap, water softener, glass, ceramics	
Glutaraldehyde	Eliminates bacteria in the water	Disinfectant, sterilization of medical and dental equipment	
Guar Gum	Thickens the water to suspend the sand	Thickener in cosmetics, baked goods, ice cream, toothpaste, sauces	
Citric Acid	Prevents precipitation of metal oxides	Food additive; food and beverages; lemon juice	
Isopropanol	Used to increase the viscosity of the fracture fluid	Glass cleaner, antiperspirant, hair coloring	

produced water, or, under certain conditions, precipitates out in scales or sludges. The radiation is weak and cannot penetrate dense materials such as the steel used in pipes and tanks.

Aerial View (Photo)



Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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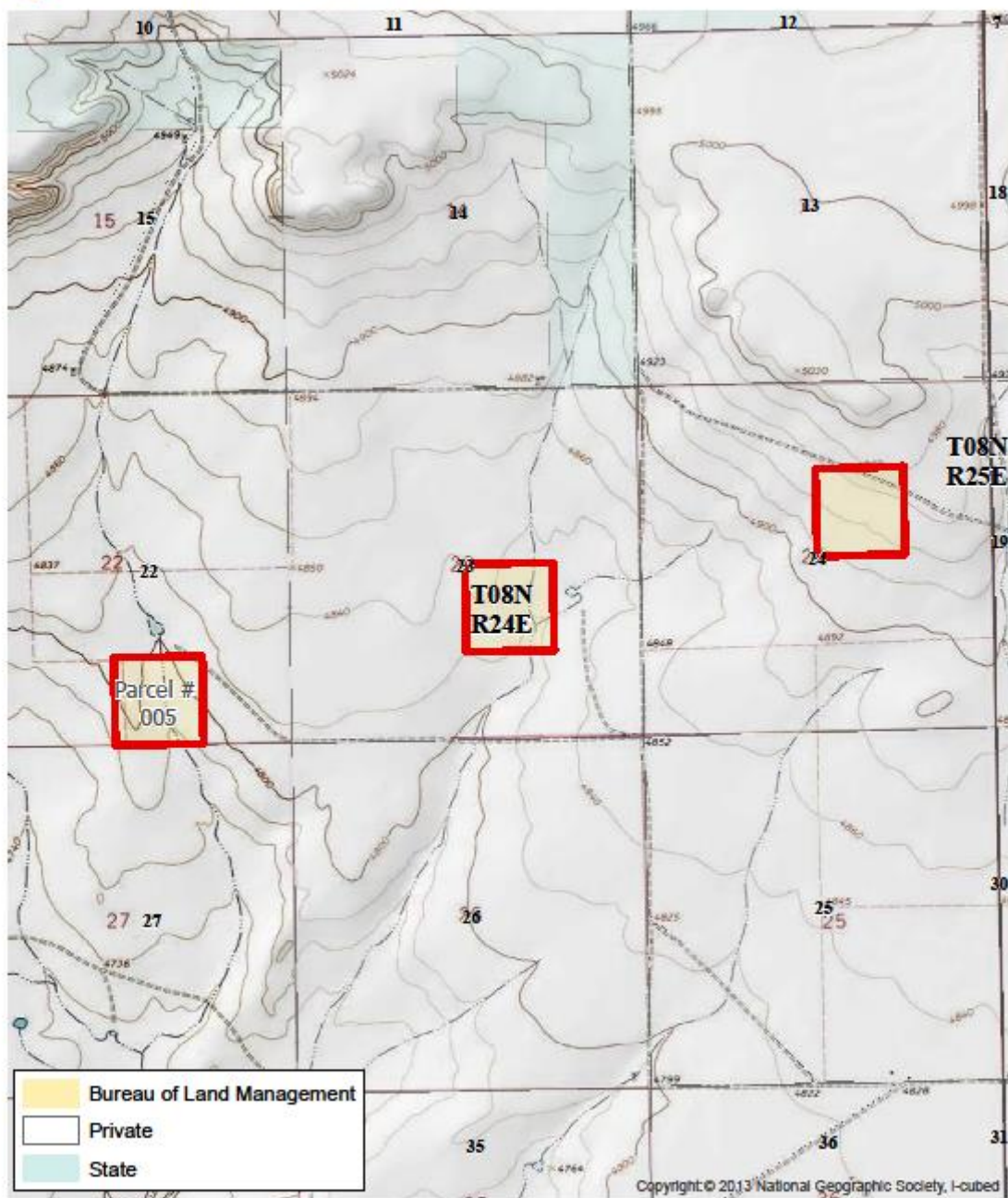
0 0.225 0.45 0.9 Miles

NM-201407-005

120 acres



Resource View (Topo)



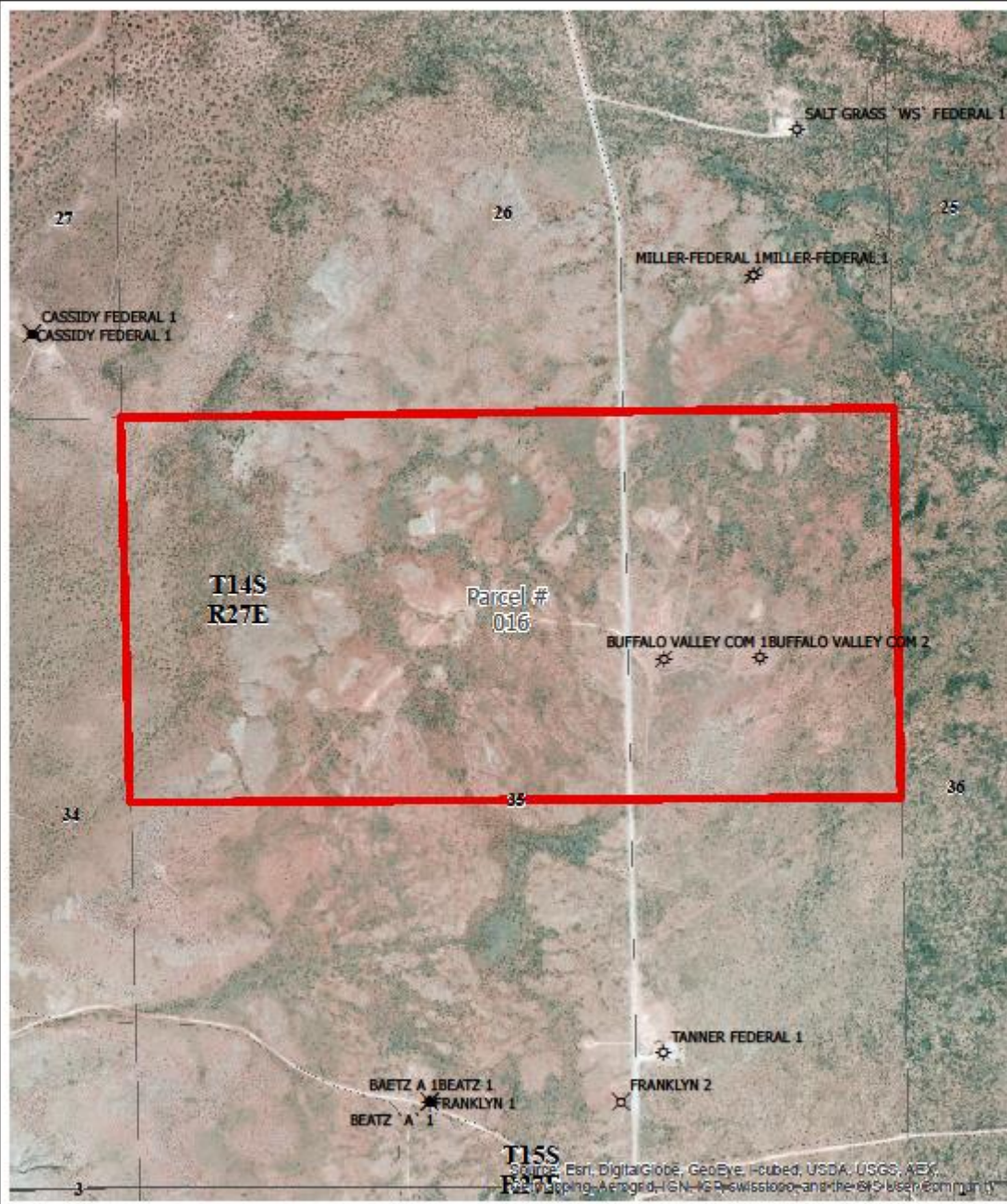
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0 0.2 0.4 0.8 Miles

NM-201407-005

120 acres

Aerial View (Photo)



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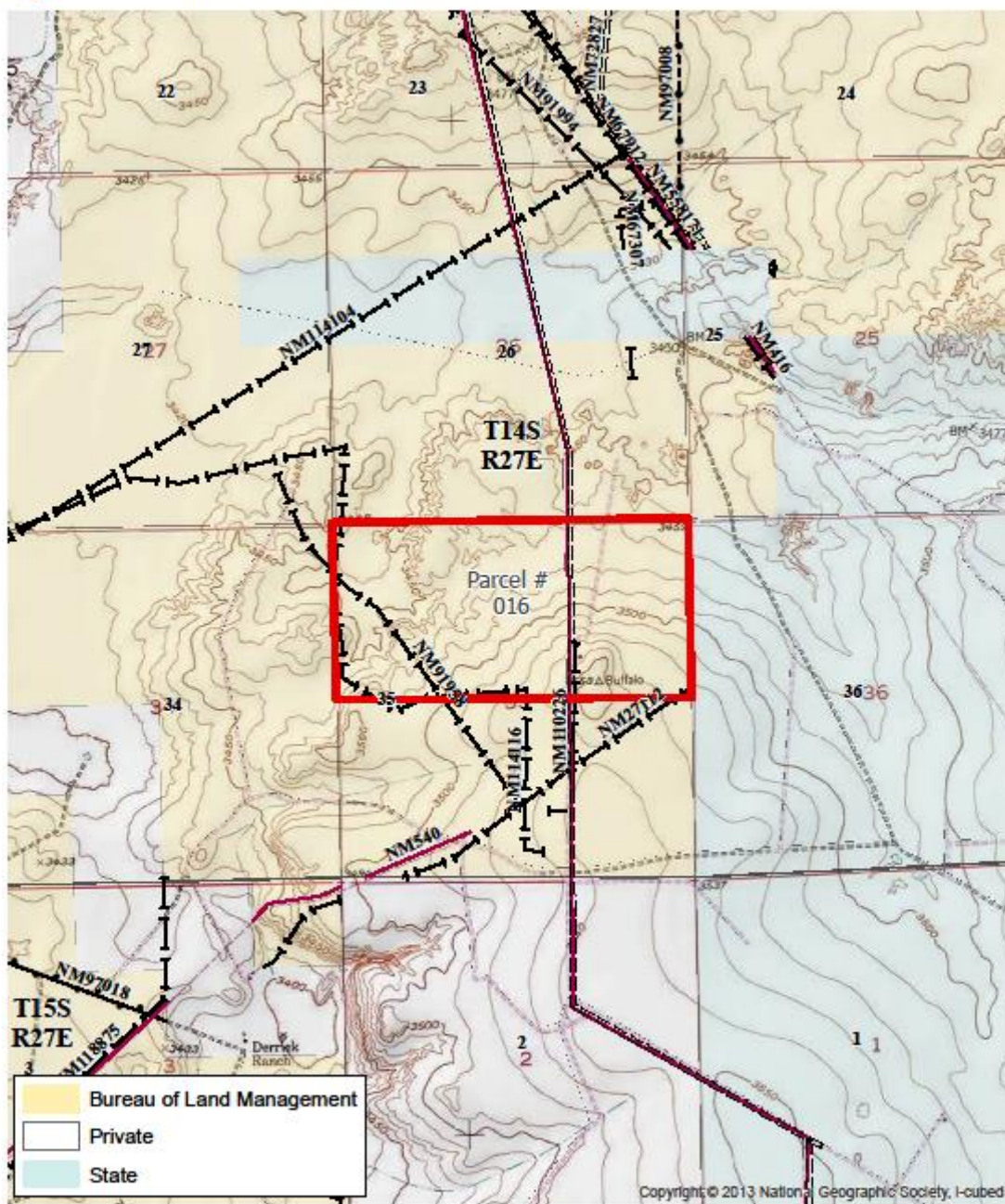
0 0.1 0.2 0.4 Miles

NM-201407-016

320 acres



Resource View (Topo)



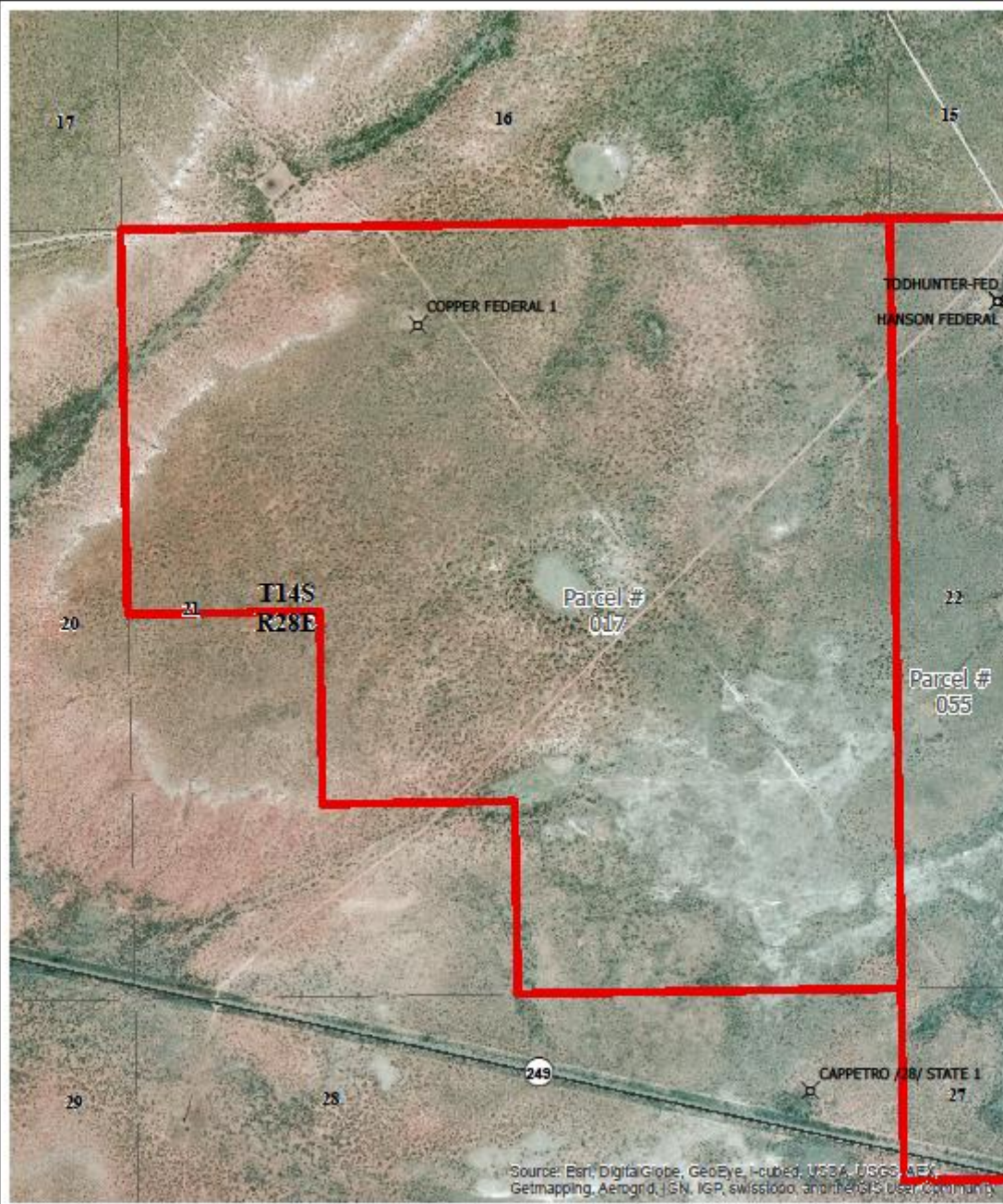
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0 0.2 0.4 0.8 Miles

NM-201407-016

320 acres

Aerial View (Photo)



Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, Aero
Getmapping, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community



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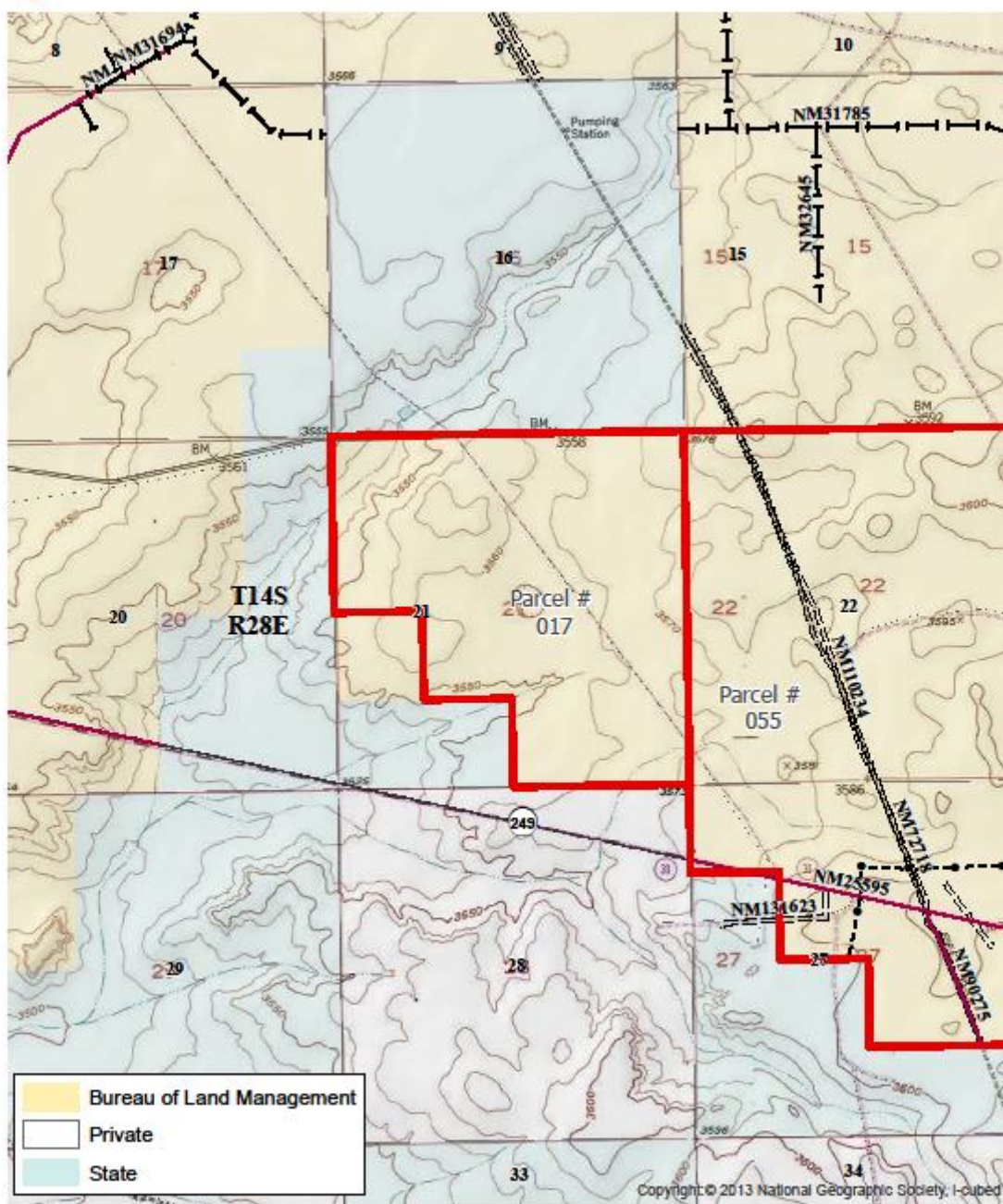
0 0.1 0.2 0.4 Miles

NM-201407-017

520 acres



Resource View (Topo)

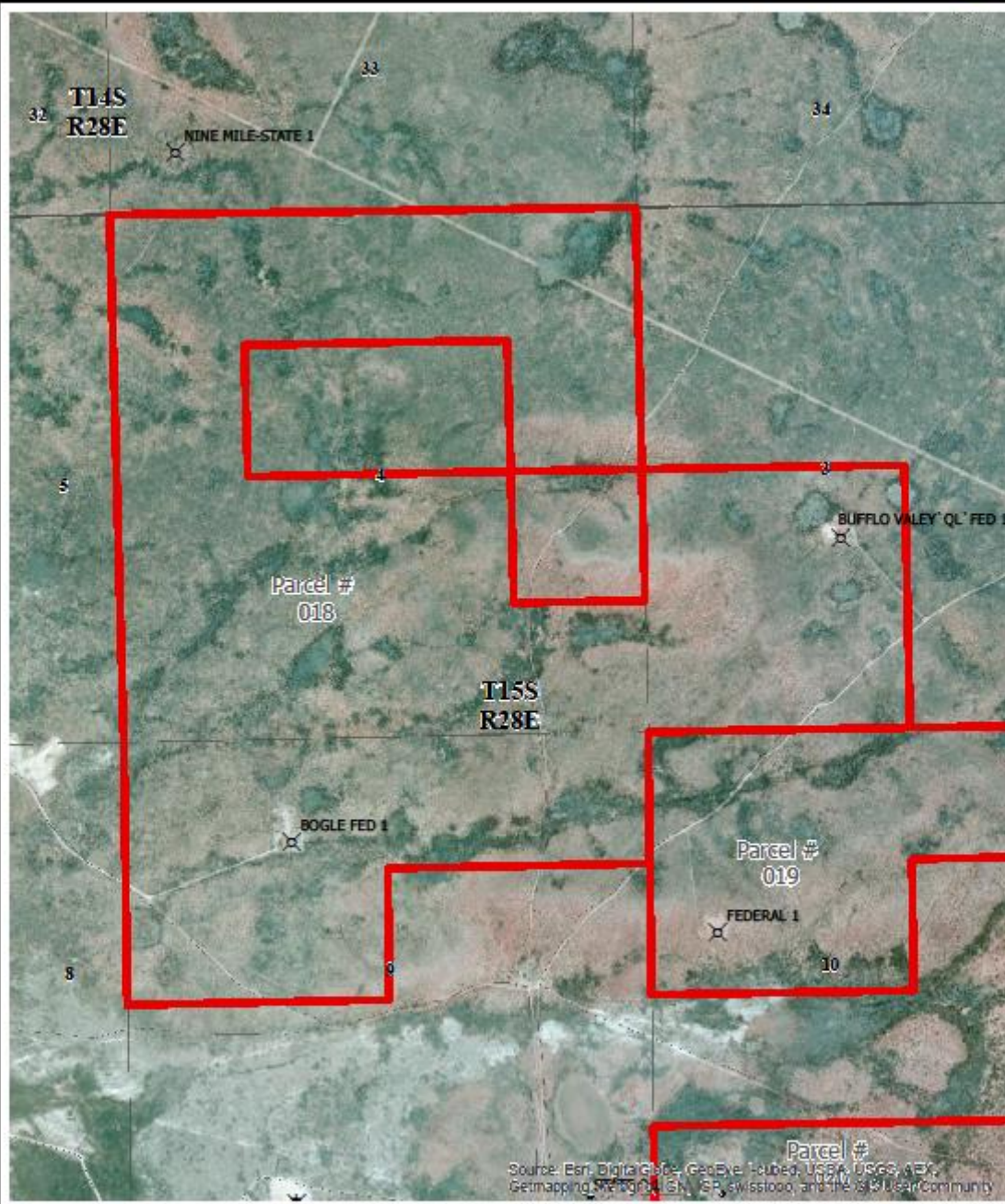


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NM-201407-017

520 acres

Aerial View (Photo)



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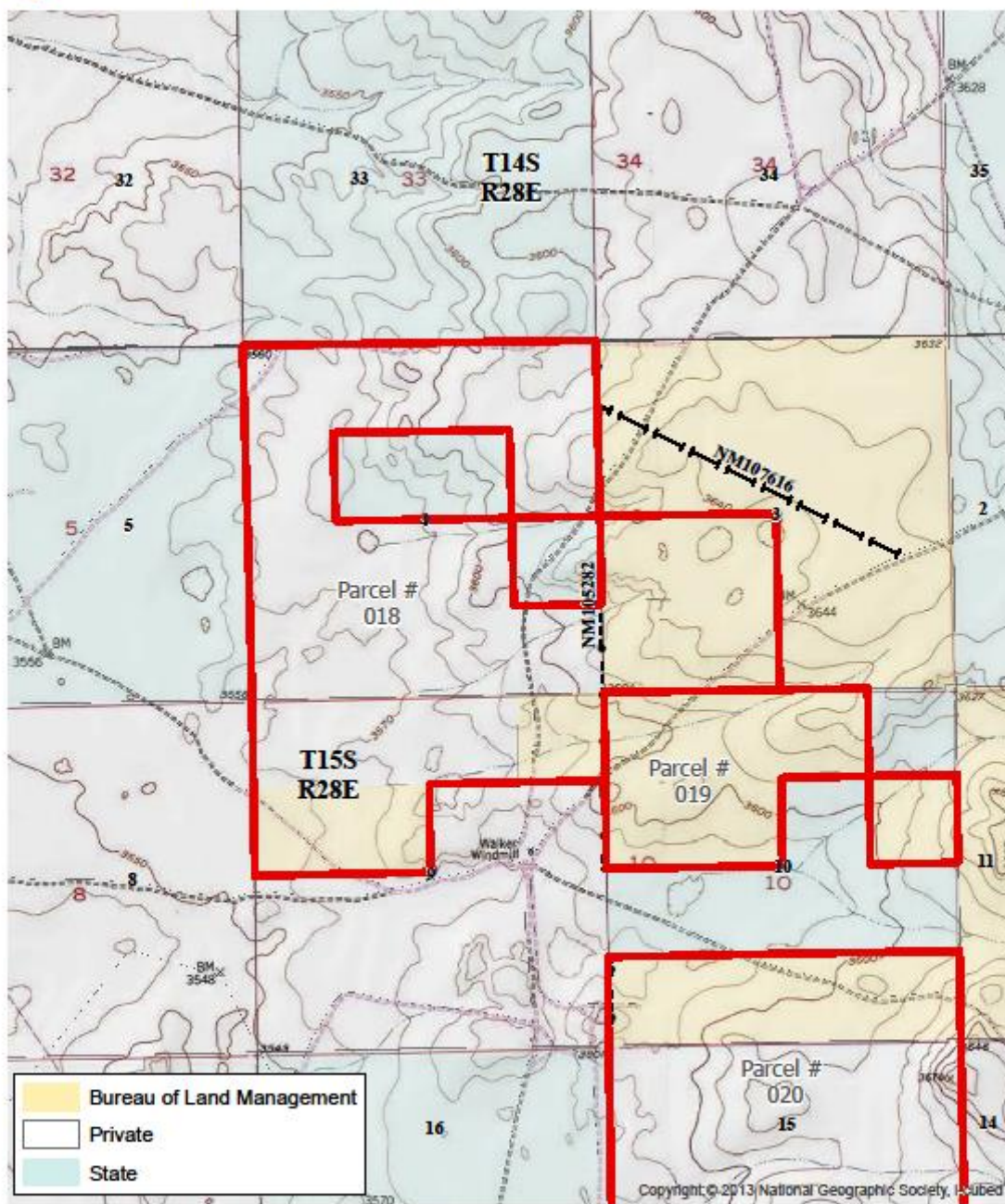
0 0.15 0.3 0.5 Miles

NM-201407-018

920.36 acres



Resource View (Topo)



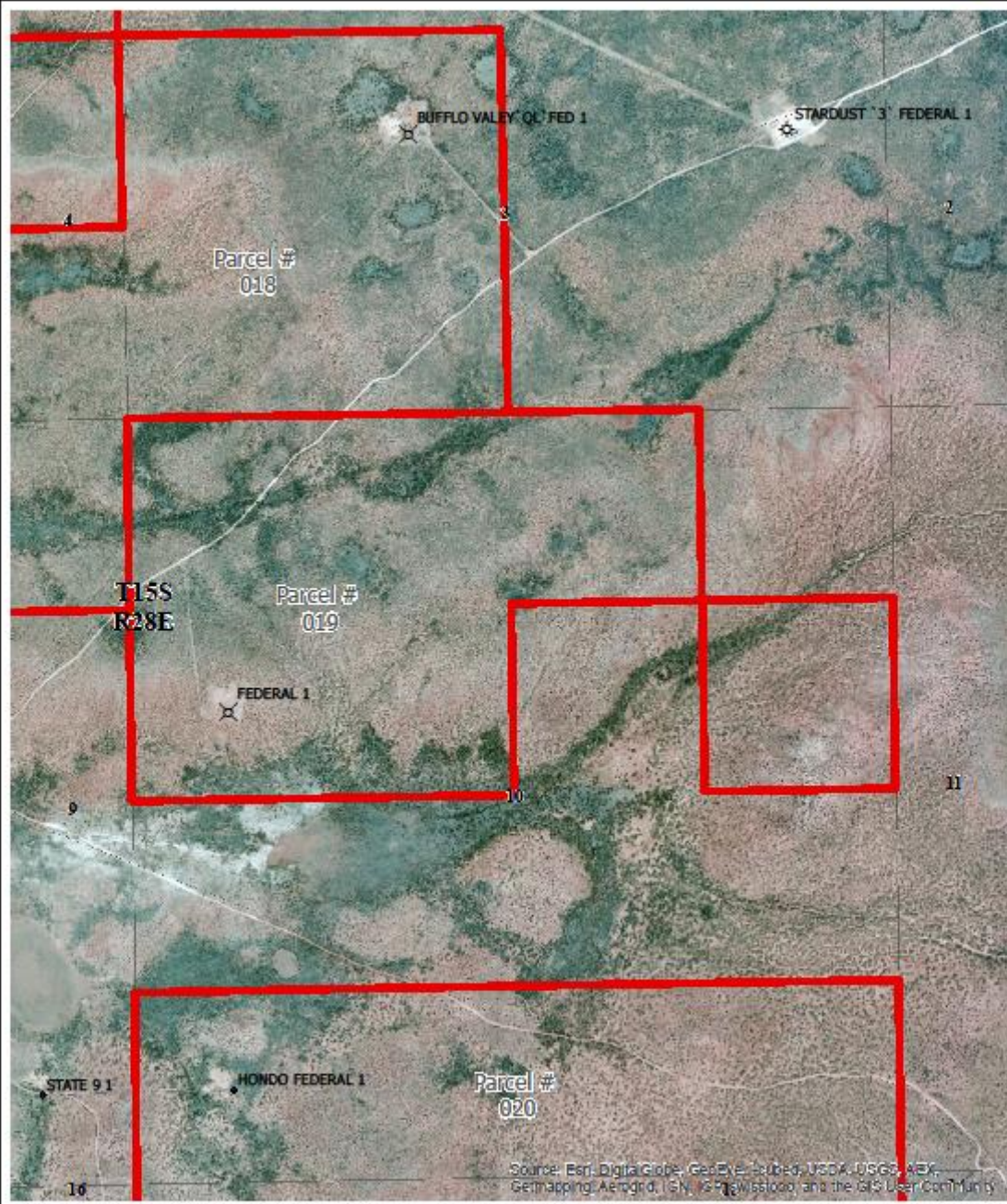
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0 0.2 0.4 0.8 Miles

NM-201407-018

920 acres

Aerial View (Photo)



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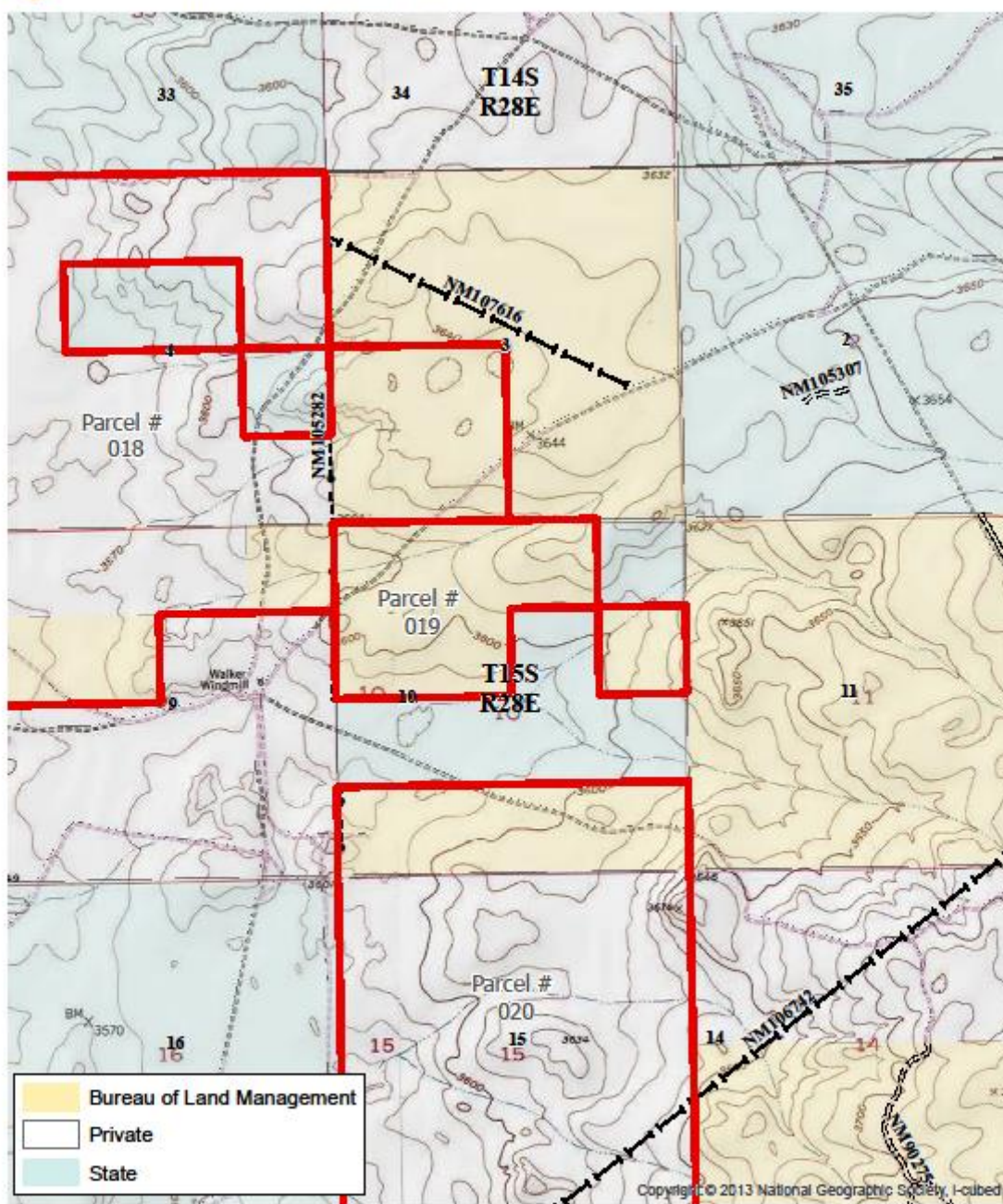
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NM-201407-019

240 acres



Resource View (Topo)



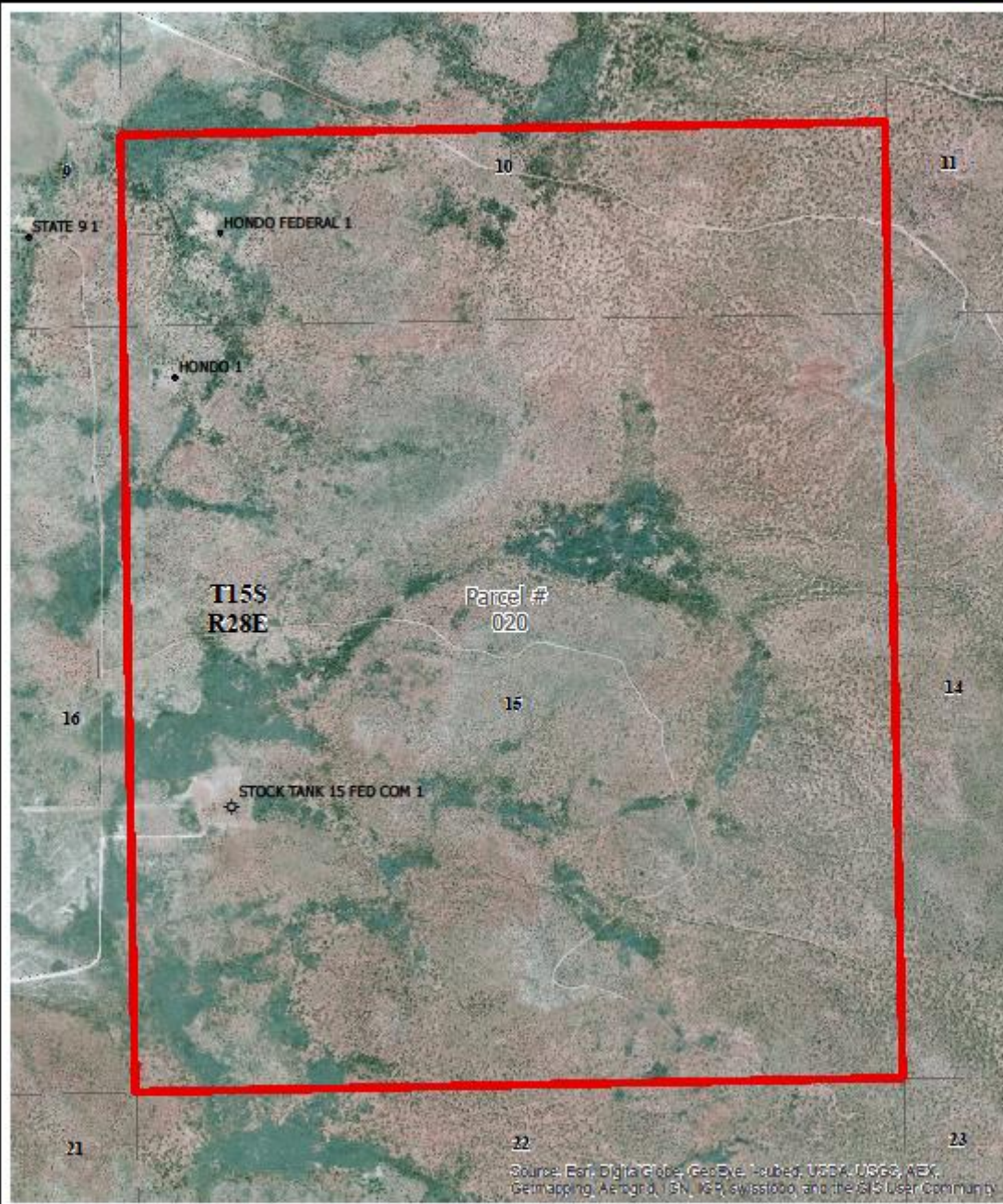
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0 0.2 0.4 0.8 Miles

NM-201407-019

240 acres

Aerial View (Photo)



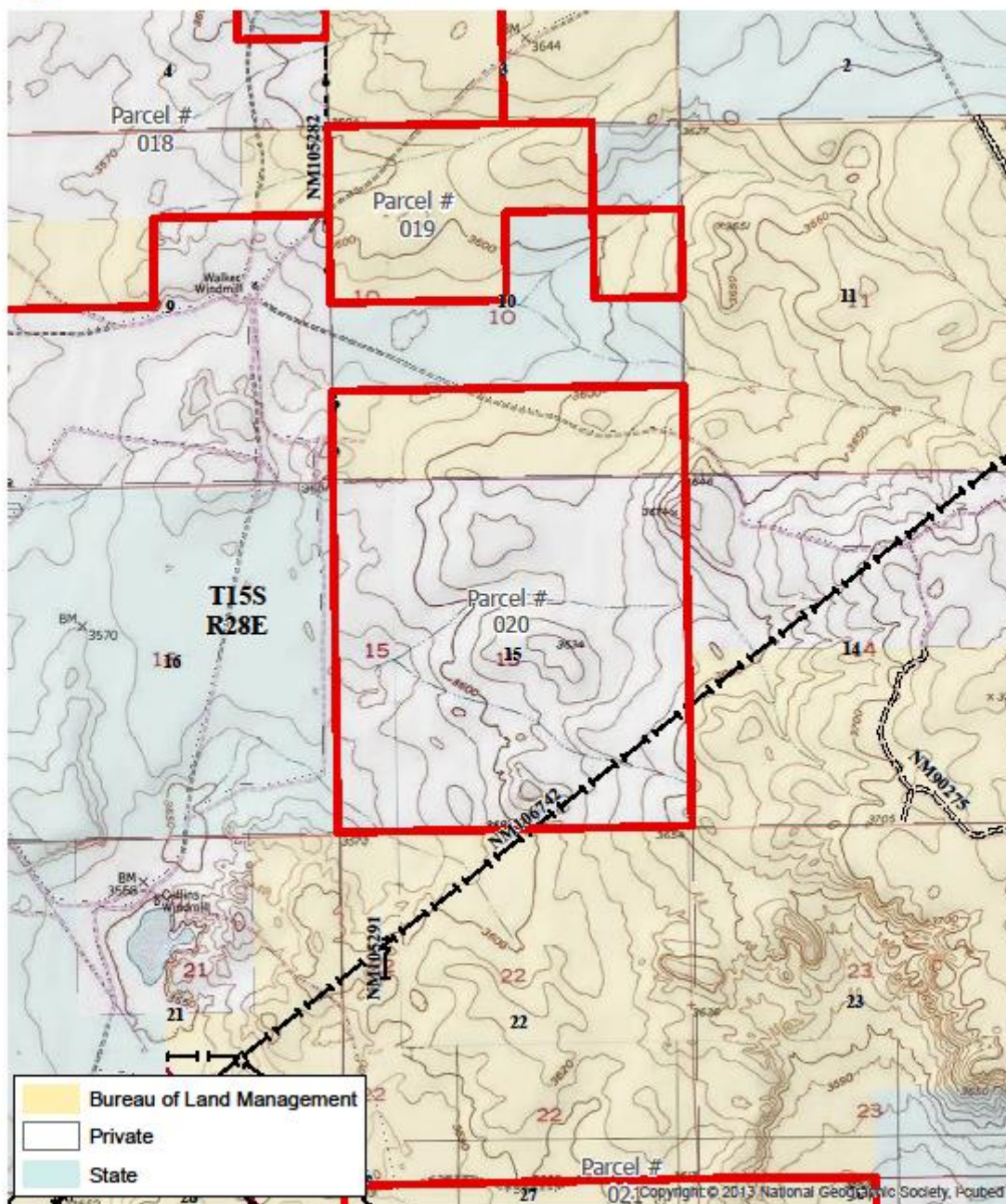
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0 0.1 0.2 0.4 Miles

NM-201407-020
800 acres



Resource View (Topo)



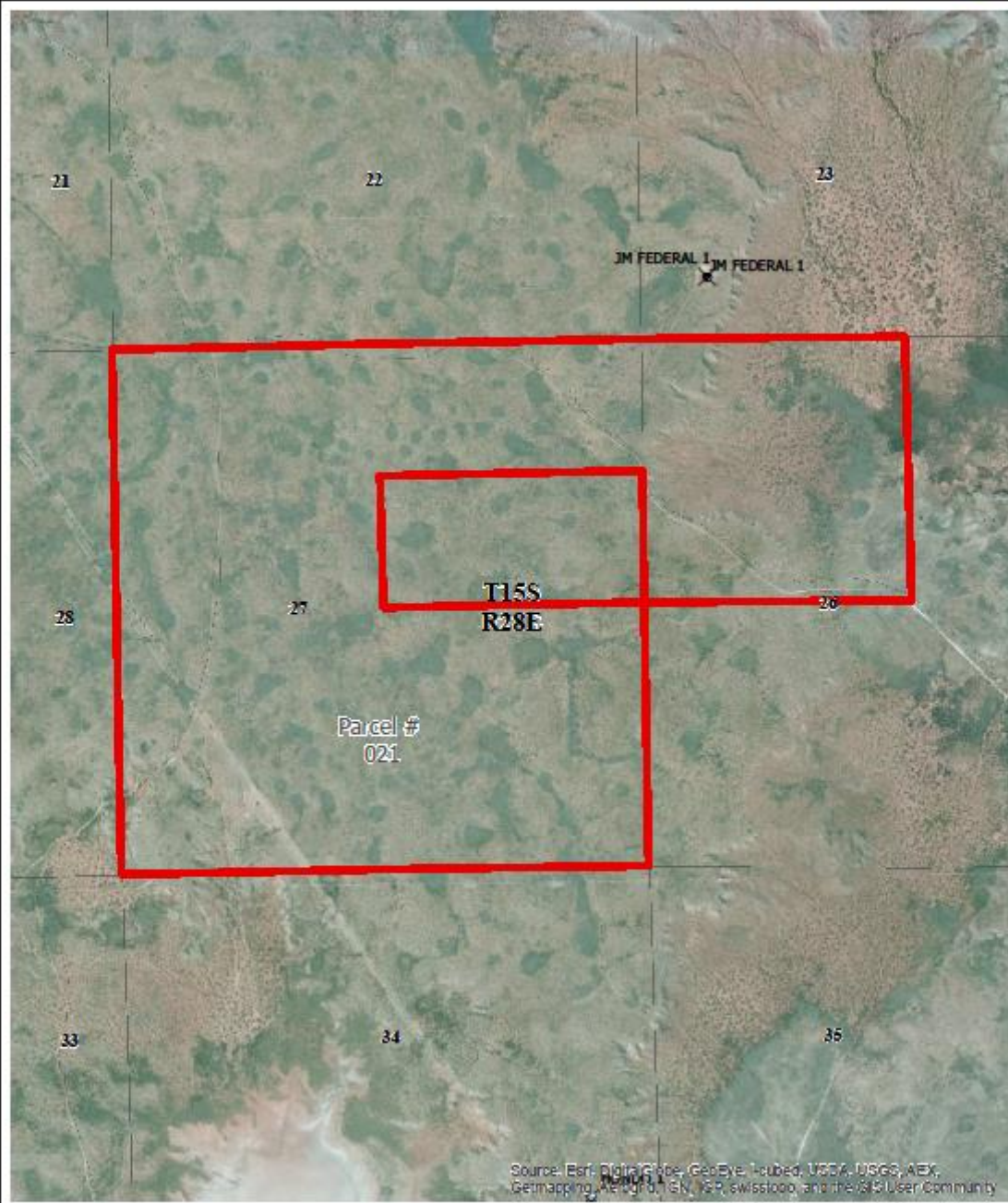
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0 0.2 0.4 0.8 Miles

NM-201407-020

800 acres

Aerial View (Photo)



Source: Esri, DigitalGlobe, GeoEye, IGN, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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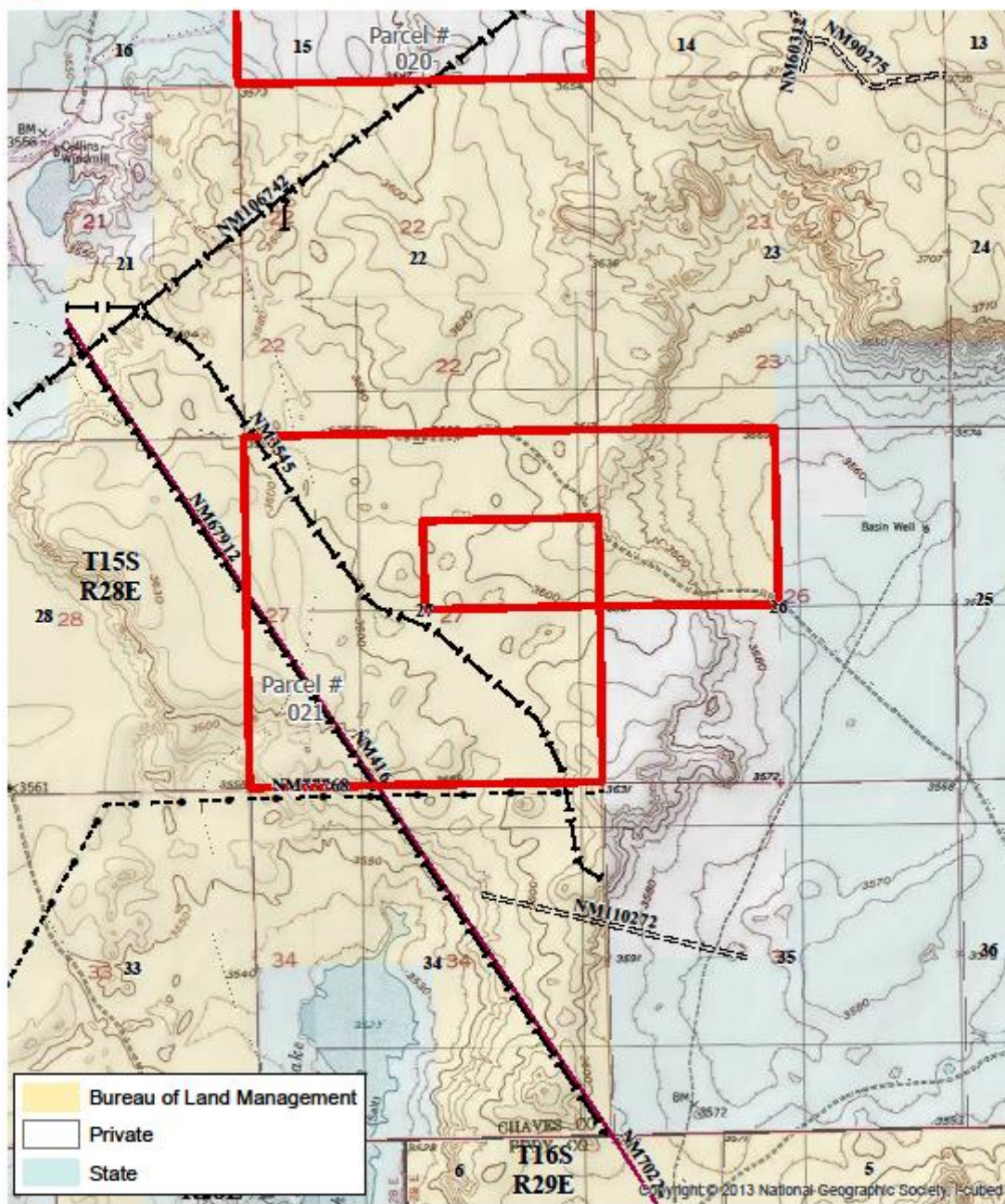
0 0.15 0.3 0.6 Miles

NM-201407-021

720 acres



Resource View (Topo)



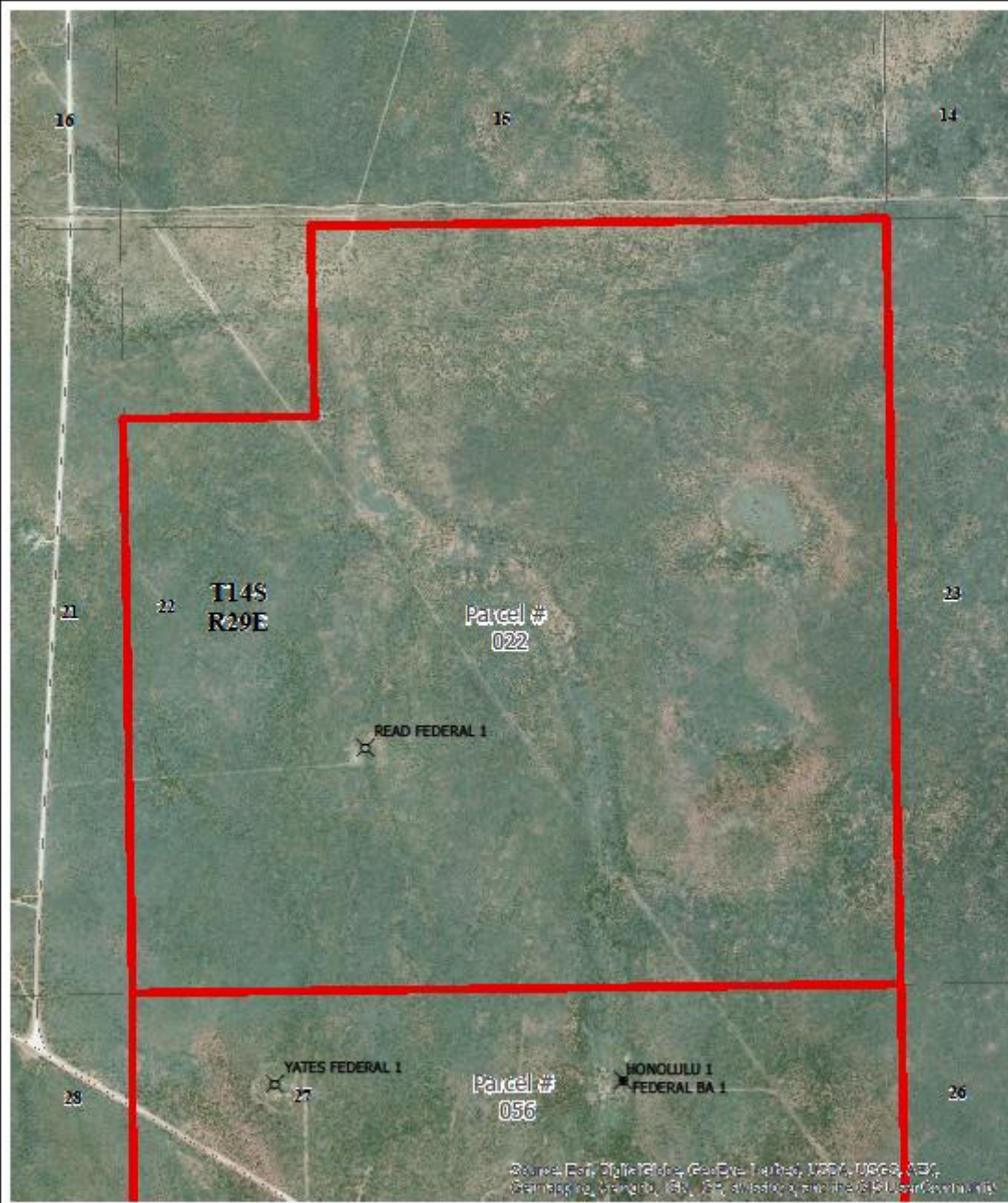
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0 0.2 0.4 0.8 Miles

NM-201407-021

720 acres

Aerial View (Photo)

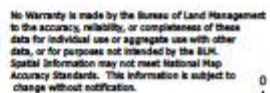
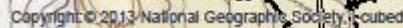


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Accuracy Standards. This information is subject to
change without notification.

0 0.1 0.2 0.4 Miles

NM-201407-022

600 acres



NM-201407-022

600 acres

Aerial View (Photo)



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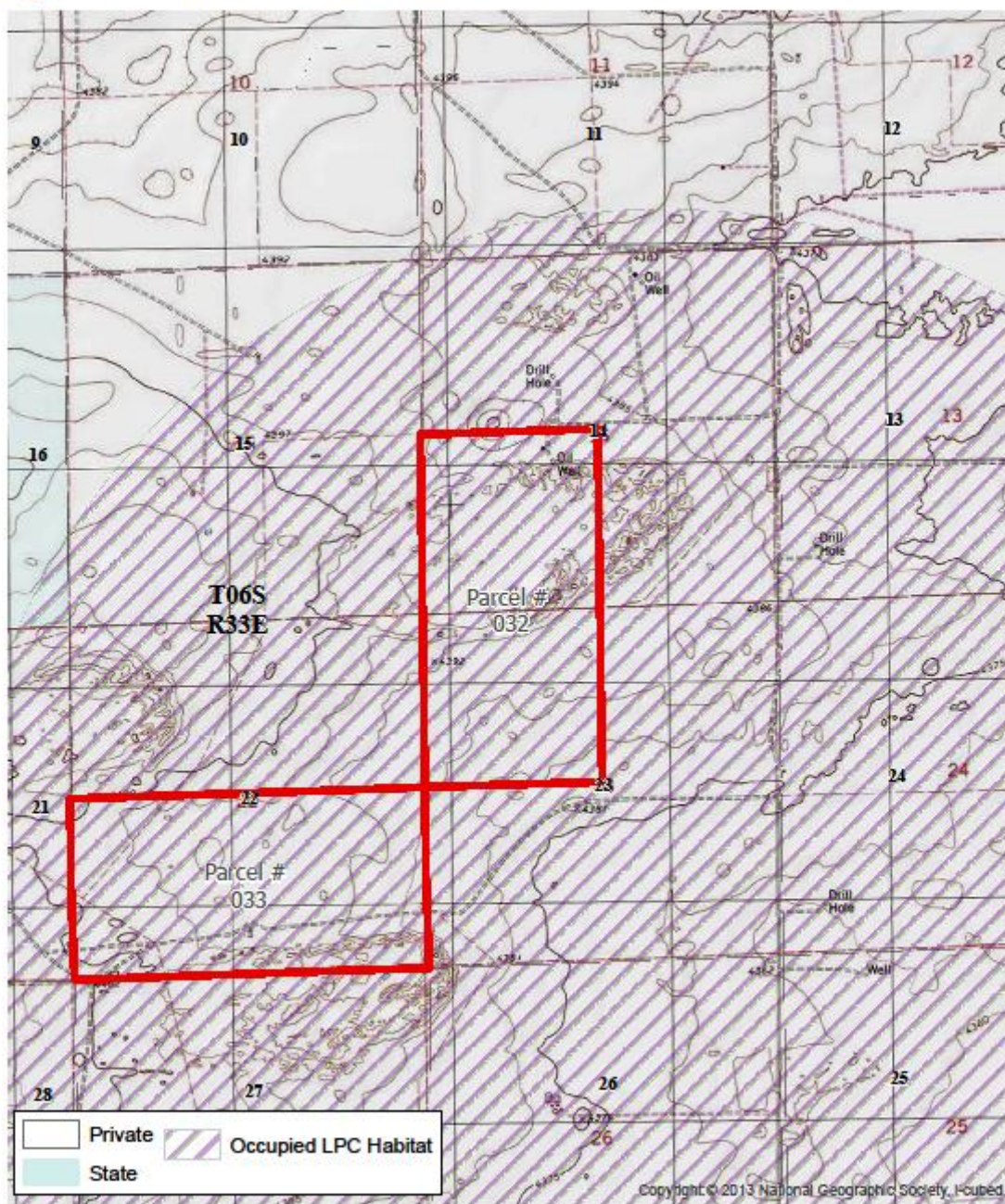
0 0.075 0.15 0.3 Miles

NM-201407-032

320 acres



Resource View (Topo)



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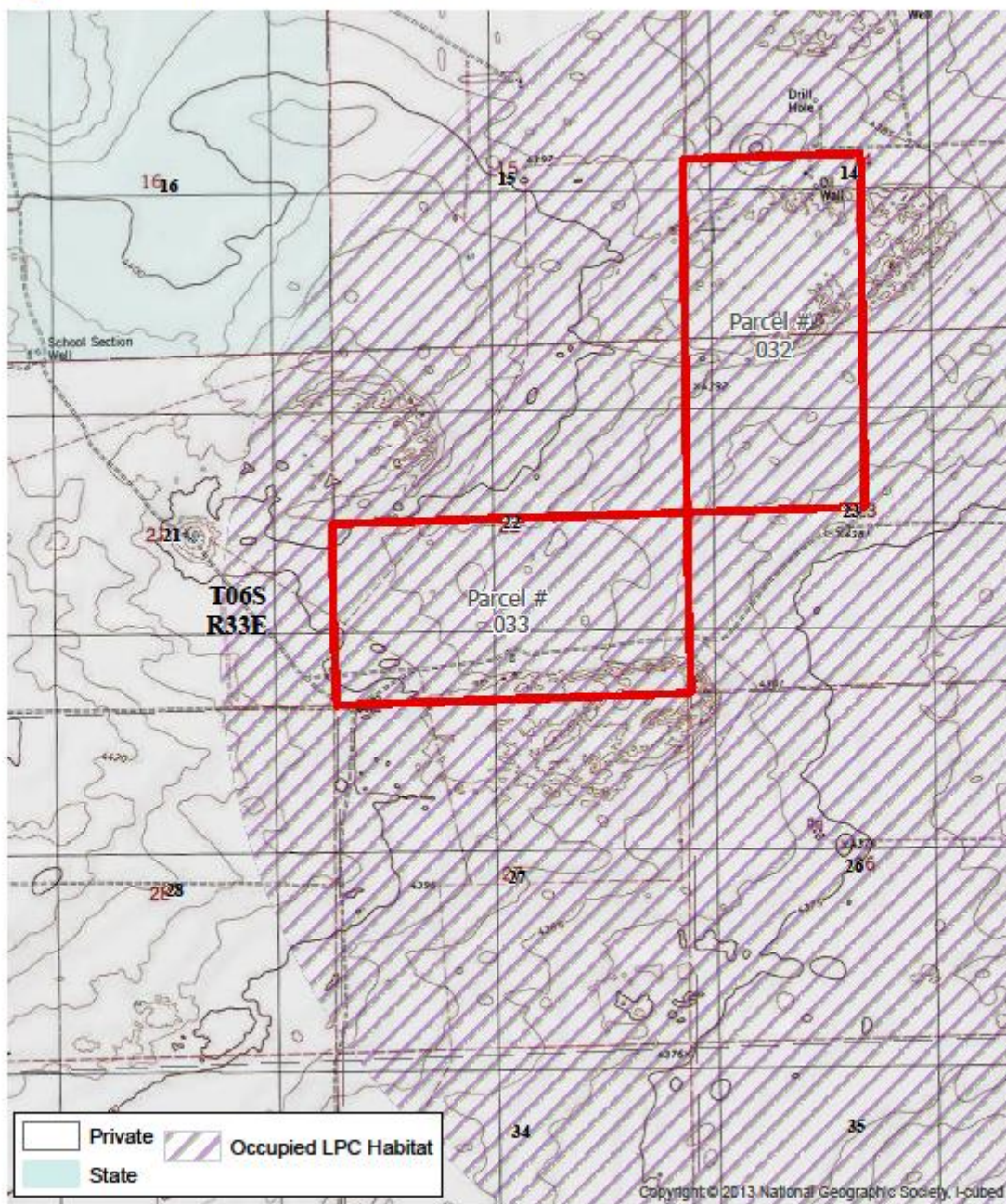
0 0.2 0.4 0.8 Miles

NM-201407-032

320 acres



Resource View (Topo)

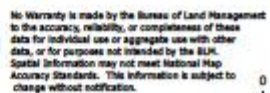


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0 0.2 0.4 0.8 Miles

NM-201407-033

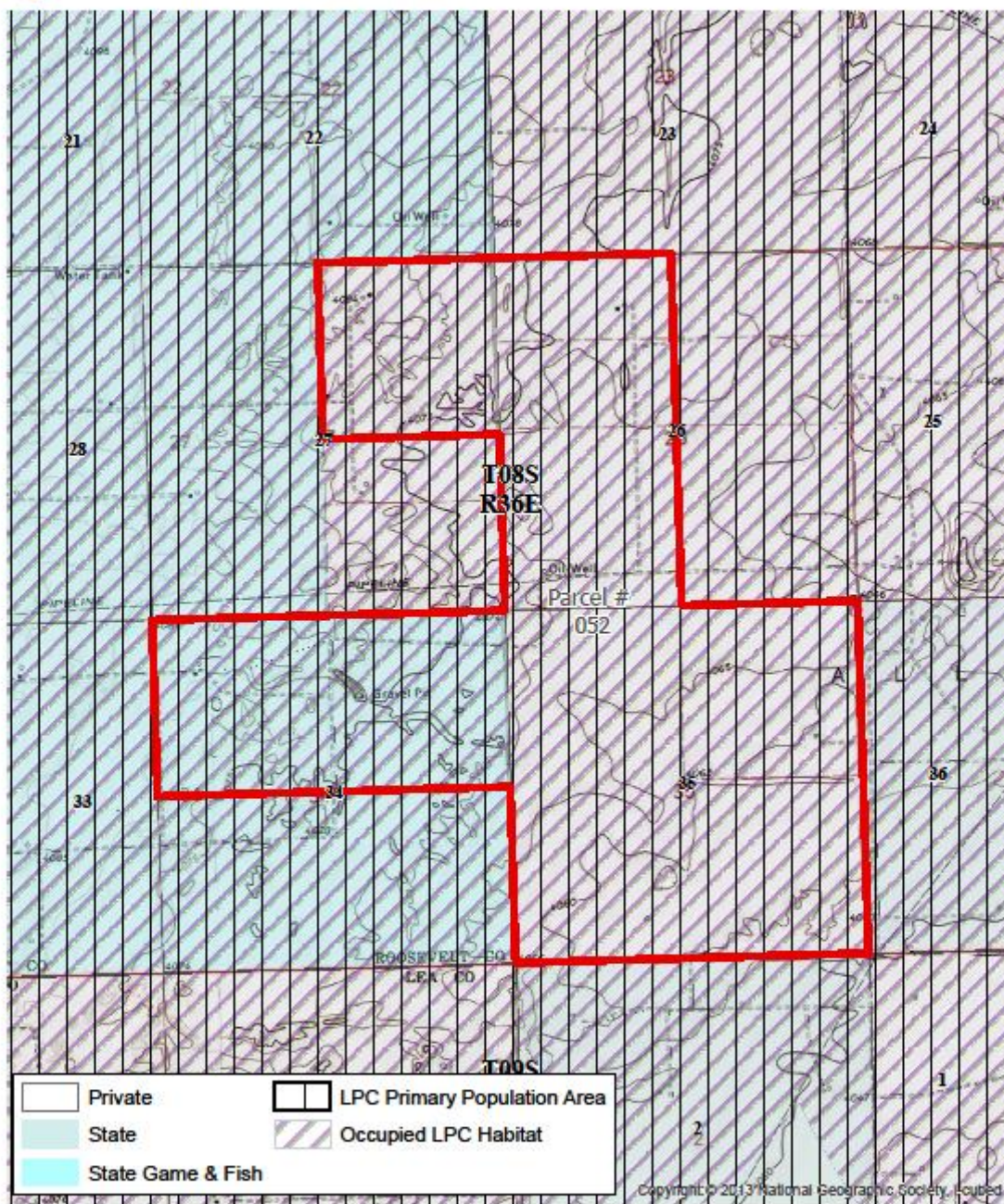
320 acres



80 acres



Resource View (Topo)



No Warranty is made by the Bureau of Land Management to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the BLM. Spatial Information may not meet National Map Accuracy Standards. This information is subject to change without notification.

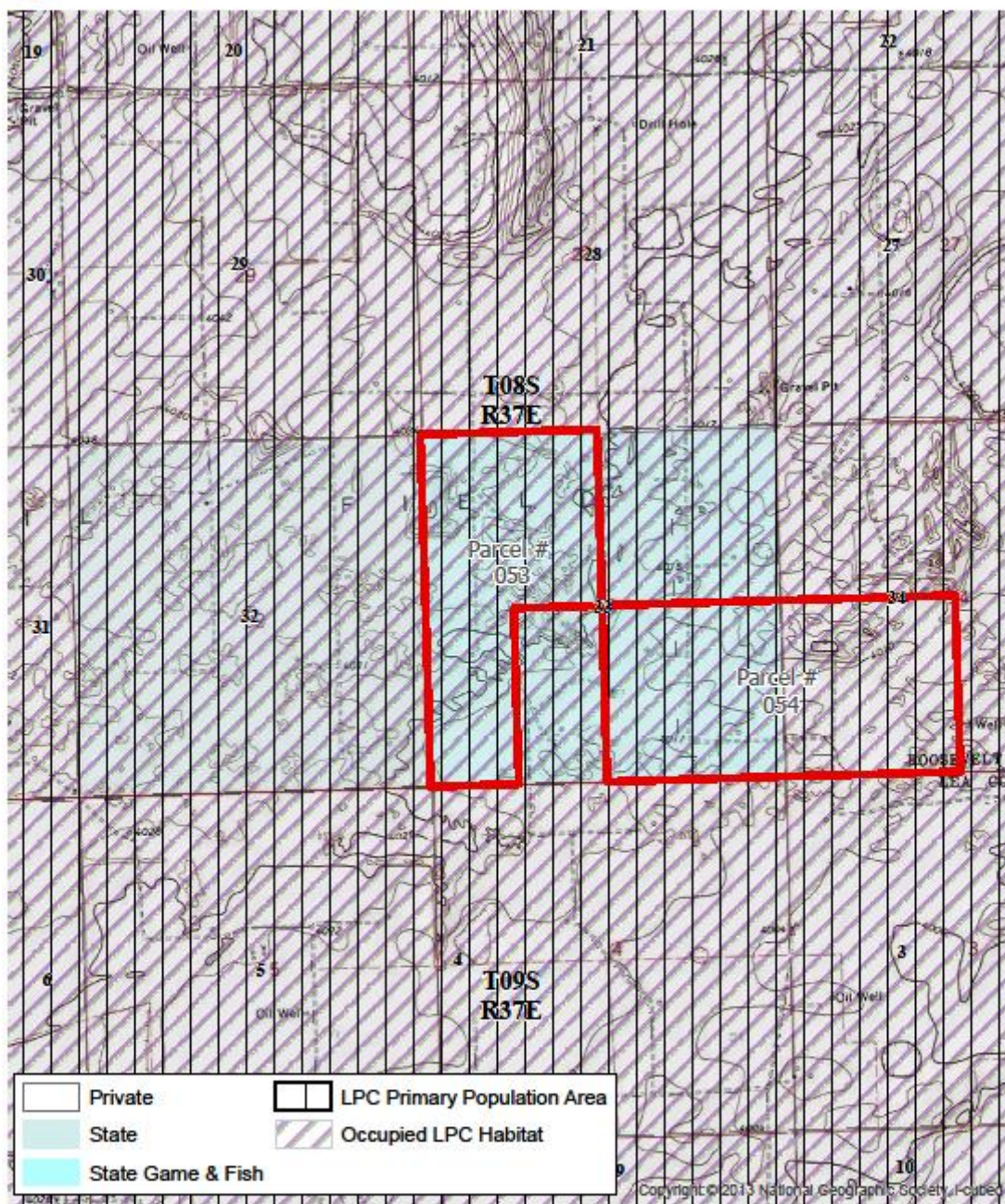
0 0.2 0.4 0.8 Miles

NM-201407-052

1440 acres



Resource View (Topo)



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0 0.2 0.4 0.8 Miles

NM-201407-053

240 acres

Aerial View (Photo)



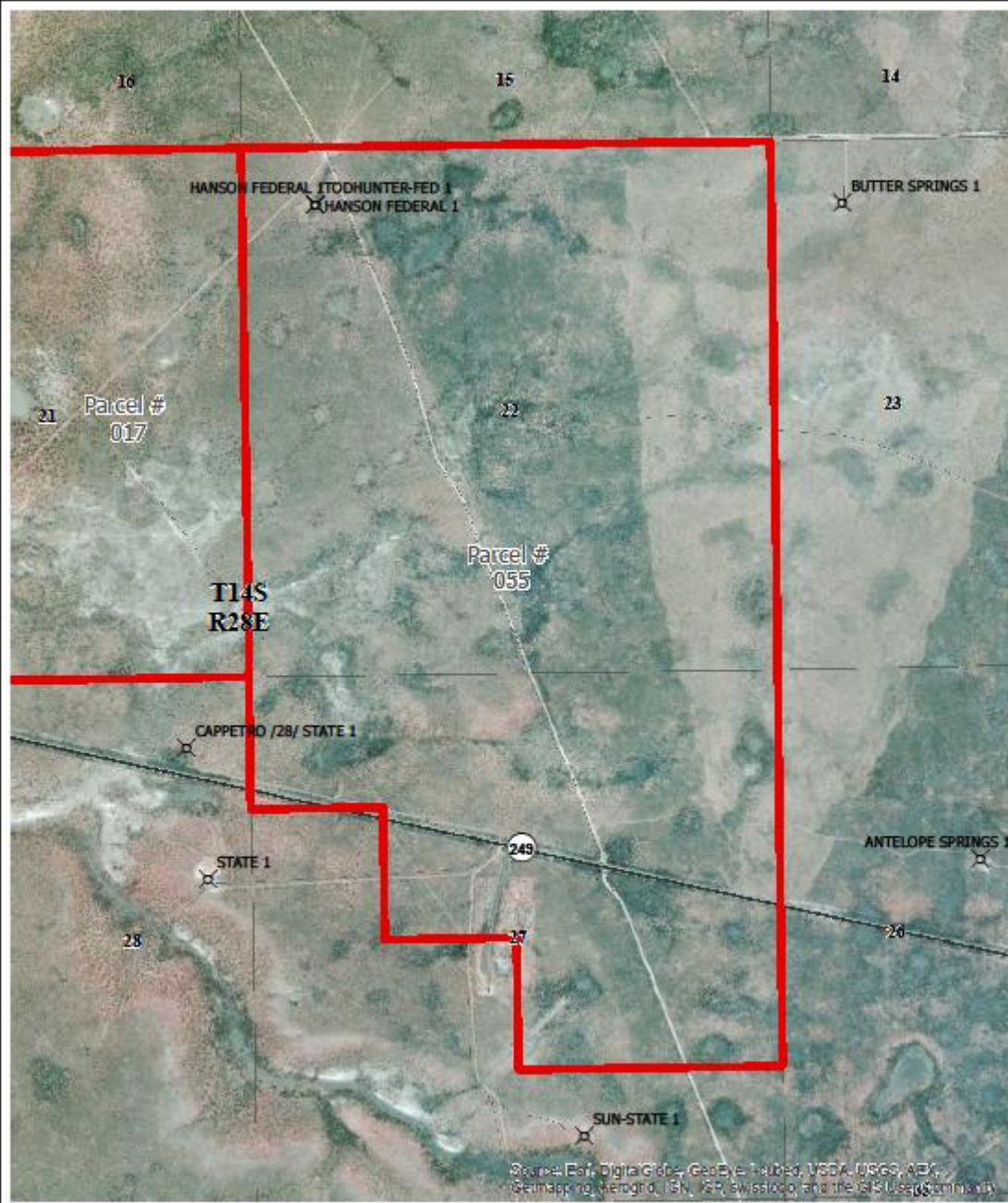
No Warranty is made by the Bureau of Land Management to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the BLM. Spatial information may not meet National Map Accuracy Standards. This information is subject to change without notification.

0 0.1 0.2 0.4 Miles

NM-201407-054

320 acres

Aerial View (Photo)



Source: Esri, DigitalGlobe, GeoEye, iSat, USDA, USGS, Aero, GeoMapping, AeroGRID, IGN, iSAR, SwissTopo, and the GIS User Community



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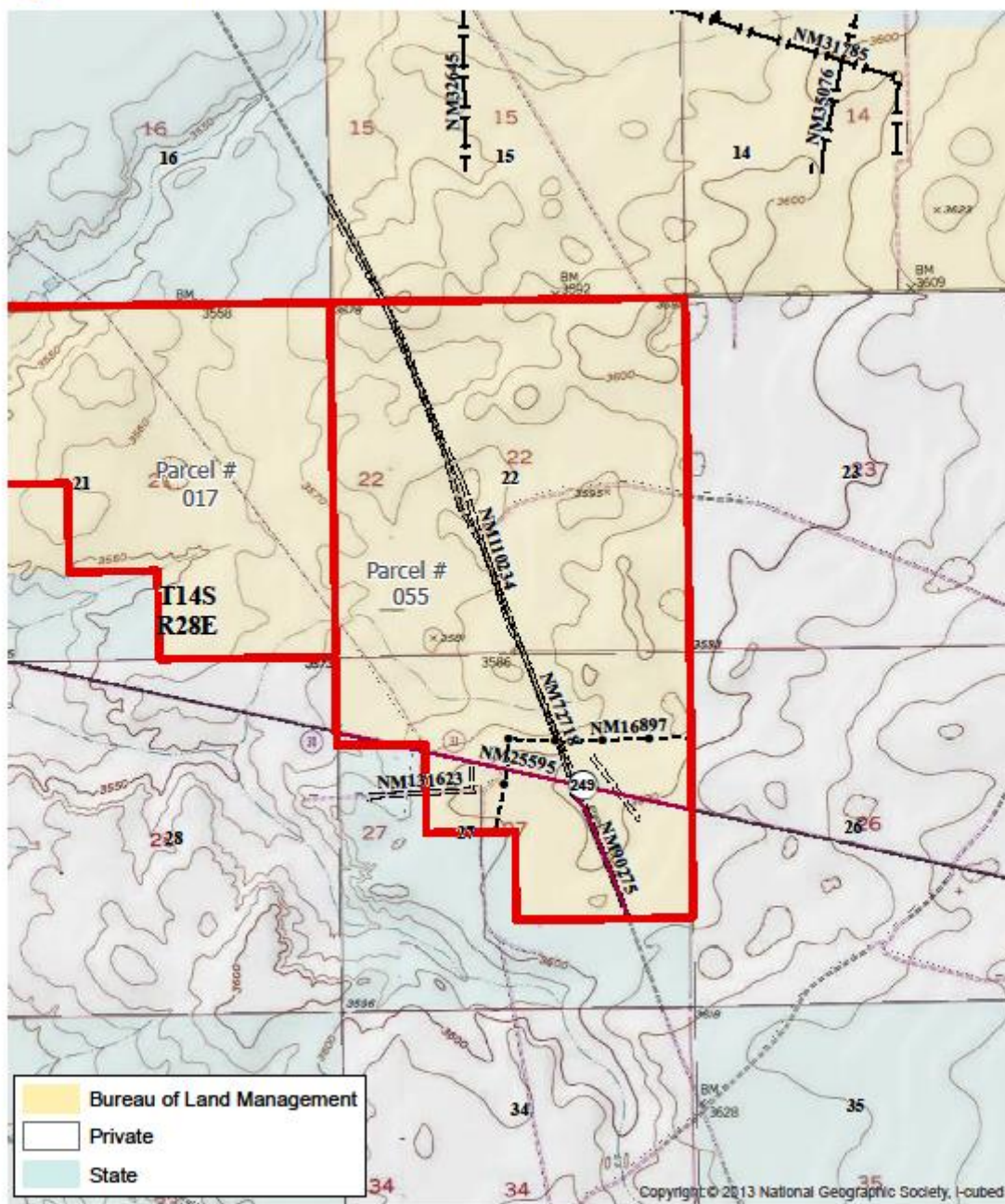
0 0.15 0.3 0.5 Miles

NM-201407-055

1000 acres



Resource View (Topo)



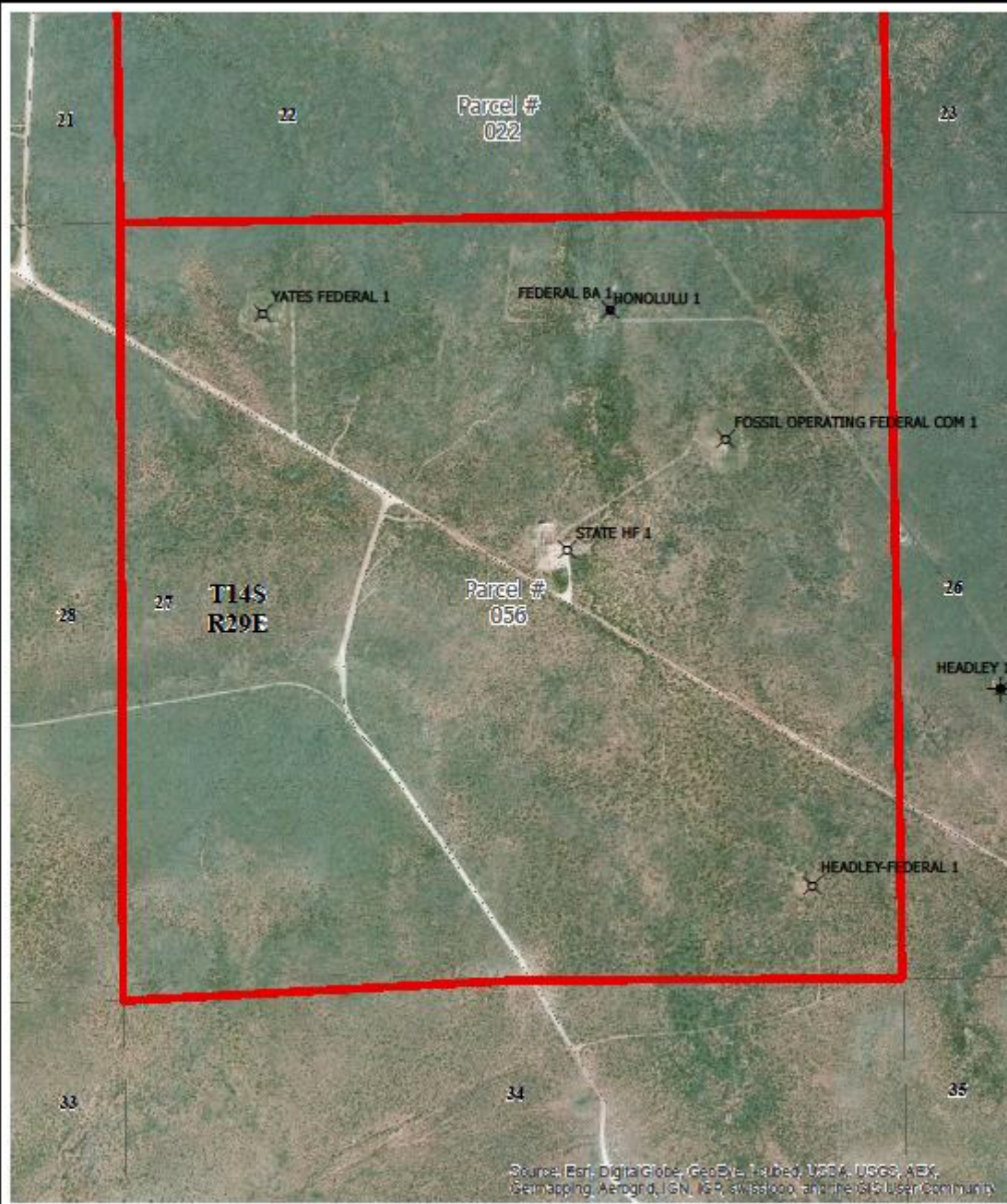
No Warranty is made by the Bureau of Land Management to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the BLM. Spatial Information may not meet National Map Accuracy Standards. This information is subject to change without notification.

0 0.2 0.4 0.8 Miles

NM-201407-055

1000 acres

Aerial View (Photo)



Source: Esri, DigitalGlobe, GeoEye, IGN, USDA, USGS, AEX, Geomatics, Aergrid, IGN, IGN, SwissTopo, and the GIS User Community



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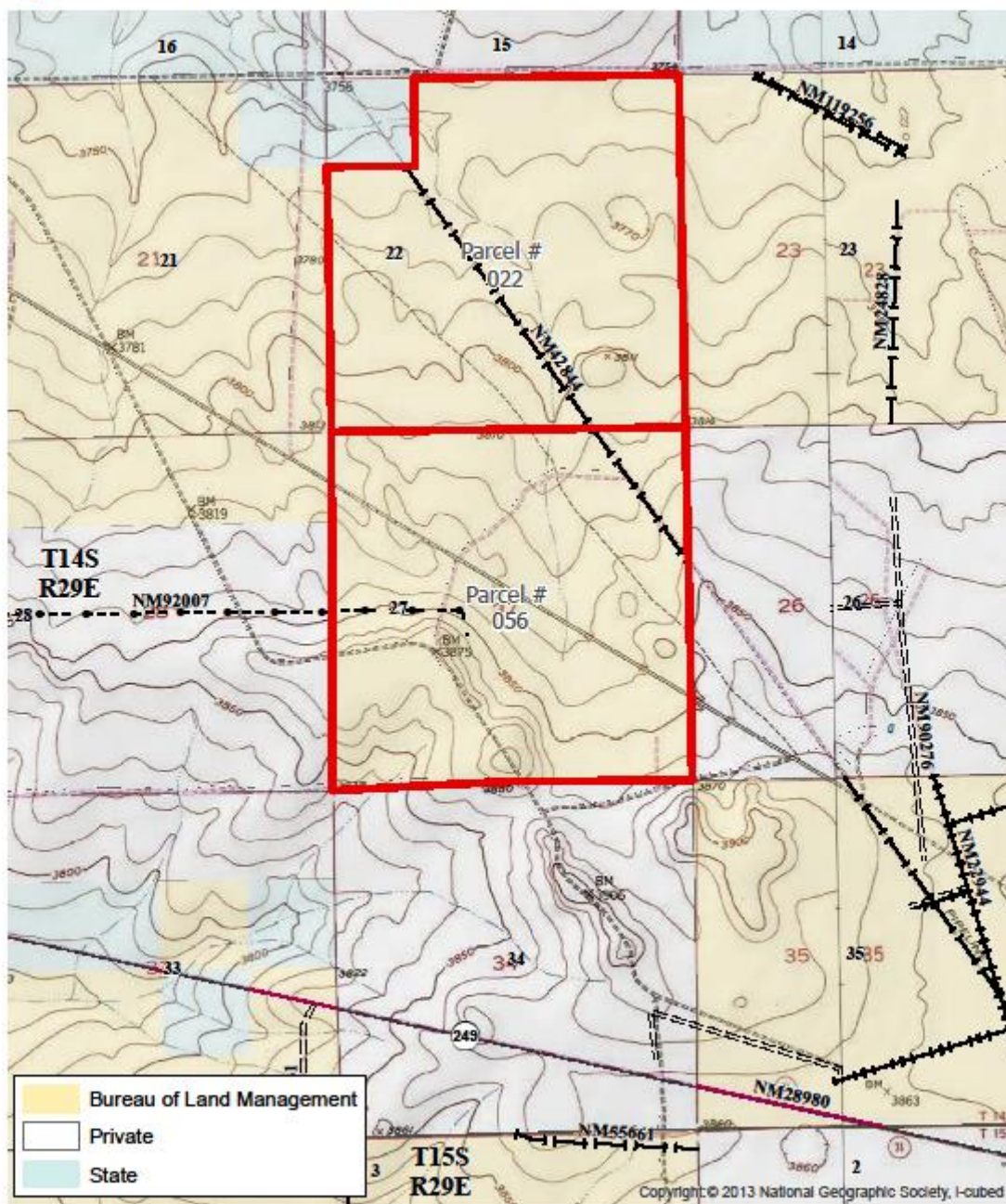
0 0.1 0.2 0.4 Miles

NM-201407-056

640 acres



Resource View (Topo)



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0 0.2 0.4 0.8 Miles

NM-201407-056

640 acres

Special Cultural Resource
Lease Notice

All development activities proposed under the authority of this lease are subject to compliance with Section 106 of the NHPA and Executive Order 13007. The lease area may contain historic properties, traditional cultural properties (TCP's), and/or sacred sites currently unknown to the BLM that were not identified in the Resource Management Plan or during the lease parcel review process. Depending on the nature of the lease developments being proposed and the cultural resources potentially affected, compliance with Section 106 of the National Historic Preservation Act and Executive Order 13007 could require intensive cultural resource inventories, Native American consultation, and mitigation measures to avoid adverse effects—the costs for which will be borne by the lessee. The BLM may require modifications to or disapprove proposed activities that are likely to adversely affect TCP's or sacred sites for which no mitigation measures are possible. This could result in extended time frames for processing authorizations for development activities, as well as changes in the ways in which developments are implemented.

LEASE NOTICE
POTENTIAL CAVE OR KARST OCCURRENCE AREA

All or portion of the lease are located in a potential cave or karst occurrence area. Within this area, caves or karst features such as sinkholes, passages, and large rooms may be encountered from the surface to a depth of as much as 2,000 feet, within surface areas ranging from a few acres to hundreds of acres. Due to the sensitive nature of the cave or karst systems of this area, special protective measures may be developed during environmental analyses and be required as part of approvals for drilling or other operations on this lease. These measures could include: changes in drilling operations; special casing and cementing programs; modifications in surface activities; or other reasonable measures to mitigate impacts to cave or karst values. These measures may be imposed in accordance with 43 CFR 3101.1-2; 43 CFR 3162.5-1; Onshore Oil and Gas Order No. 1; and Section 6 of the lease terms.

CONTROLLED SURFACE USE
STREAMS, RIVERS, AND FLOODPLAINS

Surface occupancy or use is subject to the following special operating constraints:

Surface disturbance will not be allowed within up to 200 meters of the outer edge of 100-year floodplains, to protect the integrity of those floodplains. On a case-by-case basis, an exception to this requirement may be considered based on one or more of the criteria listed below. The first three criteria would not be applied in areas of identified critical or occupied habitat for federally listed threatened or endangered species.

--Additional development in areas with existing developments that have shown no adverse impacts to the riparian areas as determined by the Authorized Officer, following a case-by-case review at the time of permitting.

--Suitable off-site mitigation if habitat loss has been identified.

--An approved plan of operations ensures the protection of water or soil resources, or both.

--Installation of habitat, rangeland or recreation projects designed to enhance or protect renewable natural resources.

For the purpose of: Protecting Streams, Rivers and Floodplains

On the lands described below:

CONTROLLED SURFACE USE
PLAYAS AND ALKALI LAKES

Surface occupancy or use is subject to the following special operating constraints:

Surface disturbance will not be allowed within up to 200 meters of PLAYAS of Alkali Lakes. Waiver of this requirement will be considered on a case-by-case basis for projects designed to enhance or protect renewable natural resources. An exception for oil and gas development will be considered if Playa lake loss was mitigated by the protection and development of another playa exhibiting the potential for improvement.

Mitigation could include:

installing fencing; developing a supplemental water supply; planting trees and shrubs for shelter belts; conducting playas basin excavation; constructing erosion control structures or cross dikes; or by improving the habitat in another area.

On the lands described below:

For the purpose of: Protecting Playas and Alkali Lakes

CONTROLLED SURFACE USE
SPRINGS, SEEPS AND TANKS

Surface occupancy or use is subject to the following special operating constraints:

Surface disturbance will not be allowed within up to 200 meters of the source of a spring or seep, or within downstream riparian areas created by flows from the source or resulting from riparian area management. Surface disturbance will not be allowed within up to 200 meters of earthen tanks or the adjacent riparian areas created as a result of the presence of the tanks. Exceptions to this requirement will be considered for the installation of habitat or rangeland projects designed to enhance the spring or seep, or downstream flows.

For the purpose of: Protecting Springs, Seeps and Tanks

CONTROLLED SURFACE USE
CAVES AND KARST

Surface occupancy or use is subject to the following special operating constraints:

Surface disturbance will not be allowed within up to 200 meters of known cave entrances, passages or aspects of significant caves, or significant karst features. Waiver of this requirement will be considered for projects that enhance or protect renewable natural resource values, or when an approved plan of operations ensures the protection of cave and karst resources.

For the purpose of: Protecting Caves and Karst Features

PRAIRIE CHICKENS

No surface use is allowed during the following time periods; unless otherwise specified. This stipulation does not apply to the operation and maintenance of production facilities.

On the land described below:

For the purpose of: Protecting Lesser Prairie-Chickens

Drilling for oil and gas, and 3-D geophysical exploration operations will not be allowed in Lesser Prairie Chicken Habitat during the period of March 1 through June 15, each year. During that period, between 3:00 a.m. and 9:00 a.m., other activities that produce noise and involve human activity, such as geophysical exploration other than 3-D operations, and pipeline, road, and well pad construction, will not be allowed. Noise producing activities which do not require a human presence, such as venting, flaring, or pumping, are exempt from the 3:00 a.m. and 9:00 a.m. restriction. Regardless of the time of year, exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 feet from the source of the noise.

VISUAL RESOURCE MANAGEMENT

Surface occupancy or use is subject to the following special operating constraints:

Painting of oil field equipment and structures to minimize visual impacts be conducted according to the requirements of Notice to Lessees (NTL) 87-1, New Mexico. Low profile facilities also may be required, when needed to reduce the contrast of a project with the dominant color, line, texture, and form of the surrounding landscape. Other surface facilities or equipment approved by the BLM, such as large-scale range improvements or pipelines, will be painted, when needed, to conform with the requirements of visual resource management to minimize visual impacts. Paint colors will be selected from the ten standard environmental colors approved by the Rocky Mountain Coordinating committee. The selected paint color will match as closely as possible the predominant soil or vegetation color of the area.

For the purpose of: Protecting Visual Resources Management

PLAN OF DEVELOPMENT (POD) STIPULATION

A plan of development (POD) for the entire lease must be submitted for review and approval, including NEPA analysis, by the BLM authorized officer, PRIOR to approval of development (APD, Sundry Notices) actions. The POD must indicate planned access to well facilities (roads, pipelines, power lines), and the approximate location of well sites. Should it become necessary to amend the POD, the amendment must be approved prior the approval of subsequent development action. Deviations from a current POD are not authorized until an amended POD has been approved by BLM.

For the Purpose of:

CONTROLLED SURFACE USE STIPULATION
PALEONTOLOGY

Surface occupancy or use is subject to the following special operating constraints:

~ Restrict vehicles to existing roads and trails.

~ A pedestrian survey must be conducted for paleontological material, using a qualified paleontologist as identified in BLM Handbook 8270, prior to any surface disturbing activity. A report on the results of the paleontological survey must be submitted and approved by BLM as part of the permit application for the proposed lease activity. The survey and report will be used to determine the presence of paleontological material, and if necessary, the appropriate treatments such as avoidance and/or project re-design during all phases of the proposed lease activity.

The lessee shall immediately notify the BLM Authorized Officer of any paleontological resources discovered as a result of operations under this authorization. The lessee shall suspend all activities in the vicinity of such discovery until notified to proceed by the Authorized Officer and shall protect the discovery from damage or looting. The Authorized Officer will evaluate, or will have evaluated, such discoveries after being notified. Appropriate measures to mitigate adverse effects to significant paleontological resources will be determined by the Authorized Officer after consulting with the operator. Upon approval of the Authorized Officer, the operator will be allowed to continue construction through the site, or will be given the choice of either (1) following the Authorized Officer's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the fossil resource, or (2) following the Authorized Officer's instructions for mitigating impacts to the fossil resource prior to continuing construction through the project area.

On the lands described below:

All Lands in Lease.

For the purpose of: Protecting paleontological resources.

If circumstances or relative resource value change or if it can be demonstrated that oil and gas operations can be conducted without causing unacceptable impacts, this stipulation may be waived, excepted, or modified by the BLM Authorized Officer, if such action is consistent with the provisions of the Roswell and Carlsbad Resource Management Plan as amended, or if not consistent, through a land use plan amendment and associated National Environmental Policy Act analysis document. If the BLM Authorized Officer determines that the waiver, exception, or modification is substantial, the waiver, exception, or modification will be subject to a 30-day public review period.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes.