Environment

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Ochoa Preference Right Lease Final Environmental Assessment

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AAQS	Ambient Air Quality Standards
ACHP	Advisory Council on Historic Preservation
amsl	above mean sea level
APE	Area of Potential Effect
AQCR	Air Quality Control Region
AQRV	Air Quality Related Value
ARMS	Archaeological Records Management Section
BEA	Bureau of Economic Analysis
BISON-M	Biota Information System of New Mexico
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FLETC	Federal Law Enforcement Training Center
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act
FMR	federal mineral royalties
FR	Federal Register
GHG	Greenhouse Gas
GRT	Gross Receipts Tax
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutant
HEA	Habitat Evaluation Area
HUC	Hydrologic Unit Code

ICP	Intercontinental Potash Corp. (USA)
IPA	Isolated Population Area
IPCC	Intergovernmental Panel on Climate Change
LANDFIRE	Landscape Fire and Resource Management Planning Tool
MACT	Maximum Achievable Control Technology
MLA	Mineral Leasing Act of 1920
MLRA	Major Land Resource Area
Mm^{-1}	Inverse Megameters
MOU	Memorandum of Understanding
MPO	Mine Plan of Operations
MSHA	Mine Safety and Health Administration
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEF	National Enrichment Facility
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act of 1966, as amended
NLCS	National Landscape Conservation System
NMAAQS	New Mexico Ambient Air Quality Standards
NMAC	New Mexico Administrative Code
NMACP	New Mexico Avian Conservation Partners
NMCRIS	New Mexico Cultural Resources Information System
NMDA	New Mexico Department of Agriculture
NMED-AQB	New Mexico Environment Department-Air Quality Bureau
NMHPD	New Mexico Historic Preservation Division
NMOSE	New Mexico Office of the State Engineer
NMSA	New Mexico Status Annotated
NMWQCC	New Mexico Water Quality Control Commission
NO_2	Nitrogen Dioxide
NP	National Park
NPA	National Programmatic Agreement
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NWMA	Noxious Weeds Management Act
O_3	Ozone
OCD	Oil Conservation Division
Pb	Lead

PFYC	Potential Fossil Yield Classification
PILT	Payments In Lieu of Tax
PM	Particulate Matter
PM_{10}	Particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 2.5 microns or less
ppm	Parts Per Million
PRLA	Preference Right Lease Application
PRPA	Paleontological Resources Preservation Act
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RFD	Reasonable Foreseeable Development
RMP	Resource Management Plan
RMPA	Resource Management Plan Amendment
ROD	Record of Decision
ROW	Right-Of-Way
SHPO	State Historic Preservation Office(r)
SO_2	Sulfur Dioxide
SOP	Sulfate Of Potash
SOPM	Sulfate Of Potash Magnesia
SPA	Secretary's Potash Area
TSP	Total Suspended Particulate
UNM	University of New Mexico
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
WBD	Watershed Boundary Dataset
WRCC	Western Regional Climate Center
WUS	Waters of the U.S.
$\mu g/m^3$	Micrograms per Cubic Meter

Contents

List of Tables

List of Figures

1.0 Introduction

1.1 Brief Project Description

Intercontinental Potash Corp. (USA) (ICP) is requesting the Bureau of Land Management (BLM) to approve its pending preference right lease applications beyond those located within the 50-year mine area analyzed in the Ochoa Mine Project EIS (BLM 2014a). The 50-year mine area and processing facilities were approved by the Ochoa Mine Project Record of Decision (ROD) (BLM 2014b). The preference right leases are almost entirely within Lea County with a small portion extending into Eddy County, and, as shown in **Figures 1-1** and **1-2**. This proposal does not request authorization of surface disturbance nor does it approve a new mine.

The proposed issuance of the leases for future subsurface mining is evaluated in this environmental assessment (EA) under BLM guidance that meets the requirements of the National Environmental Policy Act (NEPA) of 1969 and the 1988 Carlsbad Resource Management Plan (RMP).

As a result of issuance of the remaining preference right leases, it is anticipated that expanding the mine into the remaining leases beyond the approved 50-year mine area would extend mining and processing operations longer than 50 years. The mine and processing facilities would continue to be operated as described in Section 2.4.2 of the Ochoa Mine Project Final EIS (BLM 2014a). Should a change to the approved Mine Plan of Operations (MPO) be required in the future, such as the extension of mining beyond the 50-year mine area, federal law requires that new NEPA analysis would be performed to disclose potential impacts.

For the purposes of disclosure of potential impacts that would be likely to result from issuance of the preference right leases under consideration, this EA will analyze the indirect effects of developing the mine. Because the Ochoa Mine would be a subsurface mine, it is assumed that no surface disturbance would occur. Therefore, the primary issues to be analyzed would be land subsidence, groundwater demands, and potential conflicts with existing and future fluid mineral extraction, exploration, and development. Any future surface disturbance that may be necessary as the mine is developed, such as the construction of roads or shafts, would require additional NEPA analysis when site-specific proposals are submitted.

1.2 Background

The Ochoa leasing area under consideration located about 40 miles east-southeast of Carlsbad, New Mexico, 20 miles west of Jal, New Mexico. ICP is requesting issuance of 52 federal preference right leases totaling 43,449 acres that are currently identified as preference right lease applications. ICP holds 7 state mineral leases totaling 27,804 acres from the New Mexico State Commissioner of Public Lands and 15 federal preference right leases totaling 14,774 acres issued by the BLM.

Issuance of the federal preference right leases subsequent to completion of the ROD enables the extraction of polyhalite in Lea and Eddy counties, New Mexico (shown in grey on **Figures 1-1** and 1-**2**). The proposed leasing area consists of the preference right lease applications beyond those lease boundaries issued subsequent to completion of the Ochoa Mine Project ROD (BLM 2014b). The leases to be analyzed in this EA include the areas of preference right lease applications submitted by ICP extending from the approximate 50-year mine area analyzed in the EIS to the outside edge of the lease applications. There is a small amount of overlap or gap where the 50-year mine area does not line up with the lease boundaries because they are issued along section or quarter-section lines (**Figures 1-1** and 1-**2**). The project spans portions of 15 township-range blocks (T24S R34E, T24S R33E, T24S R32E, T23S R34E, T23S R33E, T23S R32E, T23S R31E, T22S R31E, T22S R32E, T22S R33E), with federal mineral rights totaling 43,449 acres.

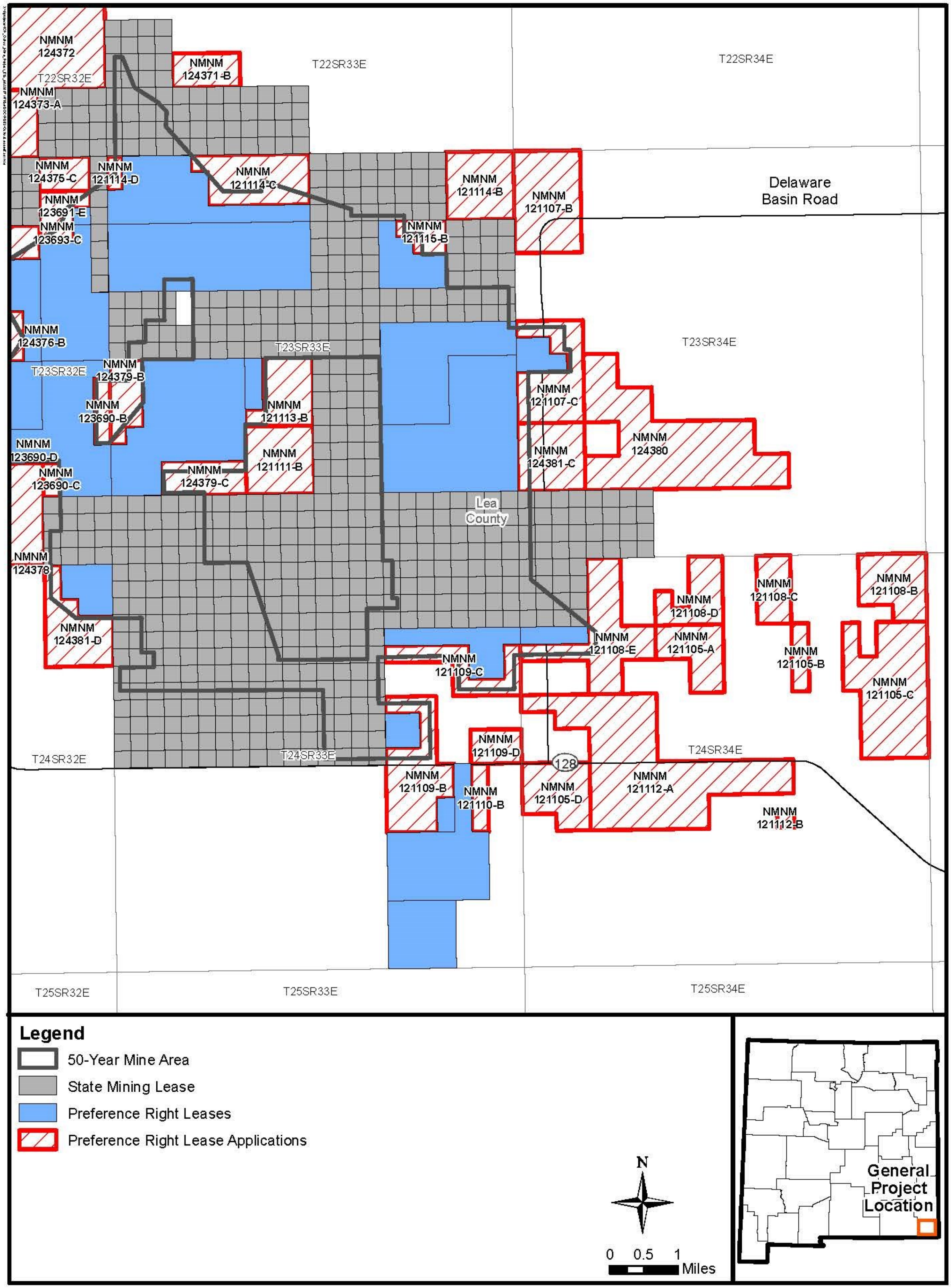


Figure 1-1 Eastern Portion of Ochoa Preference Right Lease Application Boundaries and 50-year Mine Area

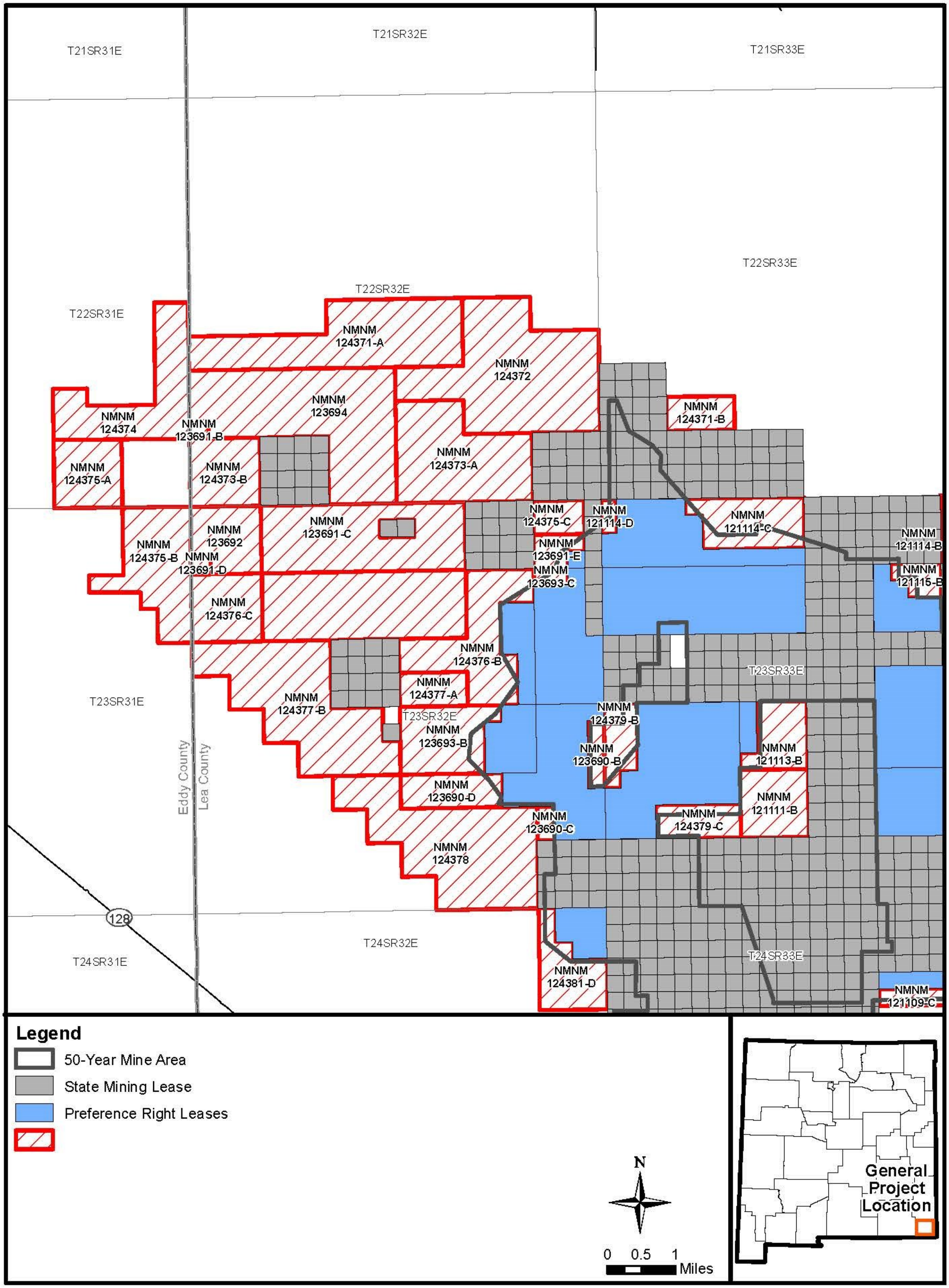


Figure 1-2 Western Portion of Ochoa Preference Right Lease Application Boundaries and 50-year Mine Area

ICP submitted the MPO to the BLM on September 30, 2011 that detailed its proposal to construct and operate an underground mine to extract polyhalite ore for the purpose of producing sulfate of potash (SOP) and sulfate of potash magnesia (SOPM). The Ochoa Mine Project EIS (BLM 2014a) disclosed the impacts of implementing the MPO, including construction of the processing facilities and associated mining structures, water demands and well locations, and requested ROWs for a 50-year period of operations. The MPO was approved by the BLM when the ROD was signed on April 10, 2014.

1.3 Purpose and Need for the Project

The BLM is responsible for the balanced management of the public lands and resources and their various values in a fashion that will best serve the needs of the American people. Management is based upon the principles of multiple use and sustained yield; combinations of uses that take into account the long-term needs of future generations for renewable and nonrenewable resources (BLM 1997).

Under the NEPA, there is a requirement to present the purpose and need for a proposed project. The “Regulations for Implementing NEPA” from the Council on Environmental Quality (CEQ), 40 Code of Federal Regulations (CFR) §1502.13, state the following about the description of the purpose and need in an EA.

> *“The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action.”*

The purpose and need statement is intended to explain the reason that the proposed project is needed by the lead agency (BLM in this case) and serves as the basis for developing a reasonable range of alternatives to be analyzed in detail.

Potash is an important industrial mineral in wide demand in the U.S. and internationally. The BLM has the responsibility for the orderly and economic development of leasable minerals, including potash, as specified under 30 United States Code (USC) § 21a, the Mineral Leasing Act of 1920 (MLA), as amended, and the Federal Land Policy and Management Act (FLPMA) of 1976 (P.L. 94-579, 43 USC 35).

The purpose of the action is to provide access for technically viable development of the federal potash resources, as required by federal law and BLM policy. The BLM will evaluate and respond to ICP’s request (Proposed Action) to approve pending preference right lease applications.

1.4 Decisions to be Made

This EA provides the analysis upon which the BLM can base its decision. The decision to be made by the BLM is whether to approve ICP’s pending preference right lease.

1.5 Authorizing Laws and Regulations, Relationship to Policies, Plans, and Programs

1.5.1 Resource Management Plans

The BLM has the responsibility and authority to manage the surface and subsurface resources on public lands located within the jurisdiction of the Carlsbad Field Office. The Carlsbad Resource Management Plan (RMP) (BLM 1988) designated lands within the proposed project area as open for mineral exploration and development. Under Continuing Management Guidance for Energy and Mineral Resources, the RMP states that the “BLM will encourage and facilitate the development by private industry of public land mineral resources so that national and local needs are met, and environmentally sound exploration, extraction, and reclamation practices are used.”

Development of a new RMP was started in June, 2010, but until it is finalized, the 1988 RMP and any subsequent amendments remain in effect. Decisions made at the end of this Ochoa Preference Right Lease EA process will be carried forward into the revised RMP.

1.5.2 Preference Right Leasing

The federal government has a two-tiered system for leasing of solid leasable minerals, except coal, and asphalt. In regions where the existence and feasibility of extracting mineral deposits is known, leases are issued on a competitive basis. Where the existence and feasibility of extracting mineral deposits is unknown, an applicant can obtain a prospecting permit to explore for federal minerals. If the exploration discovers a valuable deposit, an application can be submitted for a preference right lease, which allows the discoverer of the deposit to obtain the lease without competition.

Once a prospecting permit has been issued and a preference right lease application has been submitted by the discoverer, the federal government is obligated to process the application and issue the lease if a valuable deposit has been found. A valuable deposit is defined in 43 CFR 3501.5 as “an occurrence of minerals of such character that a person of ordinary prudence would be justified in the further expenditure of his or her labor and means, with a reasonable prospect of success in developing a profitable mine.” As part of the federal process, the applicant is required to submit evidence that the deposit exists and there is a reasonable expectation that the deposit can be developed into a profitable mine. Such a reasonable expectation can be proven by evidence that a similar deposit has recently been mined or is being developed for mining, or that recent available mining costs (including environmental mitigation and reclamation), marketing costs, and product price information yield a reasonable expectation of establishing a profitable mining project. The final step before the federal government grants a preference right lease, subsequent to any decisions made under NEPA, requires the applicant to demonstrate that the mine will be profitable after implementing the terms and conditions issued as part of the lease, including the required mitigation and reclamation measures identified in the agency decision document.

The BLM Mineral Report (BLM 2014c) completed in 2014 concludes that there is a valuable deposit meeting federal regulations and recommends that 74,468.47 acres of federal prospecting permits be converted to preference right leases. Subsequent to the completion of the Ochoa Mine Project ROD and the Mineral Report, the BLM issued 15 preference right leases totaling 14,774 acres that corresponded more or less with the boundaries of the 50-year mine area that was analyzed in the Ochoa Mine Project EIS.

1.5.3 Other Applicable Federal Laws and Regulations

BLM authority for land management derives from the FLPMA. General BLM regulations are described in 43 CFR, Subtitle B—Regulations Relating to Public Lands, Chapter II—BLM, USDI. BLM regulations for the management of mining on federal potash leases are included in 43 CFR Subpart 3590, Solid Minerals (Other Than Coal) Exploration and Mining Operations—General. Subpart 3592.1, Operating Plans. Potash is a solid leasable mineral that is managed by BLM under the authority of the MLA, as amended, the Potassium Leasing Act of 1927, and, in southeastern New Mexico, Secretarial Order 3324 Oil, Gas, and Potash Leasing and Development within the Designated Potash Area. The MLA establishes qualifications for mineral lessees, defines maximum limits on the total acres of a mineral that can be held by a lessee, and authorizes the BLM to grant these leases. Federal regulations that pertain to leasing these minerals are contained in 43 CFR Part 3500, Leasing of Solid Minerals Other than Coal and Oil Shale.

Other major federal and state regulations and permits that are relevant to the proposed project include those listed in **Table 1-1**, which is not all-inclusive.

Table 1-1 Major Federal and State Laws, Regulations, and Applicable Permits

Regulation	Brief Description	Applicable Permit or Action
NEPA (P.L. 91-190) and CEQ – Regulations for Implementing NEPA (40 CFR Parts 1500 – 1508)	Disclosure of the potential impacts of federal actions on the human environment to the decision makers and the public to ensure that informed decisions are based on science.	EA
Solid Waste Disposal Act, as amended by Resource Conservation and Recovery Act (RCRA), 42 USC 6901 et seq. delegated to the state and implemented under New Mexico Hazardous Waste Act	Regulation of hazardous waste storage, treatment, and disposal.	Hazardous Waste Permit

1.6 Scoping and Public Participation

1.6.1 Internal Scoping

The BLM Carlsbad Field Office interdisciplinary team met to discuss the external comments and to formulate alternatives to be analyzed in the EA. BLM staff coordinated on March 31, 2015 to discuss possible alternatives to be evaluated in the EA and to identify resource specific issues of concern to the BLM and to discuss how to formulate the alternatives to be analyzed in detail in the EA. It was determined at this meeting that alternatives would consist of the Proposed Action and the No Action Alternative. The primary resource issues to be analyzed in this EA were agreed during this meeting to be those listed below.

- Geology and Minerals: Land subsidence and its effects on surface resources.
- Geology and Minerals: Potential conflicts with existing and future fluid mineral extraction exploration and development.
- Water: Groundwater drawdown from increased groundwater demands.

1.7 Resources and BLM Programs Not Analyzed in the EA

The following resources and BLM programs are not analyzed in the EA because they do not exist in the project area and would not be affected by the proposed project.

- Areas of Critical Environmental Concern—none are currently identified and managed by the BLM in the leasing area and none are proposed in the leasing area for consideration in the current RMP revision process.
- Lands with Wilderness Characteristics—none exist in the project area or would be affected by the proposed project based on the initial BLM inventory completed in 1979. This inventory is being updated as part of the Resource Management Plan revision process.
- National Landscape Conservation System (NLCS)—there are no areas associated with the leasing area that are within the NLCS, including National Conservation Areas, National Monuments, Wild and Scenic Rivers, Wilderness Areas, Wilderness Study Areas, and National Scenic and Historic Trails. There are no wilderness areas managed by other federal agencies in the vicinity.

- Caves and Karst—while there are some karst features in the vicinity, the leasing area is located in an area of low potential as defined by the BLM. The closest area with high potential for caves and karst is west of the Pecos River.

- Recreation, Lands and Realty, Grazing, and Visual—these resources will not be analyzed because approval of the leases would not result in surface disturbing activities.

Soils, Vegetation, Wildlife, and Cultural Resources will be described in Chapter 3 to provide context to the leasing area setting. Because they would not be affected directly or indirectly by issuance of the preference right leases, they will not be analyzed in the impact analysis in Chapter 4.

2.0 Proposed Action and Alternatives

This chapter describes the components of the alternatives analyzed in detail. In compliance with NEPA guidance, the analysis must consider at least No Action and Proposed Action alternatives.

2.1 No Action Alternative

The No Action Alternative would deny the approval of ICP's preference right lease applications. ICP would continue mining activities in the project area as approved under the Ochoa Mine Project ROD (BLM 2014b). Under this alternative, current land and resource uses in the project area would continue to be managed under the 1988 Carlsbad RMP and applicable amendments.

There are several circumstances that could lead to the selection of the No Action Alternative in compliance with 43 CFR 3507.19. The effect of the occurrence of these circumstances would be evaluated in this EA.

- If it is determined that the polyhalite cannot be economically recovered under the lease terms required by the BLM, then the existence of a valuable deposit would not be demonstrated and no preference right leases would be issued.
- If it can be demonstrated that the lease is not in the public interest, then the preference right leases would not be issued and other leases may be offered in exchange.

2.1.1 Alternative A—Proposed Action

2.1.1.1 Preference Right Lease Applications

The Proposed Action would include approval of ICP's 52 pending preference right lease applications totaling 43,449 acres shown on **Figures 1-1** and **1-2**. Issuance of these leases would enable ICP to plan for mining the federal minerals to extract polyhalite, but would not authorize surface disturbance activities. Before extraction of the polyhalite ore could occur, the MPO must be revised, evaluated in compliance with NEPA, and approved by the BLM. Future surface disturbance in support of developing these leases would require site-specific NEPA analysis and BLM approval.

2.1.1.2 Coordination and Management Requirements

As stated in Section 2.0 of the Ochoa Mine Project ROD (BLM 2014b), ICP will comply with the management practices for co-development to ensure coordination of mining with oil and gas development. These practices would also apply to mining the expanded mine area should the preference right lease applications be approved. They include the following to be performed by ICP.

- Establish 200-foot barrier pillars around all producing and plugged and abandoned oil and gas wells.
- Implement gassy mine standards under Category IV of the Mine Safety and Health Administration (MSHA), 30 CFR Part 57.22003.
- Develop a Memorandum of Understanding (MOU) with each oil and gas lessee and owner within the potential mine subsidence area to detail mutual coordination and management specific to each company and location of facilities.
- Establish benchmarks for measuring successful co-development in consultation the BLM.
- Prepare 5-year development plans for the mine and oil and gas development within the mine area and potential subsidence area and sharing among the companies.

- Establish post-mining drilling islands to use for oil and gas wells.
- Submit reports on co-development efforts and activities to the BLM at least semi-annually.

Overall co-development of fluid and solid mineral extraction would be managed by the BLM using the following practices.

- Host meetings with all stakeholders in the vicinity of the mine to review the co-development process and discuss resource concerns. These coordination meetings will be held at least annually.
- Encourage the development of MOUs between ICP and other stakeholders that may be affected by the mine and processing facilities. This may include companies that own and maintain infrastructure such as pipelines and roads, as well as landowners and state agencies with wells, roads, and structures within the potential subsidence area.
- The BLM will facilitate an appropriate dispute resolution (ADR) process based on BLM guidance, Collaborative Stakeholder Engagement and Appropriate Dispute Resolution Guide (BLM 2009).

2.2 Alternatives Considered but Eliminated from Detailed Analysis

The preference right lease application boundaries are set by the previous leasing process and no alternative locations are under consideration. No alternatives to the No Action and Proposed Action alternatives were recommended by members of the BLM Interdisciplinary Team. Therefore, no other alternatives were considered.

2.3 Reasonably Foreseeable Future Actions

The impacts of reasonably foreseeable future actions in the vicinity of the proposed project need to be considered in combination with the proposed Project to aid in the analysis of cumulative effects in the region. Reasonably foreseeable future actions are those that are known by the BLM at the time this EA was developed. While it is assumed that current activities, such as livestock grazing and dispersed recreation, would continue into the foreseeable future, the primary known future activity would be oil and gas development and mining. Mining, oil and gas, and other energy development such as uranium enrichment and solar energy are key elements of the existing regional economy and social conditions. Other historically and economically important segments of the region’s economic base are agriculture, recreation, tourism, and more recently in the Carlsbad area, retirement migration to the area. Ongoing and proposed construction at the URENCO National Enrichment Facility (NEF) near Eunice also has the potential to create cumulative social and economic effects.

There are active oil and gas plays that overlap the leasing area. The Reasonable Foreseeable Development (RFD) Scenario for the BLM New Mexico Pecos District (Engler et al. 2012) estimated that future drilling potential is low in the vicinity of the project area with an area of moderate drilling potential to the south and east of the project area. However, a recent update to the RFD Scenario (Engler and Cather 2014) concluded that “the Southeast New Mexico portion of the Permian Basin is extremely active and has some of the highest potential in the United States for development in the near future.” This activity in the vicinity of the leasing area is due to high development of the unconventional oil plays in the Bone Spring, Yeso, and Delaware, and the use of brackish water for completion. Therefore, more oil and gas development of the leasing area must be considered reasonably foreseeable.

3.0 Description of the Affected Environment

3.1 Introduction

This chapter describes the environment that would be affected by the development of the Proposed Action in this EA. The baseline information summarized in this chapter was obtained from published and unpublished materials, and leans heavily upon the Ochoa Mine Project EIS (BLM 2014a). The affected environment for individual resources was delineated based on the area of potential direct and indirect environmental impacts for the Proposed Action.

In general, the descriptions of the affected environment focus on the land within the leasing area boundary shown in **Figures 1-1** and **1-2**. For resources such as soils and vegetation, the affected area was determined to be the physical location and immediate vicinity of the leasing area boundary. For other resources such as water, air quality, and social and economic values, the description of the affected environment is more extensive (e.g., watersheds, climate, local communities). Recreation, Lands and Realty, Livestock Grazing, and Visual Resources will not be discussed in this chapter because approval of the preference right lease applications would not be affected by leasing or the subsequent mine development. Soils, Vegetation, Wildlife, and Cultural Resources are described in Chapter 3 to provide context to the setting, but would not be affected by the leasing decision, and therefore are not analyzed in Chapter 4.0.

3.2 Geology and Minerals

3.2.1 Regional and Leasing Area Geology

The following subsections provide an overview of the geology and topography of the analysis area and describe the important geologic features in the leasing area that are relevant to the proposed project.

3.2.1.1 Physiography and Topography

The preference right lease applications are located in the Pecos Valley Section of the Great Plains Physiographic Province (Fenneman 1928). The Pecos Valley Section is located between the High Plains on the east, the Raton Section to the north, the Edwards Plateau on the south, and the Mexican Sacramento Section of the Basin and Range Province on the west (Trimble 1990). The boundary between the Pecos Valley and the High Plains is the Mescalero Ridge, a prominent escarpment that rises 100 to 200 feet above the valley. The Pecos Valley is characterized by rolling hills and mesas. Another prominent feature of the lower half of the valley is the presence of karst topography typified by sinkholes, caves, and enclosed depressions (Hill 1996). The karst topography resulted from the dissolution of evaporite deposits and limestone in the subsurface.

Although caves and karst exist in the vicinity of the leasing area, the potential for caves and karst features is believed to be low, primarily because the Rustler Formation (the primary formation that hosts caves further west) is buried too deeply for cave entrances to reach the surface. More physiographic and topographic detail is found within Section 3.2.1 of the Ochoa Mine Project EIS (BLM 2014a).

3.2.1.2 Regional Geology

The preference right lease applications are located in the Delaware Basin, a sub-basin of the greater Permian Basin of west Texas and New Mexico (see **Figure 3-1**). The Delaware Basin is bounded on four sides by basement uplifts that include the Marathon Fold Belt to the south, the Diablo Platform on the west, the Northwest Shelf to the north, and the Central Platform to the east (Montgomery et al. 1999). The sedimentary rocks in the basin dip gently to the south and east and the deepest part of the basin is on the southeast side in Pecos County, Texas (**Figure 3-2**). The Delaware Basin contains up to 30,000 feet of sedimentary rock with deposits ranging in age from Cambrian to Quaternary (Hill 1996; Roche 1997). The Precambrian basement consists mainly of granitic and metamorphic sedimentary rocks, but volcanic rocks also may be present. The Paleozoic section from Cambrian to Pennsylvanian consists of clastic and carbonate rocks deposited in a variety of environments including continental, shallow marine, shelf, and basin. The pre-Permian rocks are largely known from the drilling of the deeper oil and gas wells, but there are limited surface outcrops in mountains and uplifts generally 50 to over 100 miles to the west, southwest, and south of the leasing area (Hayes 1964).

3.2.1.3 Leasing Area Geology

The important units within the leasing area consist of Permian rocks of the Guadalupian and Ochoan Series, which are described below. The units are categorized by their locations relative to the Capitan Reef, which marks the transition from shelf (back reef) to reef (basin margin) to basin. The stratigraphic correlation diagram is shown in **Table 3-1**. The leasing area lies along the basin margin-reef area, defined by the Capitan Limestone, which partially composes the Capitan Reef Complex. Further description of the leasing area geology is found in Section 3.2.1.3 of the Ochoa Mine Project EIS (BLM 2014a).

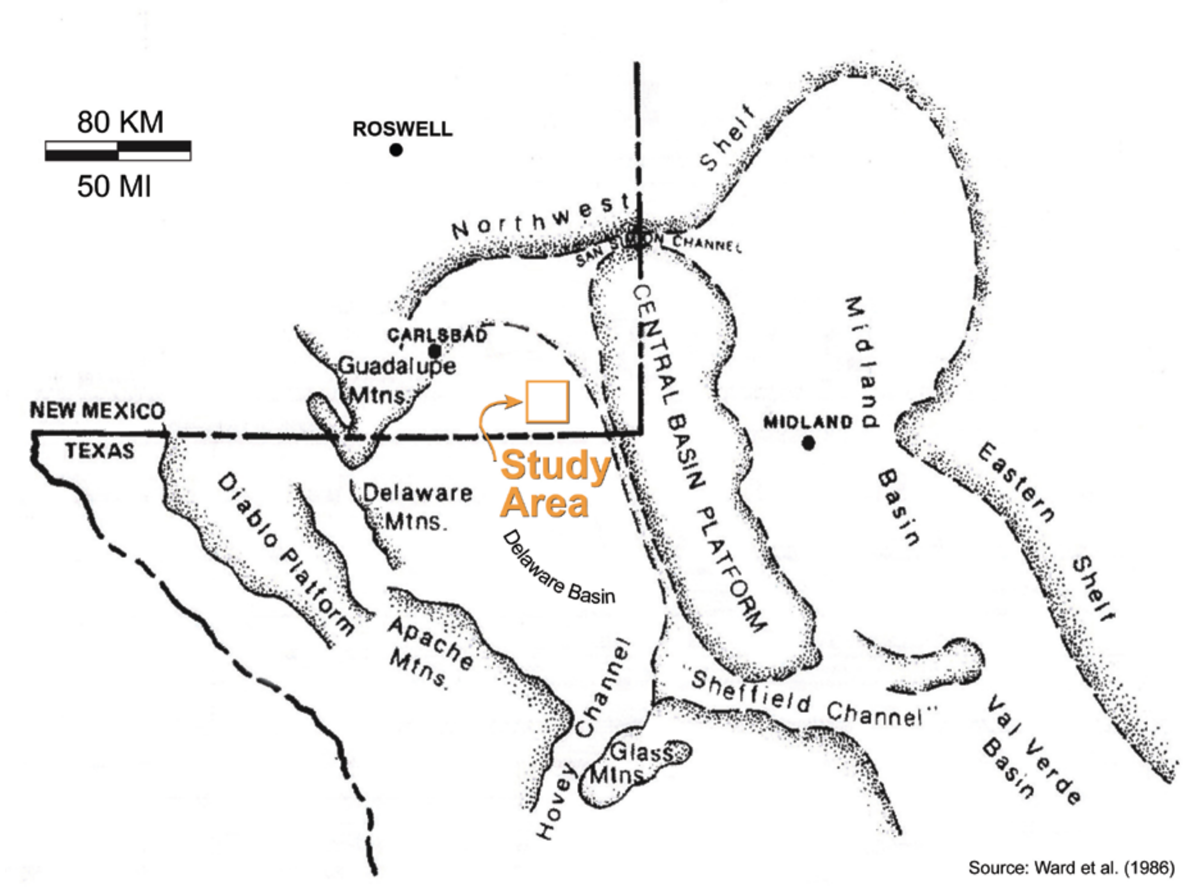
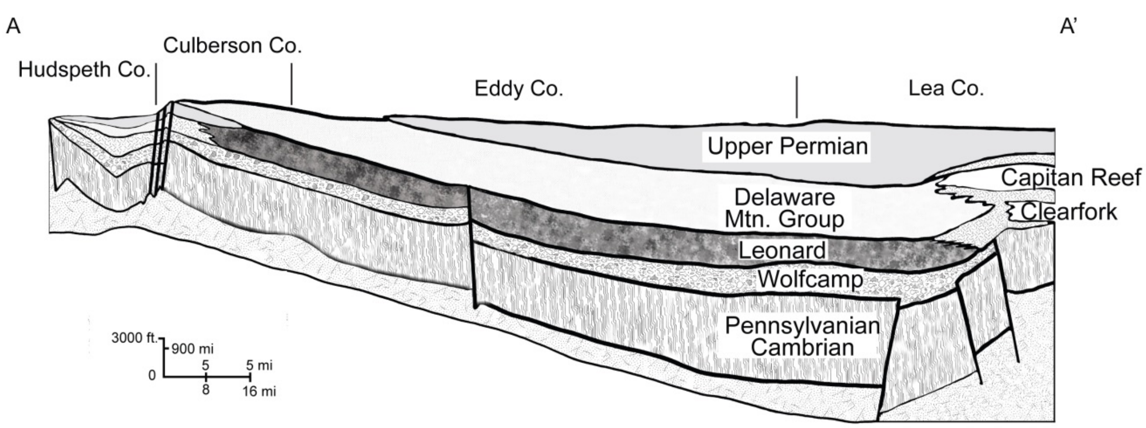


Figure 3-1 Major Structural Elements in the Region

Contours on top of Delaware Mountain Group.



Source: Montgomery et. al. (1996)

Figure 3-2 Structure Contour Map and General East-West Cross Section of the Delaware Basin

Table 3-1 Upper Guadalupian-Ochoan Formations in Project Area

		Leasing Area	Northeast		Approximate Thickness in Project Area (feet)
		Delaware Basin		Central Platform	
System	Series	Basin	Basin Margin - Reef	Shelf - Back Reef	
Permian	Ochoan	Dewey Lake Formation			Up to 500
		Rustler Formation			500
		Salado Formation			1,800-2,000
		Castile Formation		No equivalent	1,400-1,500
	Guadalupian	Bell Canyon Formation	Capitan Limestone	Tansill Formation	1,000 (Bell Canyon Formation)
				Yates Formation	
				Seven Rivers	

Sources: Hayes 1964; Hill 1996; Lambert 1983; U.S. Department of Energy (USDOE) 2004.

In addition to the upper Permian rocks, there are surficial exposures of Triassic, Tertiary, and Quaternary deposits in the project area that also are described below and a geologic map of the general project vicinity is provided in **Figure 3-2**. It should be noted that Permian rocks are not exposed in the project area.

Permian Rocks

Guadalupian Series. Rock units in the Guadalupian Series of interest in the project area consist of the Capitan Limestone, Bell Canyon Formation, and the upper Artesia Group. These units are time-equivalent: the Capitan Limestone is the basin margin reef-derived unit, the Bell Canyon Formation was deposited in the basin, and the upper Artesia Group consists of back reef and shelf deposits.

Capitan Limestone. The Capitan Limestone is composed of massive reef material and associated reef talus zones (Hayes 1964). The reef material is thought to have been derived from organisms such as algae and sponges. Diagenetic changes and recrystallization have obscured most of the fossils. The massive reef-building rock built upward and toward the basin and developed on top of its own talus deposits. The talus resulted from erosion of the reef material at the water surface to wave base. Porosity in the massive Capitan reef facies is generally low because of cements, but there are occasional vugs and cavernous porosity (Hill 1996). The Capitan Limestone is not present within the 50-year Mine Plan area, being located 10 miles to the east, but is important as a potential water source for the proposed project.

Bell Canyon Formation. The Bell Canyon Formation is the uppermost formation of the Delaware Mountain Group, a designation for the formations of the Guadalupian Series. It is time-equivalent to the Capitan Limestone and is generally composed of turbidite sandstones that were deposited in a deep water setting (Berg 1979). Carbonate rocks also are present in the Bell Canyon Formation in areas close to the reef. Bell Canyon sediments interfinger with the talus slope of the Capitan Reef.

Artesia Group. The formations in the upper part of the Artesia Group, Tansill, Yates, and Seven Rivers, are composed of rocks that are the time-equivalent units to the Capitan Limestone Hayes 1964; Hill 1996; Lambert 1983).The Artesia Group also is not present in the 50-year Mine Plan area, but bears mentioning for the overall description of Gudalupian rocks in the general vicinity.

Ochoan Series

Castile Formation. The Castile Formation marks the end of open marine conditions in the Delaware Basin and the onset of conditions favorable to evaporite deposition. The Castile is mainly composed of anhydrite, but contains two thick halite beds that range from 250 to 330 feet thick (Mercer and Orr 1977

Salado Formation. The Salado Formation is the primary salt formation in the area and the formation from which potash has been mined. The Salado can be 2,000 feet thick, but thickness ranges from 1,800 to 2,000 feet thick in the project area. It contains four distinct members and is mainly composed of halite, but also contains anhydrite, siltstone, polyhalite, and soluble potash minerals (Mercer and Orr 1977).

Rustler Formation. The Rustler Formation continues the succession of Ochoan units and is composed of anhydrite, dolomite, siltstone, sandstone, gypsum, halite, and polyhalite and varies from 450 to 550 feet thick in the project area. The top of the Rustler in the 50-year Mine Plan area is about 1,200 to 1,300 feet below the surface. Members of the Rustler Formation from bottom to top are the Los Medaños, Culebra Dolomite, Tamarisk, Magenta Dolomite, and the Forty-niner (**Figure 3-3**). The Los Medaños Member is composed of siltstone, gypsum, and fine-grained sandstone. The Culebra Dolomite is a thin-bedded crystalline dolomite that also has vugular porosity (Hill 1996). It is very resistive to weathering and forms prominent outcrops where exposed. The Culebra Dolomite is exposed west of the project area at the southern end of Nash Draw. Above the Culebra, the Tamarisk Member is largely composed of massive anhydrite that weathers to gypsum in outcrops. It also contains minor amounts of halite and siltstone. The evaporite zone in the Tamarisk Member (the M3/H3 zone) contains the polyhalite deposit proposed to be mined. The next member is the Magenta Dolomite, which is 20 to 30 feet thick and often identified by its color when it weathers varying from pink to red to purple (Hill 1996). The uppermost member, the Forty-niner, is composed of gypsum, anhydrite, siltstone, shale, and clay.

Dewey Lake Formation (Red Beds). The Dewey Lake Formation also is informally referred to as the Dewey Lake Red Beds). The Dewey Lake Formation is composed of reddish-orange siltstone with minor sandstone and clay and is not exposed on the surface in the project area or general vicinity (Hill 1996).

<u>Triassic, Tertiary, and Quaternary Deposits</u>

Triassic-aged rocks, the Santa Rosa Formation and possibly Chinle Formation (or Group) are present in the project area. Undivided Triassic rocks mapped by Dane and Bachman (1958) in the project area are composed of maroon, red, and gray sandstone interbedded with red, sandy shale and purplish limestone. The Chinle Formation consists of red and green mudstone interbedded with lenses of sandstone and conglomerate (Mercer and Orr 1977). The Tertiary Ogallala Formation may be absent or very thin in the 50-year mine area, but the proposed loadout facility north of Jal and the plant facilities may partially lie on the Ogallala Formation. Nicholson and Clebsch (1961) identified Ogallala Formation in the upper 125 feet the Continental Oil Company Bell Lake #2 well in Section 30, T25S, and R34E, less than 0.5 mile east of the mine area. The Ogallala Formation is composed of sandstone, silt, and cemented gravel capped by discontinuous caliche layers (New Mexico Bureau of Geology and Mineral Resources 2003).

The oldest Quaternary deposit is the Gatuña Formation, which is present in limited outcrops in the Nash Draw area (Vine 1963). The extent and occurrence of the Gatuña Formation in the project area has not been determined. The Gatuña Formation consists of clasts of Triassic and Ogallala rocks and volcanic ash beds (Lambert 1983). It is thought to have been deposited in depressions formed by collapse due to dissolution of evaporites in the subsurface.

The Mescalero Caliche is an informal unit defined on the basis of persistent caliche beds that are widespread on the Mescalero Plain and is described as consisting of two zones, an upper caliche caprock and a lower zone composed of nodular limestone (USDOE 2004).

Recent geologic materials in the project area consist of layers of alluvium and eolian (windblown) sand (New Mexico Bureau of Geology and Mineral Resources 2003). Where deep channels have been cut into the bedrock or in depressions created by subsidence, recent materials may attain a thickness of 500 feet.

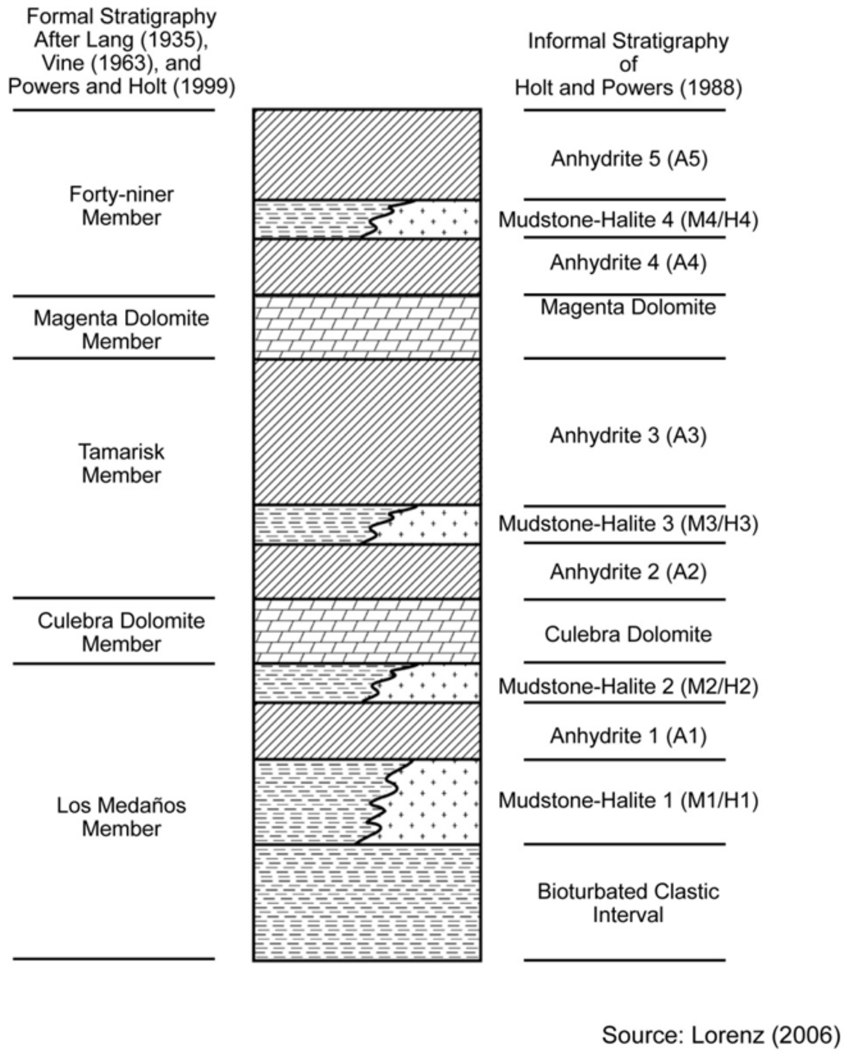


Figure 3-3 Stratigraphic Column of the Rustler Formation

Geologic Structure of the Leasing Area

There are few tectonic structural features in the Permian and younger section in the leasing area. The regional dip is 90 to 100 feet per mile (1 degree) to the southeast in western Eddy County and becomes almost flat in the leasing area in Lea County (Montgomery et al. 1999). Complex block faulting cuts the deeper Permian and Pennsylvanian rocks, but the faults appear to die out in the lower Permian. An example of this kind of fault in the leasing area is the Bell Lake Fault (Hill 1996).

3.2.2 Mineral Resources

3.2.2.1 Potash

Historic and Current Potash Mining

Potash was discovered in Eddy County in 1925 in a well that was being drilled for oil and gas by the Snowden McSweeney Company (Davis 2009). By the mid-1930s, there were eleven companies exploring for potash in southeastern New Mexico (Barker et al. 2008). The potash in southeastern New Mexico has been a major potash resource (Cheeseman 1978). The remaining potash reserves are estimated to be 500 million tons (U.S. Geological Survey [USGS] 2011). Potash production continues in the Delaware Basin with active mining by Intrepid Potash, Inc. and The Mosaic Company, about 20 miles west and northwest of the leasing area. Although much of the high-grade zones have been mined out, exploration for commercially viable deposits continues (Muller and Galyen 2009). Intrepid recently has been approved to conduct solution mining of potash minerals in order to extract some of the remaining ore from suspended mines in the main potash mining area.

The Ochoa Mine Project was approved by the BLM in 2014 (BLM 2014b). Under this project, the recoverable reserve was estimated to be 64.8 million tons over a 40-year life-of-mine (Crowl et al. 2011) for a recovery rate of 1.6 million tons per year at an average extraction rate of 84 percent. If extrapolated to a 50 year life-of-mine, the recovery would be approximately 80 million tons. The polyhalite resource has been estimated to be 2.2 billion tons at an extraction rate of 90 percent (BLM 2014a). The BLM Mineral Report (BLM 2014c) completed in 2014 concludes that there is a valuable deposit within the preference right leasing area. Section 1.5.2 provides more detail regarding the Mineral Report.

3.2.2.2 Oil and Gas Production and Development

Oil in southeastern New Mexico was discovered in 1909, 8 miles south of Artesia, but the well was never completed as a producer due to mechanical problems (Montgomery 1965). Oil and gas production began in the New Mexico portion of the Delaware Basin in 1924 with the discovery of the Dayton-Artesia Field (Independent Petroleum Association of New Mexico 2014). To the year 2000, 300 reservoirs have produced 4.5 billion barrels of oil mainly from plays on the Northwest Shelf and Central Platform areas (Broadhead et al. 2004). More than 3.5 billion barrels of the total production has come from Permian rocks. The USGS estimates that the greater Permian Basin area, including areas in southeastern New Mexico and west Texas, contains substantial undiscovered oil and gas resources on the order of 1.3 billion barrels of oil and 41 trillion cubic feet of gas (Schenk et al. 2008). Cumulative oil and gas production within the general footprint of the mining leases is approximately 37 million barrels of oil and 158 billion cubic feet of natural gas, with an accompanying 143 million barrels of produced water requiring disposal (OCD 2015).

Numerous formations produce oil and gas in the leasing area vicinity, including the Delaware, Atoka, Wolfcamp, Morrow, Woodford Shale, and Bone Spring formations (Engler et al. 2012). The Bone Spring horizontal drilling play has been the most active in southeastern New Mexico in the vicinity of the mine area (Engler and Cather 2014). From January 2010 to July 2014, Township 24 South, Range 33 East experienced most of the completions in the Bone Spring play.

As of May 2015, there are a total of 515 well locations planned or existing within 1,500 feet of the leasing area, as displayed on **Figure 3-4**. As shown in **Table 3-2**, 238 are active and producing, 26 are not yet drilled, 3 are temporarily abandoned, and 114 are plugged. Because most of the new wells and approved locations in the mine area are horizontal wells, they have been placed in a linear arrangement (see **Figure 3-4**) with laterals to be offset. Although these locations are not necessarily drilling islands, the wells and permitted locations would have a lesser impact on polyhalite recovery than the typical previously developed vertical wells on 40-acre spacing.

Table 3-2 Existing Oil and Gas Well Locations in and near Leasing Area

Well Type	Lea County	Eddy County	Total
Active	180	58	238
New (Not drilled or completed)	13	13	26
Plugged	102	12	114
Temporarily Abandoned	2	1	3
Unknown	115	19	134
Total	**412**	**103**	**515**

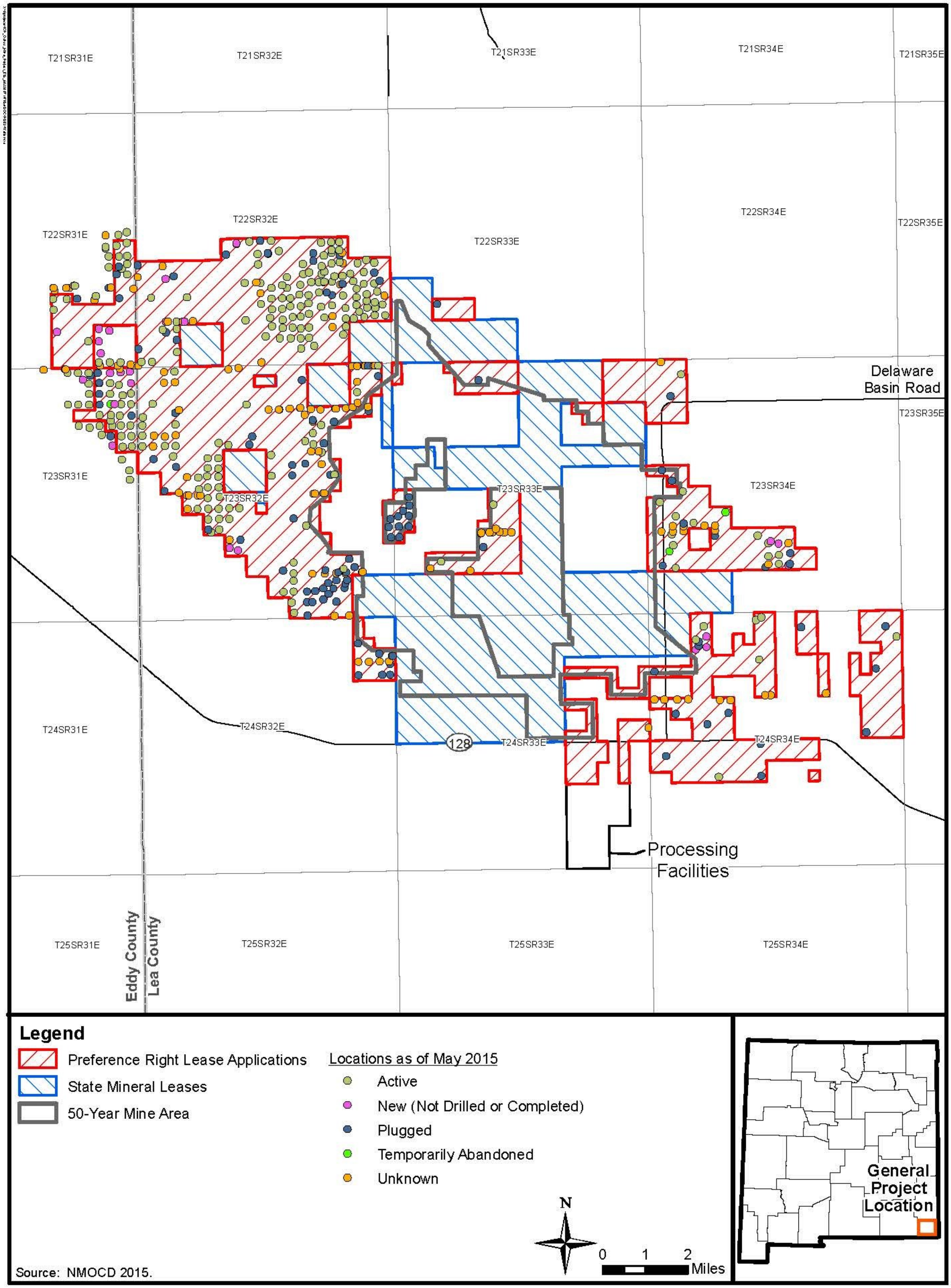


Figure 3-4 Oil and Gas Locations in the Leasing Area

3.2.2.3 Potash Mining and Oil and Gas

Although potash was originally discovered by wells that were drilled for oil and gas, conflicts between the oil and gas industry and potash mining emerged early on. In 1939, the federal government, through an order by the Secretary of the Interior, withdrew 42,685 acres from oil and gas leasing in deference to potash mining (1939 Order). The 1939 withdrawal remained in effect until 1951, at which time the Secretary of the Interior issued a new Order withdrawing the 1939 Order providing for concurrent operations in the prospecting for, and development and production of oil and gas and potash deposits owned by the U.S. within the designated Potash Area. A succession of orders followed (1951, 1965, 1975, 1986, and 2012), with each order except the most recent expanding the SPA. On October 21, 1986, the Order of the Secretary of the Interior (51 FR 39425, October 28, 1986) expanded the SPA to 497,002 acres. The most recent Secretary's Order was published in the FR on December 4, 2012 (77 FR 71822). Commonly referred to as the 2012 Order, it now governs the co-development of federal oil, gas, and potash leasing and development within the SPA. The PRLA is not within the SPA and therefore is not bound by the Order.

3.2.2.4 Other Minerals

Other minerals produced in Lea and Eddy counties include sand and gravel, caliche, and salt (USGS 2011).

3.2.3 Geologic Hazards

3.2.3.1 Natural and Anthropogenic Subsidence

Subsidence is defined as "a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (Galloway et al. 2005). Subsidence can occur from several conditions including dissolution of subsurface strata, underground mining, withdrawal of subsurface fluids, drainage of organic soils, hydrocompaction, thawing frost, and natural consolidation.

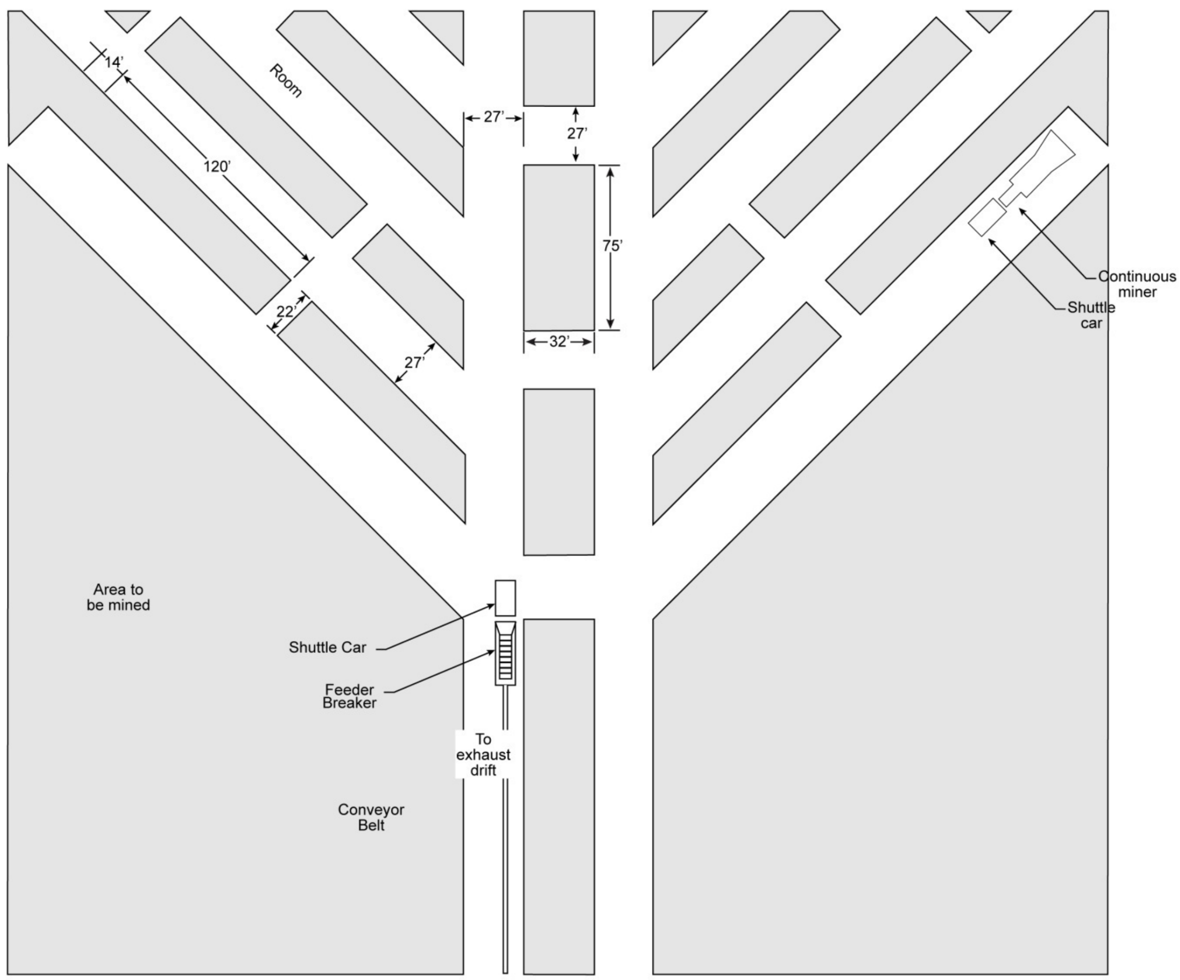
Subsidence in the Delaware Basin has been caused primarily by the dissolution of subsurface strata or potash mining. Dissolution of subsurface strata may occur as the result of natural conditions as well as the deliberate or inadvertent actions by humans. The mining of potash has caused some ground subsidence in the region. Topographic depressions are widespread in the Delaware Basin, some of which are due to the dissolution of evaporite minerals, called evaporite karst features. Further discussion of natural subsidence is detailed in Section 3.2.3.1 of the Ochoa Mine Project EIS (BLM 2014a).Subsidence also can be caused by human activities. In the Delaware Basin, anthropogenic subsidence largely has occurred as a result of potash mining and activities involving the withdrawal or injection of fluids for oil and gas production and brine extraction. Subsidence is the phenomenon or response that occurs when an underground opening is created. The overlying and surrounding rock or soil around the opening naturally deforms in an effort to arrive at a new overall equilibrium position. This equilibrium-seeking action can result in both vertical and horizontal ground movement, which, if not controlled or minimized, can cause damage to both surface and subsurface structures. Further discussion of anthropogenic subsidence is detailed in Section 3.2.3.2 of the Ochoa Mine Project EIS (BLM 2014a).

<u>Potash Mining</u>

Room-and-pillar mining employs a regular grid pattern of passages and pillars, such as that shown in **Figure 3-4**). In this mining method a substantial proportion of the target mineral is locked up in the pillars and is often removed during the latter stages of mining (e.g., on retreat, often referred to as "pillar robbing" or "second mining"), usually to the extent that the number, size, or distribution of remaining pillars is insufficient to continue to support the roof. The surface effects of the collapse of room-and-pillar workings depend on the depth and geometry of the workings, as well as the strength and integrity of the pillars and the surrounding and overlying strata.

The amount of subsidence realized at the surface is dependent on the depth, width, and thickness of the minerals extracted; on the ratio of the extracted void (mined out area) to the retained pillar area; and on the extent of area over which underground pillar failure and subsidence takes place (**Figure 3-5**).

The rate of subsidence is largely dependent on the type of material being mined. From a mine design and operations perspective, subsidence issues largely relate to the stability and safety of an excavation in rock. This is determined by the extent to which disruptive displacements can be prevented and the extent to which disruptive displacements can be controlled. These same primary design objectives similarly influence the potential to affect the surface and the degree of effect at the surface.



Source: ICP (2011)

Figure 3-5 Plan View of Room-and-Pillar Mining

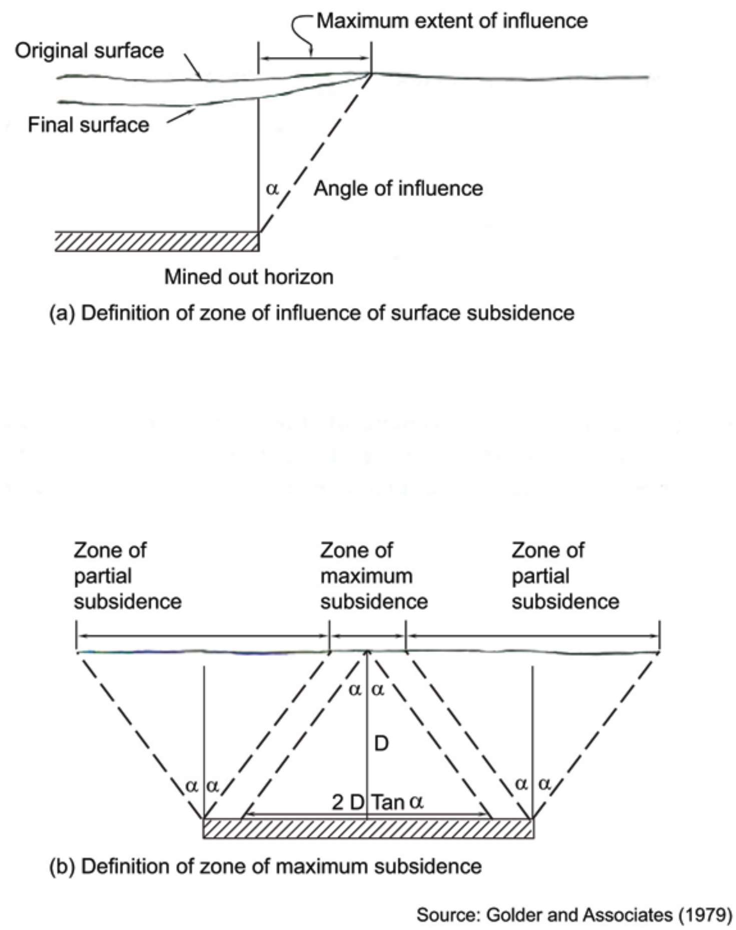


Figure 3-6 Subsidence Effects Zones

The amount of maximum subsidence that could occur cannot exceed the thickness of the zone of mineral extracted (the mining thickness) (Van Sambeek 2008, 2000). Maximum subsidence depth, however, is seldom observed, due to one or more of the following reasons:

- Subsidence actually spreads over an area somewhat larger than the mined area.
- Convergence, or closure of the mined area is never fully complete or total, so some voids inevitably remain, reducing the total amount of subsidence.
- The overlying rocks expand slightly in volume due to breakage as the ground moves downward into the mined area, resulting in a “bulking” effect, which contributes to a reduction in subsidence volume and depth.
- The subsidence process can be slow for rocks that creep, such as salt formations, so several hundred years may be required for full subsidence to occur.

It is important to note that both historic data and anecdotal evidence suggest that for the southeastern New Mexico potash mines, virtual completion of the maximum surface subsidence profile occurs within 5 to 7 years after completion of second mining (Intrepid Potash/Shaw 2008). Minor, protracted subsidence or creep may continue to occur over an extended period of time thereafter. Potash is an elastoplastic rock, which is massive, homogeneous, and isotropic, but possesses load-deformation characteristics that deviate significantly from linearity, causing the rock to slowly flow or deform rather than break.

Oil and Gas Activities

Oil and gas exploration and production has been occurring since the 1920s and the Delaware Basin has been a prolific oil and gas producing area. Thousands of wells have been drilled through evaporite formations to explore for and produce oil and gas. Because of the extent of the evaporites (salt and anhydrite), drilling and completion operations have to be conducted in a manner that prevents the dissolution of the salt and protects the well during drilling and through the productive lives of the wells, often 20 to 30 years or more. Further information on oil and gas activities in the region is detailed in Section 3.2.3.2 of the Ochoa Mine Project EIS (BLM 2014a).

3.2.3.2 Seismicity

The leasing area is located in an area with very little earthquake activity and such events that are recorded are of small magnitude. From 1973 to the present there have been 12 recorded events ranging from 2.8 to 4.1 magnitude (USGS 2015).

No active faults have been identified in southeastern New Mexico (USGS and New Mexico Bureau of Geology and Mineral Resources 2006). The nearest potentially active faults are located about 60 miles south of the leasing area in the Guadalupe and Delaware Mountains in Texas.

The USGS seismic hazard mapping indicates that ground motion in the leasing area from a maximum credible event would be less than 10 percent of the acceleration of gravity, with a 2 percent probability of exceedence in 50 years (Petersen et al. 2008). Further information on seismicity is detailed in Section 3.2.3.3 of the Ochoa Mine Project EIS (BLM 2014a).

3.2.4 Paleontological Resources

3.2.4.1 Regulatory Structure

Federal protection for scientifically important paleontological resources applies to construction or other impacts caused by disturbance of paleontological resources that occur on federally owned or managed lands. The BLM manages paleontological resources (fossils) on federal lands under the Paleontological Resources Preservation Act (PRPA), passed in March 2009, authorizes the BLM to manage and provide protection to fossil resources using "scientific principles and expertise" (BLM 2013). Besides the PRPA, BLM protects fossil resources under several regulations found in Title 43 CFR. In addition to the statutes and regulations listed above, fossils on public lands are managed through the use of internal BLM guidance and manuals. Included among these are the BLM Manual 8270 and the BLM Handbook H-8270-1. Various internal instructional memoranda have been issued to provide guidance to the BLM in implementing management and protection to fossil resources.

3.2.4.2 Potential Fossil Yield Classification

The BLM uses the Potential Fossil Yield Classification (PFYC) system to identify and classify fossil resources on federal lands (BLM 2013). Paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions. The BLM intends for the PFYC system to be used as a guideline rather than rigorous categories. Descriptions of the potential fossil yield classes are summarized below**:**

- Class 1 - Igneous and metamorphic geologic units (excluding tuffs) that are not likely to contain recognizable fossil remains.
- Class 2 - Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.
- Class 3 - Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence.
- Class 4 - Class 4 geologic units are Class 5 units that have lowered risks of human-caused adverse impacts or lowered risk of natural degradation. Proposed ground-disturbing activities would require assessment to determine whether significant paleontological resources occur in the area of a Proposed Action and whether the action would impact the resources.
- Class 5 - Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils or scientifically significant nonvertebrate fossils and that are at high risk of natural degradation or human-caused adverse impacts.

3.2.4.3 Paleontological Resources in the Leasing Area

The surface units in the leasing area consist of the Permian Ochoan Series (Rustler Formations and Dewey Lake Red Beds), Triassic Santa Rosa Formation, Gatuña Formation, Mescalero Caliche, and recent alluvial and windblown sand deposits, as described in Section 3.2.1.3. There is are now Class 5 Geological Units within the leasing area; however, there are two Class 4 Geological Units with the leasing area, the Cave Deposits and the Ogallala Formation. The Cave Deposits consist of water laid sediments and cost host a variety of vertebrate fossils. The Ogallala has the potential to contain important vertebrate fossils, and fossil tracks have been found at the base of the Ogallala northeast of Roswell. Further discussion of the regulatory framework, classification, and management of paleontological resources is detailed in Section 3.2.4.2 of the Ochoa Mine Project EIS (BLM 2014a).

3.3 Water

3.3.1 Surface Water

Surface water resources have been characterized in this section for the areas covered by pending preference right lease applications submitted by ICP (leasing area). Subwatersheds that contain any portion of the leasing area are discussed in this section. The leasing area is transected by most ephemeral streams. Ephemeral streams exhibit streamflow that is seasonal and typically with no groundwater contribution. Additional information can be found in Section 3.3.1 of the Ochoa Mine Project EIS (BLM 2014a).

3.3.1.1 Precipitation and Evaporation

The climate of the area is semi-arid with average annual precipitation ranging from 12 to 16 inches (WRCC 2012). Average annual potential evaporation rates far exceed average annual precipitation. Evaporation rates may approach 73 inches per year in this area (WRCC 2012), resulting in a large moisture deficit for many months of the year. The large moisture deficit limits stream flow because most precipitation is absorbed by the dry soils. However, during times of heavy precipitation the capacity of soils for infiltration can be surpassed by the rate of rainfall, causing surface water runoff.

3.3.1.2 Subwatersheds and Stream Channels

The leasing area falls within 11 subwatersheds (NRCS 2005), shown in **Figure 3-7**. **Table 3-3** lists the 11 subwatersheds that contain a portion of the leasing area.

Stream channels have been identified using the National Hydrography Dataset (NHD) (USGS 2009). This dataset is associated with the Watershed Boundary Dataset (WBD) 12-digit Hydrologic Unit Code (HUC) numbers. Stream reaches are coded using the corresponding WBD numbers and then additional digits are added to the number to differentiate each stream reach. The NHD also defines the flow regime of identified streams, within the confines of the dataset, and provides a flow network (when one exists) for water resource analyses. **Figure 3-7** includes the NHD features within and near the leasing area. Throughout the following surface water discussions, it is assumed that the streams identified as intermittently flowing channels (streamflow is seasonal and derived in part from groundwater) in the NHD actually exhibit ephemeral flow conditions (streamflow is seasonal with no groundwater contribution) on the ground.

The subwatersheds relate to other drainages in and near the leasing area in two ways. The first way subwatersheds relate to other drainages in the leasing area are that some watersheds are hydrologically connected to another subwatershed through the flow of surface water in stream channels or as overland runoff. The second way subwatersheds relate to other drainages in the leasing area is through closed basins. When a drainage is a closed basin, it does not have an outlet into an adjacent drainage. Drainages were considered closed when there is potential flow into the next drainage downstream but no further. Therefore, precipitation falling inside a closed basin will remain within the boundaries of the drainage or infiltrate into the groundwater.

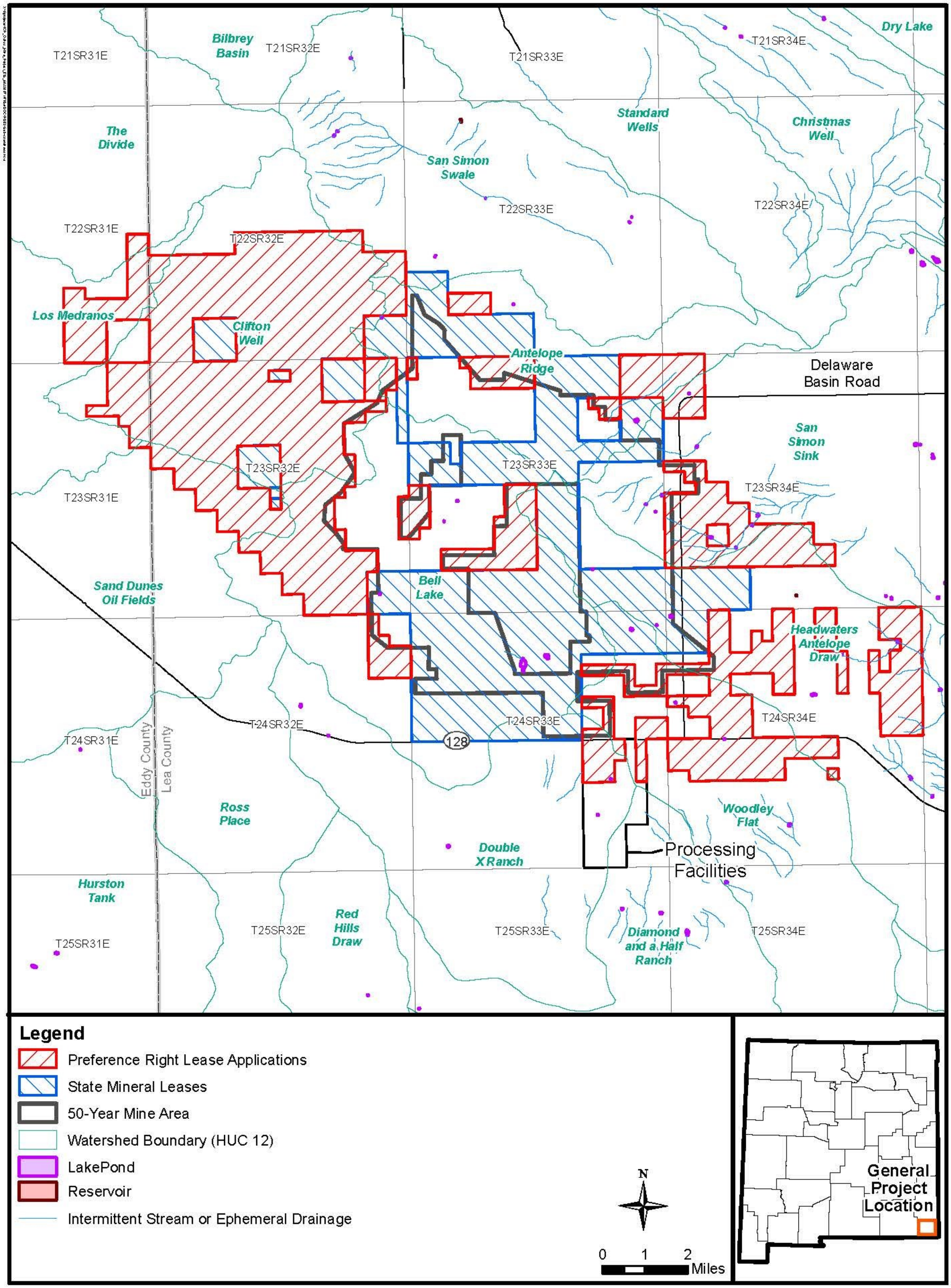


Figure 3-7 Subwatersheds in the Lease Area

Table 3-3 Subwatersheds that Contain Portions of the Leasing area

Region	Basin	Sub-basin	Watershed	Subwatershed	HUC-12 ID
Rio Grande	Upper Pecos	Black	Salt Lake[1]	The Divide	130600111702
				Clifton Well	130600111703
				Los Medranos	130600111704
				Sand Dunes Oil Fields	130600111705
	Lower Pecos	Landbeth-Monument Draws	Simon Sink[1]	San Simon Swale	130700070304
				Antelope Ridge	130700070305
				San Simon Sink[1]	130700070306
			Rock Lake	Bell Lake[1]	130700070401
				Woodley Flat	130700070402
				Double X Ranch	130700070403
			Antelope Draw	Headwaters Antelope Draw	130700070506

[1] Drainage is hydrologically closed; there is no surface outlet to downstream waters.

Source: NRCS 2005.

Connected Subwatersheds

Woodley Flat. Woodley Flat can be characterized as sloping from north to south, beginning at approximately 3,660 feet amsl in the north to approximately 3,300 feet amsl in the south where it might empty towards the Pecos River. Although this subwatershed is characterized as being a connected drainage, there is minimal topography with multiple low-lying areas, which can be described as playas that capture water where it evaporates or infiltrates. There are several ephemeral stream channels identified that are present in the middle portion of the drainage through an area of increased slope.

Double X Ranch. The Double X Ranch Subwatershed generally slopes from west to east, with a upper elevation of approximately 3,650 feet amsl, and a low of 3,350 feet amsl. There are multiple ephemeral stream channels mapped in the upper and middle elevations along the eastern side of the drainage.

Headwaters Antelope Draw. The highest elevations in this drainage are in the northwest and near 3,740 feet amsl, and the outlet in the southeast is at approximately 3,170 feet amsl, where it drains to Outlet Antelope Draw Subwatershed towards the Pecos River. The lower-elevation, eastern portion of this subwatershed has multiple mapped ephemeral stream channels that connect to the downstream subwatershed.

Closed Subwatersheds

The Divide. The Divide Subwatershed has a high-point of approximately 3,800 feet amsl in the eastern-most portion of the drainage, and a low-point of 3,150 feet amsl in the southwestern edge of the drainage. There is one long ephemeral channel leading from near the high-point to the middle of the drainage, and multiple ephemeral channels that lead down Livingston Ridge escarpment to the low-point of the drainage.

Clifton Well. This subwatershed generally slopes from east to west, and ranges from approximately 3,400 to 3,800 feet amsl. There is one short ephemeral channel identified in the northern portion of the drainage.

Los Medranos. The Los Medranos Subwatershed slopes from the northeast towards the southwest. The high point of the drainage is at approximately 3,750 feet amsl, and the lowest point is the same area of dunes as the Los Medranos Subwatershed at approximately 3,100 feet amsl, There are multiple ephemeral channels along the western edge of this drainage.

Sand Dunes Oil Fields. The Sand Dunes Oil Fields Subwatershed slopes from the east towards the west. The high point of the drainage is along the Bootleg Ridge at approximately 3,680 feet amsl, and the lowest point is the same area of dunes as the Los Medranos Subwatershed at approximately 3,100 feet amsl, There are multiple ephemeral channels along the western edge of this drainage.

San Simone Swale. This Subwatershed drains from the northwest towards the southeast. The high point is a ridge of Hat Mesa in the north at an elevation of 3,900 feet amsl, to a low of approximately 3,400 feet amsl in the southeast.

Antelope Ridge. Antelope Ridge Subwatershed slopes from west to east, and ranges from approximately 3,750 to 3,390 feet amsl. There are a few ephemeral channels identified in the southern portion of the drainage.

San Simon Sink. This subwatershed drains from its edges towards the middle, where the San Simon Sink is located. The edges extend to approximately 3,720 feet amsl, and the sink is at approximately 3,280 feet amsl. There are multiple ephemeral channels mapped, generally concentrated along the southwestern side of the drainage.

Bell Lake. The slope of this subwatershed is from the north at approximately 3,750 feet amsl and towards the south at approximately 3,530 feet amsl. There are several ephemeral ponds identified near the south end of this drainage and other low-lying areas that capture surface runoff.

<u>Playas and Salt Ponds</u>

Within the leasing area, there are a total of nine waterbodies identified by the NHD (USGS 2009). All of these are identified as intermittent lakes or ponds, and eight of these are identified as salt lakes, better known as playas. Playas are created when precipitation runoff leaches salts from the soil during runoff, collects in the low-lying areas, and then evaporates. The salts left behind decrease infiltration rates into the soil and allow water to pool. Water quality characteristics and related effects have been studied on playas historically used for brine disposal (Bristol 1998; Davis and Hopkins 1993; Meteyer et al. 1997), but no comparable baseline water quality data are known from undisturbed playas in the lease vicinity. Typically, playa lakes sampled in the southern Great Plains region have alkaline pH values and are saline to hypersaline.

Investigations in the southern Great Plains indicate that playa inundation in the region primarily depends on precipitation and runoff (Bartuszevige et al. 2012; Playa Lakes Joint Venture 2013). In New Mexico, the average interval for an individual playa to be filled may be over three years (Playa Lakes Joint Venture 2013). Playa inundation most often results from supercell thunderstorms or several continuous days of rain, typically in May and June. Water quality varies within an individual playa and between playas because of the variable nature of precipitation, infiltration and evaporation, temperature, and soils (Hall et al. 1999). Additional information on playas is found in the Ochoa Mine Project EIS (BLM 2014a).

3.3.1.3 Floodplains

The Federal Emergency Management Agency (FEMA) maintains maps of flood-prone areas throughout the nation that they use for administering the National Flood Insurance Program. In Lea and Eddy counties, New Mexico, these maps are part of the Flood Insurance Rate Map (FIRM) series. FIRM maps are coded according to flood potential and level of analysis performed regarding that potential. The leasing area has been included as an area identified by Zone D, or an area that has an undetermined but possible flood hazard. In other words, although index maps are provided for the area, it has not been mapped for flood hazard (FEMA 2012, 2010, 2008).

3.3.1.4 Surface Water Quality

The New Mexico Water Quality Control Commission (NMWQCC) is responsible for setting water quality standards and designating beneficial uses for waterways. All surface waters of the state are assigned the beneficial uses of aquatic life, livestock watering, wildlife habitat, and secondary contact (State of New Mexico 2000). Surface water quality is regulated in New Mexico by the Environment Department, Surface Water Quality Bureau. Water quality parameters are reported to the USEPA under the requirements of the Clean Water Act (CWA), specifically Sections 303(d) and 305(b). The 303(d)/305(b) Integrated Report lists any streams that are considered impaired because they do not meet water quality standards or are not suitable for assigned beneficial uses. New Mexico's current 303(d)/305(b) Integrated Report was published in 2014 (NMWQCC 2014), and does not identify any streams or waterbodies in the leasing area as having impairments (NMWQCC 2014).

3.3.1.5 Surface Water Use

Water use in New Mexico is administered by the New Mexico Office of the State Engineer (NMOSE) under the prior appropriation doctrine, or "first in time, first in right." Any use of water must be permitted through the NMOSE, and is given a priority date based on when the application was received. All rights with "senior" (earlier) priority dates must be satisfied prior to "junior" (later) rights. The lack of surface water rights within the leasing area reflects the absence of surface water flows.

<u>NMOSE Recorded Beneficial Uses</u>

A search of NMOSE records indicates there are no surface water rights found in the leasing area (NMOSE 2015).

3.3.2 Groundwater

The Delaware Basin contains regional aquifers in many of the Permian stratigraphic units, but aquifers in the overlying Triassic Dewey Lake Red Beds and the Santa Rosa Formation are local in nature and not continuous throughout the basin. The Salado Formation locally contains brine, as does the Castile Formation, but neither unit acts as an aquifer. The important aquifers for the Ochoa leasing area are those in the Rustler Formation, the Capitan Limestone, the Artesia Group, the Bell Canyon Member of the Delaware Basin Group, the San Andres Formation, the Santa Rosa Formation, and the Ogallala Formation.

The five main aquifers in the northern part of the Delaware Basin are listed from lowest to highest stratigraphic layer below.

1. Bell Canyon Aquifer of the Delaware Mountain Group
2. Capitan Aquifer, Artesia Group, San Andres Formation
3. Aquifers of the Rustler Formation
4. Santa Rosa Formation
5. Ogallala Aquifer

Additional information on these aquifers is found in Section 3.3.2 of the Ochoa Mine Project EIS (BLM 2014a).

3.4 Air Quality

Air quality is defined by pollutant concentrations in the atmosphere and generally is expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Regional air quality is affected by both natural events (such as windstorms and wildfires) and human activities (such as power plants, industrial facilities, and vehicle use in urban corridors). Natural events generally are short-lived, lasting from several hours to several days. The effects on air quality during these events may adversely affect human health and the environment, but generally are considered part of the natural physical environment. Human activities that affect air quality also can be short-lived in duration or can elevate the background concentrations in a given area.

The physical effects of air quality depend on the characteristics of the receptors (human or environmental) and the type, amount, and duration of exposure. The air quality analysis area for the Ochoa Preference Right Lease EA is within Lea County and a small portion of eastern Eddy County, New Mexico. The issuance of the preference leases is not expected to alter the mine nor the processing facility operations relative to what is described in Chapter 2.0 of the Ochoa Mine Project EIS (BLM 2014a). However, issuance of the preference leases is likely to extend the mining and operations longer than 50 years. This section discusses the air regulations that may apply to the Proposed Action as well as existing air quality conditions within the analysis area.

3.4.1 Air Quality Regulatory Framework

The Clean Air Act (CAA) of 1970 (42 USC 7401 et seq.) as amended in 1977 and 1990 is the basic federal statute governing air pollution. Provisions of the CAA of 1970 that potentially are relevant to the project are listed below.

- National Ambient Air Quality Standards (NAAQS)
- Prevention of Significant Deterioration (PSD)
- New Source Performance Standards (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- Maximum Achievable Control Technology (MACT) Standards
- Federal Operating Permits Program
- Greenhouse Gas (GHG) Tailoring Rule
- GHG Reporting Rule

In addition to the CAA, the FLPMA of 1976 requires the BLM to protect air resources. In addition to federal regulations, the CAA provides states with the authority to regulate air quality within state boundaries. The State of New Mexico has additional ambient air quality standards applicable only within New Mexico.

3.4.1.1 National and State Ambient Air Quality Standards

The CAA amendments of the 1990s require all states to control air pollution emission sources so that NAAQS are met and maintained. The CAA directs the USEPA to delegate primary responsibility for air pollution control to state governments. The State of New Mexico adopted the NAAQS as state air quality standards and has added more stringent ambient air quality standards applicable only within New Mexico. In addition to these requirements, under the CAA, Federal Land Managers (FLM) managing Class I areas have an affirmative responsibility to protect air quality related values (AQRVs), such as visibility.

The NAAQS establishes maximum acceptable concentrations for nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (PM), ozone (O_3), and lead (Pb). Given the extremely low levels of lead emissions from mine and processing facility sources, the lead standards are not addressed in this analysis. These pollutants are known as criteria pollutants. The NAAQS are established by the USEPA and are outlined in 40 CFR 50. New Mexico Ambient Air Quality Standards (NMAAQS) establish additional standards of maximum acceptable concentrations of hydrogen sulfide (H_2S) and Total Suspended Particulate (TSP).

These standards represent the maximum allowable atmospheric concentrations to protect public health and welfare, and include a reasonable margin of safety to protect the more sensitive individuals in the population. The air quality analysis for the project must analyze project impacts relative to the NAAQS and the NMAAQS. Together the NAAQS and the NMAAQS will be referred to as the AAQS. An area that does not meet the AAQS is designated as a nonattainment area on a pollutant-by-pollutant basis. Applicable federal and state AAQS are presented in **Table 3-4**.

Table 3-4 National and New Mexico Ambient Air Quality Standards

Pollutant	Averaging Period	Significance Level [D] ($\mu g/m^3$)	NAAQS	NMAAQS
CO	8-hour	500	9 ppm (10 mg/m^3) [1]	8.7 ppm
	1-hour	2,000	35 ppm (40mg/m^3) [1]	13.1 ppm
H_2S	1-hour	1.0	—	0.010 ppm [A,1]
	0.5-hour	5.0	—	0.100 ppm [B]
	0.5-hour	5.0	—	0.030 ppm [C]
Pb	Rolling 3-month	—	0.15 $\mu g/m^3$	—
NO_2	Annual	1.0	0.053 ppm (100 $\mu g/m^3$)	0.050 ppm
	24-hour	5.0	—	0.10 ppm
	1-hour	5.0	0.100 ppm [2]	—
O_3	1-hour	—	0.12 ppm [3]	—
	8-hour	—	0.075 ppm [4]	—
$PM_{2.5}$ *	Annual	0.30	12$\mu g/m^3$ [5]	—
	24-hour	1.17	35 $\mu g/m$ [6]	—
PM_{10} *	Annual	1.0	Revoked [7]	—
	24-hour	5.0	150 $\mu g/m^3$ [1]	—
Particulates (TSP)	Annual Geometric Mean	1.0	—	60 $\mu g/m^3$
	30-day	—	—	90 $\mu g/m^3$
	7-day	—	—	110 $\mu g/m^3$
	24-hour	5.0	—	150 $\mu g/m^3$

Table 3-4 National and New Mexico Ambient Air Quality Standards

Pollutant	Averaging Period	Significance Level [D] (μg/m³)	NAAQS	NMAAQS
SO_2	Annual	1.0	Revoked [8]	0.02 ppm
	24-hour	5.0	Revoked [8]	0.10 ppm
	3-hour	25.0 [10]	0.50 ppm	—
	1-hour	—	0.075 ppm [9]	—

[A] For the state, except for the Pecos-Permian Basin Intrastate Air Quality Control Region (AQCR).

[B] For the Pecos-Permian Basin Intrastate AQCR.

[C] For areas within 5 miles of the corporate limits of municipalities within the Pecos-Permian Basin AQCR.

[D] Significance levels are listed in 20.2.72.500 (New Mexico Administrative Code)

[1] Not to be exceeded more than once per year.

[2] The 3-year average of the 98th percentile of the daily maximum 1-hour average is not to exceed this standard.

[3] (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is <= 1, as determined by Appendix H.
(b) The 1-hour NAAQS will no longer apply to an area 1 year after the effective date of the designation of that area for the 8-hour ozone NAAQS. The effective designation date for most areas is June 15, 2004 (40 CFR 50.9; see FR of April 30, 2004 [69 FR 23996]).

[4] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.

[5] To attain this standard, the 3-year average of the annual arithmetic mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 12.0 μg/m³.

[6] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 μg/m³.

[7] The annual PM_{10} NAAQS of 50 μg/m³ was revoked by USEPA on September 21, 2006; FR Volume 71, Number 200, October 17, 2006.

[8] The 24-hour and annual SO_2 NAAQS was revoked by USEPA on June 22, 2010; 75FR35520.

[9] The 3-year average of the annual 99th percentile of the 1-hour daily maximum must not exceed this standard.

[10] The 3-hour SO_2 standard is a secondary standard.

* $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 microns or less; PM_{10} = particulate matter with an aerodynamic diameter of 10 microns or less; mg/m³ = milligrams per cubic meter.

Source: New Mexico Environment Department-Air Quality Bureau (NMED-AQB) 2011; USEPA 2015.

There are eight AQCRs designated in New Mexico. The leasing area is located primarily in Lea County, which is part of the Pecos-Permian Basin ACQR 155.

3.4.1.2 Carbon Dioxide and Other Greenhouse Gases

Carbon dioxide (CO_2) and other GHGs are naturally occurring gases in the atmosphere whose status as a pollutant is not related to their toxicity, but to the added long-term impacts they may have on climate due to their increased levels in the earth's atmosphere. Because they are non-toxic and non-hazardous at normal ambient concentrations, CO_2 and other naturally occurring GHGs do not have applicable ambient standards or emission limits under the major environmental regulatory programs.

On October 30, 2009, the USEPA issued the final mandatory reporting rule for major sources of GHG emissions (40 CFR Part 98). The rule requires a wide range of sources and source groups to record and report selected GHG emissions, including CO_2, methane (CH_4), nitrous oxide, and some halogenated compounds.

On June 3, 2010, the USEPA issued the PSD and Title V GHG Tailoring Rule. The rule tailors the applicability criteria that determine which stationary sources become subject to permitting requirements for GHG emissions under the PSD and Title V programs of the CAA. Under the rule, new facilities with GHG emissions of at least 100,000 tpy carbon dioxide equivalents (CO_2e) and existing facilities with at least 100,000 tpy CO_2e making changes that would increase GHG emissions by at least 75,000 tpy CO_2e are required to obtain PSD permits. Facilities that must obtain a PSD permit anyway, to cover other regulated pollutants, also must address GHG emissions increases of 75,000 tpy CO_2e or more. New and existing sources with GHG emissions above 100,000 tpy CO_2e also must obtain operating permits.

The USEPA rules do not require any controls or establish any standards related to GHG emissions or impacts. Therefore, there is no evident requirement at this time that would affect the issuance of the preference right leases under the USEPA rules.

3.4.1.3 Other Potential CAA Regulations

The issuance of the preference right leases would not add additional sources to those currently described in Sections 4.5.5.1 and 4.5.5.2 of the Ochoa Mine Project EIS (BLM 2014a), so further evaluation of the following CAA regulations is not necessary:

- PSD
- NSPS
- NESHAP
- MACT Standards
- Federal Operating Permits Program

Because issuance of the preference right leases would not add additional sources, PSD and NSPS regulations would not be applicable. While, the PSD minor source baseline date has been triggered in AQCR 155 for NO_2, $SO_{2,}$ and PM_{10}, an increment analysis would not be necessary when new sources are not being added.

Preference right lease issuance is not anticipated to be an additional source of hazardous air pollutants (HAPs), so the NESHAP standard would not be applicable. Additionally, there are currently no applicable area source MACT standards that apply to the proposed project.

The preference right lease issuance would be likely to extend mining operations beyond the 50-year timeframe analyzed in the Ochoa Mine Project EIS (BLM 2014a). If mining operations into this leasing area are proposed, the Mine Plan of Operations would be revised and new NEPA analyses would be performed to disclose potential impacts due to the expansion.

3.4.2 Regional Air Quality

Representative ambient background levels of pollutants were measured for the Ochoa Mine Project EIS (BLM 2014a). Site and background values are found in **Table 3-5**. The monitoring sites in **Table 3-5** were selected to provide a representative estimate of current background conditions in the leasing area. All background values were shown to be well below AAQS.

As discussed in Section 3.5.2.2 of the Ochoa Mine Project EIS (BLM 2014a), the visibility at the Guadalupe Mountains NP is one of the better (less impaired) in the nation. During the regional haze baseline period from 2000 through 2004, the average total light extinction for the 20 percent best days was 10.1 inverse megameters (Mm^{-1}); for the worst 20 percent days, it was 49.3 Mm^{-1}; the average over the whole baseline period was 26.2 Mm^{-1}Typically spring and summer are when Guadalupe Mountains NP experiences the most sustained reduction in visible range.

Table 3-5 Ambient Air Quality Background Values[1]

Pollutant	Averaging Period	Concentration	Units	Monitor/County
NO_2	1-hour	0.053	ppm	2007-2009 Hobbs, New Mexico, in Lea County
	Annual	0.007	ppm	2007-2009 Hobbs, New Mexico, in Lea County
CO	1-hour	2.1	ppm	2003-2006 2ZR Rio Rancho Senior Center (Considered to be representative of all areas in New Mexico except Sunland Park)
	8-hour	1.5	ppm	2003-2006 2ZR Rio Rancho Senior Center (Considered to be representative of all areas in New Mexico except Sunland Park)
SO_2	1-hour	0.023	ppm	2007-2009 5ZP Artesia Average 3-year 100% maximum concentration (considered to be representative of Eastern New Mexico)
PM_{10}	24-hour[2]	46.2	$\mu g/m^3$	2007-2009 Hobbs, New Mexico, in Lea County
	Annual	21.1	$\mu g/m^3$	2007-2009 Hobbs, New Mexico, in Lea County
$PM_{2.5}$	24-hour	12.4	$\mu g/m^3$	2007-2009 Hobbs, New Mexico, in Lea County
	Annual	6.2	$\mu g/m^3$	2007-2009 Hobbs, New Mexico, in Lea County
O_3	1-hour	0.076	ppm	2007-2009 Hobbs, New Mexico, in Lea County

[1] High Second High (second highest value).

Source: BLM 2014a.

3.5 Climate and Greenhouse Gas Emissions

3.5.1 Regional Climate and Effects on Air Quality

Southeastern New Mexico has a mild, arid or semiarid, continental climate characterized by light precipitation totals, abundant sunshine, low relative humidity, and a relatively large annual and diurnal temperature range. A climate summary for Jal, New Mexico, is presented in **Table 3-6** (WRCC 2015a). In January, the coldest month, average daytime high temperatures are in the mid to upper 50s (°F), and while minimum temperatures below freezing are common, it is rare that temperatures fall below 0°F. The coldest temperature on record at Jal was -11°F on January 11, 1962 (WRCC 2015b). June and July are the warmest months with average daytime highs averaging in the upper 90s and occasionally exceeding 100°F. The hottest temperature recorded at the Jal station was 114°F, and occurred in June 2011 (WRCC 2015b).

State-wide average annual precipitation ranges from less than 10 inches over much of the southern desert to more than 20 inches at higher elevations in the state. A wide variation in annual totals is characteristic of arid and semiarid climates and is illustrated by annual extremes of 2.00 and 25.73 inches at Jal during a period of more than 92 years. In Lea County, summer rains fall almost entirely during brief, but frequently intense thunderstorms. July and August are typically the rainiest months in the leasing area. Precipitation during the warmest 6 months of the year, May through October, adds up to about 60 percent of the annual total in the Jal area. The southeastern plains of New Mexico receive on average about 0.5 inch of precipitation each month during the period November through April (WRCC 2015c).

Table 3-6 Monthly Climate Summary: Jal, New Mexico

Period of Record: 3/1/1919 to 1/19/2015													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Maximum Temperature (°F)	59.9	65.2	72.9	81.8	89	95.6	96.3	95.0	88.8	80.3	68.6	61	79.5
Average Minimum Temperature (°F)	27.9	32.4	38.8	47.6	56.8	65.3	68	66.8	60.2	48.9	36.7	29.2	48.2
Average Total Precipitation (inches)	0.41	0.48	0.42	0.63	1.42	1.28	1.82	1.79	2.08	1.31	0.47	0.46	12.58
Average Total Snow Fall (inches)	1.3	0.7	0.3	0	0	0	0	0	0	0	0.6	0.8	3.5
Average Snow Depth (inches)	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: WRCC 2015a.

3.5.2 Climate Change and Greenhouse Gas Emissions

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) GHG emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by impeding the rate of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2e concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that warming of the climate system is unequivocal and most of the observed increase in globally average temperatures since the mid-20th century very likely is due to the observed increase in anthropogenic GHG concentrations (IPCC 2007).

The average global temperature has risen about 1.4°F (0.8°C) since 1880, according to recent analysis (NASA 2013). Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24°N) have exhibited temperature increases of nearly 2.1°F since 1900, with nearly a 1.8°F increase since 1970. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially CO_2 and CH_4) from fossil fuel development, large wildfires, activities using combustion engines, changes to the natural carbon cycle, and changes to radiative forces and reflectivity (albedo) of the earth-atmosphere system. It is important to note that GHGs will have a sustained climatic impact over different temporal scales. For example, recent emissions of CO_2 may influence climate for 100 years.

It may be difficult to discern whether climate change is already affecting resources globally, let alone those in the vicinity of the leasing area. In most cases, there is little information about the potential or projected effects of global climate change on natural resources. It is important to note that projected changes are likely to occur over long periods of time (several decades to a century). Therefore, many of the projected changes to climate may not be measurably discernible within the reasonably foreseeable future. Existing climate prediction models are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change on the analysis area and vicinity.

While assessing if climate change is affecting a specific region is difficult, the research available on climate trends in New Mexico and the Southwest was reviewed and summarized in a recent analysis of climate change vulnerability in the region (The Nature Conservancy 2008). That review indicated that warming trends in the Southwest have exceeded the global averages by nearly 50 percent and precipitation, on average, has increased slightly across New Mexico since the 1970s.

3.6 Socioeconomics

Lea and Eddy counties comprise the analysis area for socioeconomic effects of the proposed leasing and mining. Lea County is responsible for providing most of the local government administrative and public services to the leasing area.

3.6.1.1 Lea County and Eddy Counties

Oil and gas is the primary economic drivers of the Lea and Eddy county economies, although new industrial activities have emerged in recent years that are serving to diversify the local economy and add to the areas economic and population growth. In 2010, Lea County was the top oil producing county in New Mexico and Eddy County had the second largest oil production. In that year, Eddy County ranked third in natural gas production in the state and Lea County ranked fourth (BLM 2014a).

Potash mining and processing is another key component of the southeastern New Mexico economy. New Mexico produces more potash than any other state in the country (BLM 2014a). Currently the active potash mines in the New Mexico are all located in Eddy County, with a new mine project beginning construction in 2012.

Farming and ranching are important to both counties as part of the region's heritage and culture. These activities and outdoor recreation and tourism also contribute to the area's economic diversity.

Further county and local information is detailed in Section 3.15.2 of the Ochoa Mine Project EIS (BLM 2014a).

3.6.2 Population and Demographics

Both Lea and Eddy counties experienced an extended period of population growth spanning the late 1970s and early 1980s. Oil and gas development was the major driver of this growth. In 1983, the population of both counties peaked, at 66,164 in Lea County and at 53,266 in Eddy County. Both subsequently experienced substantial declines, Lea County losing almost 15 percent of its population in the ensuing 6 years. During the same period Eddy County's population declined by about 10 percent.

Lea County population began climbing again in 2004, driven by resurgence in oil and gas development and construction of the URENCO facility. Lea County was the fourth fastest growing county in New Mexico between 2000 and 2010, outpacing the state's growth rate by over three percentage points (BLM 2014a; U.S. Census Bureau 2014).

Beginning in 1990, Eddy County experienced another cycle of renewed growth, decline and growth. The county's population stabilized at between 51,000 and 52,000 residents from 2000 through 2007, and then climbed to 55,471 in 2013. The most recent growth has been driven by resurgence in oil and gas development, high potash prices, and expanded operations of the Federal Law Enforcement Training Center (FLETC) in Artesia. **Table 3-7** details populations near the leasing area.

3.6.3 Employment, Labor Force, and Economic Structure

Changes in local labor market conditions over time portray economic conditions in the analysis area more so than do the changes in population. The increases in employment in both counties from 2009 through 2013 illustrate the economic expansion due to increases in oil and gas activity and mining, the start of construction of the URENCO facility, and residential construction, tourism and recreation, lifestyle migration, and expansion of the FLETC (**Table 3-8**).

Table 3-7 Population Settlement within Eddy and Lea Counties, 2000 to 2013

Area	2000	2005	2010	2013 (estimate)	Change
Lea County	55,511	56,109	64,727	68,062	12,551
Eunice	2,562	2,643	2,922	3,065	503
Hobbs	28,657	28,609	34,122	36,041	7,384
Jal	1,996	2,010	2,047	2,153	157
Lovington	9,471	9,831	11,009	11,550	2,079
Remainder of the County	12,825	13,016	14,627	15,253	2,428
Eddy County	51,658	50,236	53,829	55,471	3,813
Artesia	10,692	10,375	11,301	11,484	792
Carlsbad	25,625	25,165	26,138	27,653	2,028
Loving	1,326	1,321	1,413	1,412	86
Remainder of the County	14,015	13,375	14,977	14,922	907

Sources: BLM 2014a; U.S. Census Bureau 2014.

Table 3-8 Trends in Total, Mining and Construction Employment, Lea and Eddy Counties, 2009 to 2013

Industry	2009	2010	2011	2012	2013	2009 – 2013 % Change
Lea County						
Mining	6,624	7,157	7,355	9,159	9,882	49.2
Construction	3,075	2,802	3,191	3,150	3,744	21.8
Total Covered Employment	**34,416**	**34,423**	**36,246**	**38,638**	**40,541**	**17.8**
Eddy County						
Mining	4,298	4,950	5,702	6,969	8,166	90.0
Construction	2,422	2,276	2,494	2,525	2,485	2.6
Total Covered Employment	**30,339**	**30,643**	**31,895**	**33,154**	**34,587**	**14.0**

Source: U.S. BEA 2014.

Other key private industries in the local economy include retail trade, health care, and accommodation and food services. The latter reflects Lea County's position as a regional trade center and hub for oil and gas activity and the role of tourism and recreation in Eddy County.

The mining sector, which includes oil and gas extraction and potash mining, and the construction industry have long been mainstays of the regional economy, directly and indirectly providing jobs and capital investment.

Farm employment accounted for 2.1 percent of Lea County employment and 2.7 percent of Eddy County employment in 2013, both comparable to the statewide average. Public sector employment, including public education, was 9.3 percent in Lea County and 11.4 percent in Eddy County during 2013, both substantially below the 19.6 percent statewide (**Table 3-9**). Operations of the FLETC in Artesia, the BLM office in Carlsbad, Carlsbad Caverns NP and the Guadalupe Ranger District of the Lincoln National Forest contributed to the a higher percentage of government employment in Eddy County compared to Lea County.

Table 3-9 Annual Employment, by Major Category, 2013: New Mexico and Lea and Eddy Counties

Geographic Area	Full and Part Time Employment by Category				% of Total Employment		
	Farm	Non-farm Private	Government[1]	Total	Farm	Non-farm Private	Government
New Mexico	28,310	839,397	211,360	1,079,067	2.6	77.8	19.6
Lea County	843	35,910	3,788	40,541	2.1	88.6	9.3
Eddy County	927	29,707	3,953	34,587	2.7	85.9	11.4

Source: U.S. BEA 2014.

[1]Includes federal, military, state, and local government.

Table 3-10 displays Lea and Eddy County average annual labor force and unemployment trends for 2008 through 2014. Unemployment in 2008 was very low, reflecting the robust pre-recession economic conditions, strong oil, natural gas and potash prices, and industrial construction activities. The higher unemployment rates in 2009 and 2010 reflect declines in gas prices and lower construction employment, with the subsequent decrease in unemployment in 2011 likely reflecting the positive effects of higher oil prices on the pace of energy development and higher employment that year.

Table 3-10 Labor Force, Employment and Unemployment

	2008	2009	2010	2011	2012	2013	2014	2008 – 2014 Change (%)
Lea County								
Labor Force	29,278	28,329	26,292	27,159	28,268	29,227	30,192	3.1
Unemployment	836	2,237	2,081	1,523	1,338	1,306	1,288	54.1
Unemployment Rate	2.9%	7.9%	7.9%	5.6%	4.7%	4.5%	4.3%	48.3
Eddy County								
Labor Force	27,311	28,005	26,100	26,800	27,170	28,047	29,017	6.2
Unemployment	831	1,644	1,660	1,361	1,264	1,271	1,246	49.9
Unemployment Rate	3.0%	5.9%	6.4%	5.1%	4.7%	4.5%	4.3%	43.3

Sources: U.S. BLS 2015.

3.6.4 Personal Income and Poverty

Personal income is an important measure of economic well-being for individuals and communities. **Table 3-11** shows income characteristics for the State of New Mexico, Lea County, and Eddy County. Median household incomes for Lea and Eddy counties were both higher than the state of New Mexico median household income for the 2009 to 2013 timeframe. Personal per capita money income for Eddy County was higher than the state average; however, Lea County recorded personal per capita income that was slightly less than the state average. Both counties had persons below the poverty level that were well below the state average.

More on personal income poverty can be found in Section 3.15.4 of the Ochoa Mine Project EIS (BLM 2014a).

Table 3-11 Income Characteristics for Lea County, Eddy County, and the State of New Mexico

Parameter	Lea County	Eddy County	New Mexico
Median Household Income (2009 – 2013)	$50,694	$49,165	$44,927
Personal per capita money income (2009 – 2013)	$22,848	$28,438	$23,763
Persons below poverty (2009 – 2013)	15.0%	12.5%	20.4%

Source: U.S. Census Bureau 2015

3.6.5 Housing

Housing availability and affordability are issues in both Lea and Eddy counties, particularly rental housing for workers and middle and low income families (Ochoa Mine Project 2014). The cities of Carlsbad, Hobbs, Eunice, and Jal all have developed housing plans and have efforts underway to address current and anticipated housing needs. Substantial housing development recently occurred in Hobbs, Carlsbad, and Eunice, and these communities have aggressive housing incentive plans for developers.

Further information detailing housing stock, vacancies, development, and temporary housing resources are detailed in the Ochoa Mine Project EIS (BLM 2014a).

3.6.6 Public Infrastructure, Services, and Local Government Fiscal Conditions

Public infrastructure and services within the socioeconomic analysis area are provided by Lea County and the cities of Jal, Eunice and Hobbs, and by Eddy County and the City Carlsbad. There also are a number of special districts and volunteer agencies. Public services provided by Lea County to the leasing area include law enforcement and road maintenance. The leasing area is located within the service area of the Jal Volunteer Fire Department and Ambulance Service for emergency response.

Water, wastewater, and solid waste disposal infrastructure are discussed in-depth in the Ochoa Mine Project EIS 2014. Additionally, law enforcement, emergency response (fire and ambulance), health care, and public education also are detailed in the Ochoa Mine Project EIS (BLM 2014a).

3.6.6.1 Mining Related to Public Sector Fiscal Conditions

Public sector fiscal conditions in the region are integrally linked to natural resource development and the presence of public lands. The State of New Mexico and many local entities derive substantial revenues from development activity. Major revenue sources include payments in lieu of taxes (PILTs) on federal lands, gross receipts taxes (GRTs) on the taxable value of commodities sold and purchases by energy firms, their vendors and employees, mineral royalties, severance taxes, and *ad valorem* taxes on the value of production and mining equipment. Recent receipts from several of these sources are highlighted below.PILTs, federal mineral royalties (FMR), New Mexico imposes a severance tax, conservation tax, and an emergency school tax on the sales value of oil and gas produced, regardless of ownership. Similar in some respects to a sales tax, the New Mexico GRT is levied on the sales and leases of most goods, property, and services. Lea and Eddy counties and other local taxing authorities assess and collect *ad valorem*/property taxes on mineral production and mining-related equipment located within its taxing boundaries.

3.6.6.2 Taxable Value

The 2011 taxable values for both counties are substantial, in excess of $3.0 billion each, reflecting the value of oil, gas and mineral production. The 2011 taxable value of the selected municipalities, based primarily on residential, commercial, and some industrial properties, ranges from $4.4 million for Loving to $225.2 million for Carlsbad. Further information is detailed in Section 3.15.7.9 of the Ochoa Mine Project EIS (BLM 2014a).

3.6.6.3 County and Municipal Budget Summaries

Fiscal year 2011 total revenues exceeded expenditures in Eddy County, resulting in a fund balance of $43.3 million for the year. Conversely, fiscal year expenditures exceeded revenues by $1.5 million in Lea County, resulting in transfers from other sources. County and municipal budget summaries are further detailed in Sections 3.15.7.10 and 3.15.7.11 of the Ochoa Mine Project EIS (BLM 2014a).

3.7 Environmental Justice

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (USEPA 1998). EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, tasks "each Federal agency [to] make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations."

Implementation of EO 12898 for NEPA requires the following steps:

1. Identification of the presence of minority and low-income populations and Indian Tribes in areas that may be affected by the action under consideration.
2. Determination of whether the action under consideration would have human health, environmental, or other effects on any population.
3. Determination of whether such environmental, human health or other effects would be disproportionately high and adverse on minority or low-income populations or Indian Tribes.
4. Provision of opportunities for effective community participation in the NEPA process, including identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of public meetings, crucial documents, and notices (USEPA 1998).

3.7.1 Minority Populations

Table 3-12 presents 2013 estimated Census information on the prevalence of minority populations in Lea and Eddy counties. As shown, the concentration of minority populations in each of these geographies is lower than the New Mexico statewide average.

Table 3-12 Percentage of Minorities in Geographic Comparison Areas, 2013 (estimate)

Geographic Area	Percentage of Total Population				Variance in the Percentage of Minority Population with the Statewide Average
	White Alone and Non-Hispanic	Hispanic or Latino	Other Racial and Ethnic Minorities	Total Racial and Ethnic Minorities	
United States	62.6	17.1	20.3	37.4	-22.9
New Mexico	39.4	47.3	13.3	60.6	n/a
Lea County	39.9	54.3	5.8	60.1	-0.5
Eddy County	50.3	45.7	4.0	49.7	-10.9

Source: U.S. Census Bureau 2014.

3.7.1.1 Low Income Population

Table 3-13 identifies the prevalence of low-income populations in Lea and Eddy counties. Both counties recorded poverty levels that were well below the New Mexico state average. In conclusion, as shown in Tables 3-11, 3-12, and 3-13, Census Bureau estimates detail regional population income that is above the state average and poverty and minority levels that are below the state average. Additionally, direct observation indicates an absence of human habitation within the leasing area, an extremely low population density surrounding the leasing area and a comparatively low prevalence of minority and low-income populations in Lea and Eddy counties (BLM 2014a).

Table 3-13 Low Income Population

Geographic Area	Percentage of Total Population Below Poverty Level	Percentage of Low-income Population Above/Below Statewide Average
United States	15.4	n/a
New Mexico	20.4	n/a
Lea County	15.0	-5.4
Eddy County	12.5	-7.9

Sources: U.S. Census Bureau 2014.

3.8 Soils

A variety of data sources were used to identify the baseline soil characteristics in the leasing area. Information on Major Land Resource Areas and soil types was obtained from NRCS literature or databases, including the Land Resource Regions and Major Land Resource Areas of the U.S., the Caribbean, and the Pacific Basin, U.S. Department of Agriculture (USDA) Handbook 296 (NRCS 2006).

3.8.1 Major Land Resource Areas

The leasing area boundary lies within Major Land Resource Area (MLRA) 42, Southern Desertic Basins, Plains, and Mountains (NRCS 2006). This MLRA is distinguished by intermontane desert basins and broad valleys bordered by gently sloping to strongly sloping bajadas, alluvial fans, and terraces. Elevation in this MLRA ranges from 2,600 to 4,950 feet amsl in areas on the plains and basins.

The soils generally are moderately deep to very deep, well drained, and loamy or clayey. Some of the soils are shallow or very shallow over a petrocalcic horizon or bedrock. The dominant soil orders in this MLRA are aridisols, entisols, and mollisols. Aridisols are well developed soils that have a very low concentration of organic matter and form in an arid or semi-arid climate. In contrast, mollisols are fertile soils with high organic matter and a nutrient-enriched, thick surface. Entisols are considered recent soils that lack soil development because erosion or deposition rates occur faster than the rate of soil development.

The leasing area consists of arid rangeland. Portions of the leasing area have been previously disturbed primarily by oil and gas activities and livestock grazing. More information on soils in this region can be found in Section 3.4.2 of the Ochoa Mine Project EIS (BLM 2014a).

3.9 Vegetation

The following section presents general vegetation resources, including noxious weeds and invasive species, and wetlands. There are five listed special plant species for Eddy County, New Mexico and none for Lea County, New Mexico. There are no listed special status plant species for Lea County, New Mexico and subsequently, the leasing area. The analysis area for vegetation resources is defined as the leasing area encompassing the preference right lease applications beyond mine area analyzed in the 2014 Ochoa Mine Project EIS (BLM 2014a) and is comprised of approximately 43,442 acres.

3.9.1 Plant Communities

The leasing area is located within the Chihuahuan Desert Grassland subregion of the Chihuahuan Desert ecoregion. The Chihuahuan Desert ecoregion extends from the southeastern Arizona to south-central Texas, and more than 500 miles south into Mexico. The Chihuahuan Desert ecoregion historically has been dominated by desert grasslands and by shrublands dominated by creosotebush (*Larrea tridentata*). Over the last several hundred years, the extent of desert grasslands has declined, and desert shrublands have become increasingly dominant. The gradual desertification is thought to be caused by grazing and other anthropogenic activities. The Chihuahuan Desert Grasslands subregion is found at higher elevations, such as elevated basins between mountain ranges, low mountain benches, plateau tops, and north-facing mountain slopes. The Chihuahuan subregion is arid, with an average annual rainfall of over 12 inches a year (see **Table 3-14**).

Vegetation community types within the leasing area are based on LANDFIRE geospatial vegetation data (LANDFIRE 2013). Vegetation communities in the leasing area are similar to those identified in Section 3.7.1 of the 2014 Ochoa Mine Project EIS (BLM 2014a). Seven vegetation communities occur within the leasing area including coppice dune and sand flat scrub, desert bottomland and swale grassland, mesquite scrub and shrubland, mixed desert scrub steppe, semi-desert and desert grassland, shinnery oak shrubland, and sparsely vegetation/developed/disturbed. Acreages for vegetation cover type in the various components of the leasing area are summarized in **Table 3-14**. Although seven vegetation communities were identified, two communities cover most of the leasing area (combined 90 percent): coppice dune and sand flat scrub and mesquite upland scrub steppe. Species nomenclature is consistent with the NRCS Plants Database (NRCS 2012) and the New Mexico State Noxious Weed List found in New Mexico Status Annotated (NMSA) 1978, 76-7-1 to 76-7-30. **Figure 3-8** illustrates the vegetation cover types present within the leasing area. The vegetation cover types that are dominant or otherwise important as habitat are described below.

Table 3-14 Vegetation Community Types within the Leasing Area

Vegetation Cover Type	Acres	% of Leasing Area
Coppice Dune and Sand Flat Scrub	11,127	26
Desert Bottomland and Swale Grassland	13	<1
Mesquite Scrub and Shrubland	27,824	64
Mixed Desert Scrub Steppe	3,093	7
Semi-Desert and Desert Grassland	235	<1
Shinnery Oak Shrubland	723	2
Sparsely Vegetated/Developed/Disturbed	428	1
Total	**43,442**	**100**

Source: LANDFIRE 2013

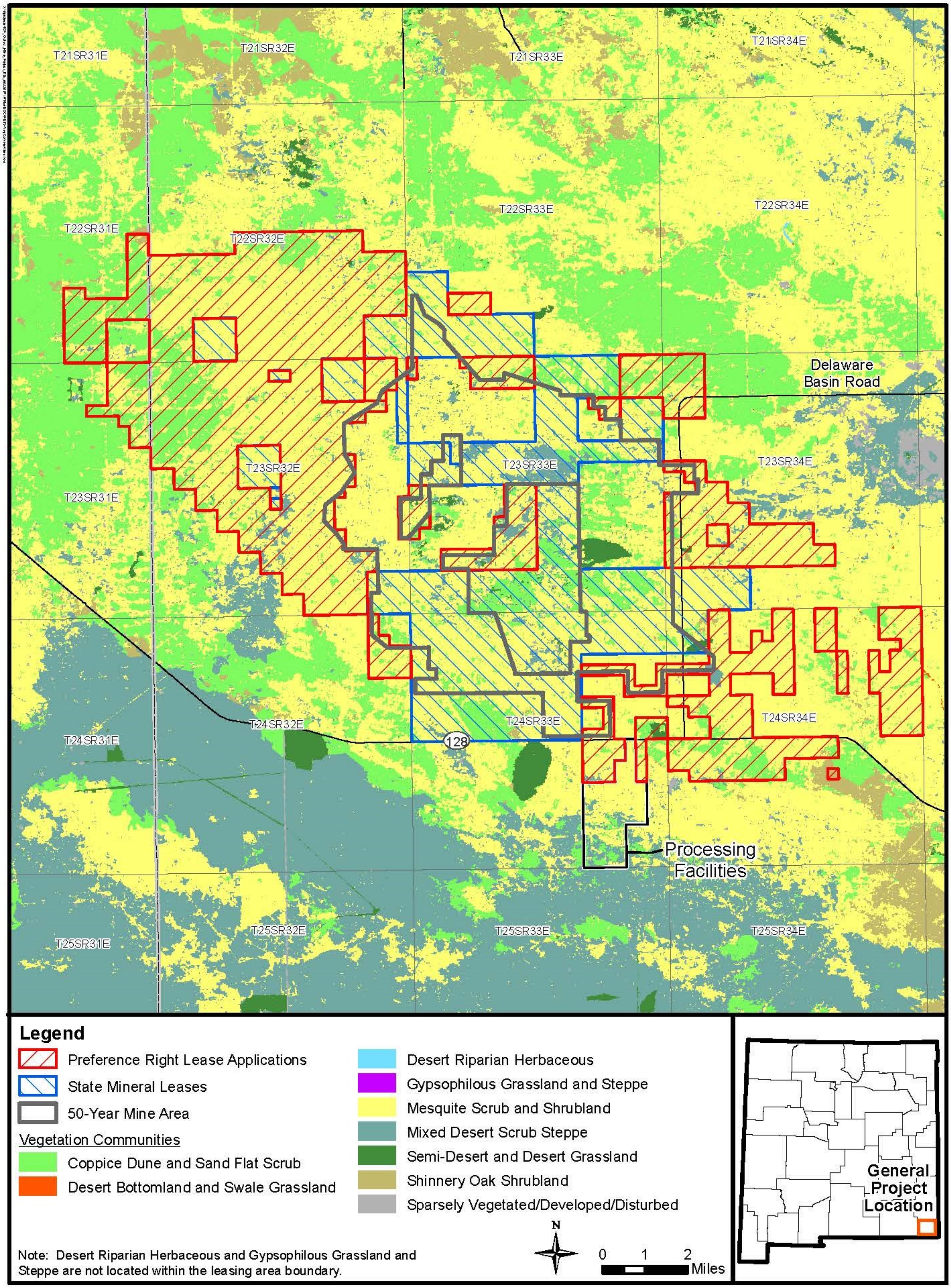


Figure 3-8 Vegetation Cover Types within the Leasing Area

3.9.1.1 Coppice Dune and Sand Flat Scrub

The coppice dune and sand flat scrub vegetation community type is the second most dominant community types found within the leasing area and covers approximately 26 percent of the project area, predominantly in the northern and western portion of the leasing area. This vegetation community is found on low, sandy flats, where wind forms a series of shifting sand dunes and depressions which creates vegetation microclimates. Bare ground is 30 to 45 percent of the cover, which combined with the lack of rooted vegetation, results in increased susceptibly to erosion. Vegetation consists of sand sagebrush (*Artemesia filfolia*), with limited occurrences of honey mesquite (*Prosopis glandulosa*). Species typically found on former and now degraded gypsophilous grassland and steppe communities include blazing star (*Mentzelia* spp.), Torrey's joint fir (*Ephedra torreyana*), leadplant (*Amorpha canescens*), skunkbush sumac (*Rhus trilobata*), and *Yucca* spp.

3.9.1.2 Mesquite Scrub and Shrubland

Often found adjacent to mixed desert scrub steppe, a similarly structured community, mesquite upland scrub steppe is the most dominant community found within the leasing area and covers approximately 64 percent of the project area. The mesquite upland scrub steppe is the result of grasslands being invaded by shrubs probably due to disturbances such as drought, overgrazing, seed dispersal by livestock, and decreases in natural fire frequency. Vegetation has little diversity, and is dominated by shrubs such as honey mesquite and broom snakeweed (*Gutierrezia sarathrae*). Associated shrubs include desert buckthorn (*Ceanothus greggii*), rabbitbrush (*Chrysothamnus* spp.), and javelina bush (*Condalia ericoides*). Understory species include grasses such as low woollygrass (*Dasyochloa pulchella*), Lehmann lovegrass (*Eragrostis lehmanniana*), rough menodora (*Menodora scabra*), bush muhly (*Muhlenbergia porti*), and sand dropseed (*Sporobolus cryptandrus*), and forbs such as prickly Russian thistle (*Salsola tragus*), annual buckwheat (*Eriogonum annuum*), tulip prickly pear (*Opuntia phaeacantha*), buffalobur nightshade (*Solanum rostratum*), and Rocky Mountain zinnia (*Zinnia grandiflora*).

3.9.1.3 Mixed Desert Scrub Steppe

Mixed desert scrub steppe is found in approximately seven percent of the leasing area. Disturbances such as livestock grazing or drought have spread the mixed desert scrub steppe into areas once covered by desert grasslands. The vegetation community is typically found on mid to upper gravelly piedmont slopes. On mid to lower slopes, the mixed desert scrub steppe often transitions into creosote desert scrub. Dominant vegetation in the project area includes whitethorn and catclaw acacia (*Acacia* spp.), with associated species consisting of sand dropseed, honey mesquite, and sand sagebrush. Lehmann lovegrass, a non-native grass species, tends to dominate the understory vegetation in many areas. Other non-dominant species include purple threeawn (*Aristida purpurea*), milkweed (*Asclepias* sp.), buffalograss (*Buchloë dactyloides*), sunflower (*Helianthus* spp.), needle and thread (*Hesperostipa comata*), bush muhly, and soaptree yucca (*Yucca elata*). Small areas of creosote desert scrub are included in this community, similar to the rest of the area but dominated by creosote bush (*Larrea tridentata*). A small area of succulent desert scrub vegetation is also included in this community. These sites are hot and dry with abundant gravel and rock on the ground surface. The vegetation is characterized by a relatively high cover of succulent species including Lechuguilla (*Agave lechuguilla*), green sotol (*Dasylirion leiophyllum*), *Ferocactus* spp., *Opuntia* spp., and *Yucca* spp interspersed with other non-dominant species.

3.9.1.4 Shinnery Oak Shrubland

Shinnery oak shrubland occurs in two percent of the leasing area. It is typically found on stable dunes adjacent to mesquite scrub and shrubland communities described above on areas with more unstable, and shifting dunes. The dominant vegetation species is shinnery oak (*Quercus havardii*), a low, slow-growing shrub that has large underground stem and root systems. It can resprout following a fire and may persist for long periods of time once established. Plant composition and dune stabilization can be affected by drought, fire, grazing, and vegetation treatments affecting the distribution of the vegetation communities. Other shrub species include sand sagebrush, desert ceanothus, javelina bush, and honey mesquite. Herbaceous species in this community include purple threeawn, annual buckwheat, rough menodora, bush muhly, little bluestem (*Schizachyrium scoparium*), sunflower, blazingstar, and soaptree yucca.

3.9.2 Special Status Plant Species

Special status plant species are species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species protected under the ESA, species that are candidates for listing by the U.S. Fish and Wildlife Service (USFWS), species that are listed by the state as threatened or endangered, and BLM sensitive species.

In accordance with the Endangered Species Act (ESA), the lead agency, in coordination with the USFWS, must ensure that any federal action to be authorized, funded, or implemented would not adversely affect a federally listed threatened or endangered species or its critical habitat. The BLM Special Status Species Management Policy 6840 requires the BLM to manage and protect any USFWS candidate species, or state listed species, to prevent the need for future federal listing as threatened or endangered. There are five federally listed plant species and no BLM sensitive, or state listed plant species for Eddy County. There are no federal, BLM sensitive, or state listed plant species in Lea County. **Table 3-15** summarizes the five federally listed species in Eddy County with a description of their habitats. There are no known occurrences of these species within the leasing area (University of New Mexico [UNM] 2005). Site-specific surveys will be conducted for special status plant species prior to construction activities..

Table 3-15 Federally Listed Plant Species in Eddy County, New Mexico

Species (Scientific Name)[1]	Status	Habitat Description[2]	Known Occurrence within the Leasing Area[3]
Gypsum wild-buckwheat (*Eriogonum gypsophilum*)	Threatened	Found in open areas with gypsum in grama grasslands in semi-arid habitats; eroded gypsum clay hills and fans, creosote bush communities.	None
Kuenzler hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*)	Endangered	Limestone ledges, rock cracks, and gentle slopes; or on flat steps of sunny, grass-covered hillsides in the lower fringes of pinyon-juniper savannah.	None
Lee pincushion cactus (*Escobaria sneedii* var. *leei*)	Threatened	Restricted to the tansil limestone formation and grows only on north-facing limestone ledges, slopes, and ridgetops.	None
Sneed pincushion cactus (*Escobarioa sneedii* var. *sneedii*)	Endangered	Restricted to limestone ledges and the rocky slopes of limestone mountains in desert and desert grasslands.	None
Wright's marsh thistle (*Cirsium wrightii*)	Candidate	Marshy wetlands (cienegas) near springs in otherwise semi-arid to arid areas.	None

[1] Source: USFWS 2015.

[2] Source: NatureServe 2015.

[3] Source: UNM 2005.

3.9.3 Wetlands and Riparian Areas

Wetlands and other waters of the U.S. are protected under Section 404 of the CWA. Section 404 requires that any discharges of dredge or fill material into these water must be permitted. Most oil and gas development, such as well pads and pipelines, is likely to be conducted under Nationwide Permits.

Waters of the U.S. are defined in 33 CFR 328.3 as all non-tidal waters that are currently, or were used in the past, or may be susceptible to use in interstate commerce; all interstate waters including wetlands; all other waters such as interstate lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, of which the use, degradation or destruction could affect interstate commerce; and all impoundments of waters of the U.S. In addition, tributaries of the above listed waters, including arroyos and other intermittent drainages, and wetlands adjacent to the above waters also are considered to be waters of the U.S..

Wetlands are a waters of the U.S. that are considered to be a special aquatic site. According to the U.S. Army Corps of Engineers (USACE's) 1987 Wetland Delineation Manual, a "three-parameter" approach is required for delineating USACE-defined wetlands (USACE 1987), where areas are identified as wetlands if they exhibit hydrophytic vegetation, hydric soils, and wetland hydrology.

Riparian areas are generally defined as the vegetated transitional zones that lie between aquatic and terrestrial (upland) environments. Riparian areas usually occur as belts along streams, rivers, lakes, marshes, bogs, and other water bodies. As a transitional zone between aquatic and upland environments, riparian systems often exhibit characteristics of both. Generally, only perennial and intermittent streams can support riparian areas that serve the entire suite of riparian ecological functions. Ephemeral streams rarely possess the hydrologic conditions that allow true riparian vegetation to grow.

The leasing area is located within a landscape where wetlands and other waterbodies are small and uncommon. Playas and ephemeral washes were identified in an area adjacent to the leasing area during surveys conducted as part of the Ochoa Mine Project EIS (BLM 2014a).

3.9.4 Noxious and Invasive Species

Noxious weeds have become a growing concern in the western U.S. due to their ability to increase in cover and exclude native plants from an area. The spread of noxious weeds caused damage to endangered native species, resulting in reductions in available forage for livestock and wildlife. Impacts to livestock and wildlife can result in impacts to economic resources. As a result, the State of New Mexico passed the Noxious Weeds Management Act (NWMA), which requires the New Mexico Department of Agriculture (NMDA) to develop a list of noxious weeds, identify methods of control, and educate the public (76-7-1 to 76-7-30 NMDA 1978). The NWMA defines a noxious weed as any weed or plant that is harmful or possesses noxious characteristics, as determined by the board of county commissioners. The board of county commissioners acts as the governing body of the district.

The federal Noxious Weed Act of 1974, as amended (7 USC 2801 et seq.) requires cooperation with state, local, and other federal agencies in the application and enforcement of all laws and regulations relating to the management and control of noxious weeds. The BLM acknowledged the Act by establishing a goal to include noxious weed considerations in NEPA documents. Analysis should include the potential for the spread of noxious weed species and provide preventive rehabilitation measures for each management action involving surface disturbance. A list of noxious weeds for the State of New Mexico can be found in Table 3.7-2 in the Ochoa Mine Project EIS (BLM 2014a).

In the state, African rue (*Peganum harmala*), Malta star-thistle (*Centaurea melitensis*), and Russian knapweed (*Acroptilon repens*) are of the highest concern and are all Class B species. No specific noxious weed data is available for the leasing area; however, ten noxious weeds known to occur within Lea and Eddy counties are described below in **Table 3-16**.

Table 3-16 Noxious Weeds Found Within Lea and Eddy Counties, New Mexico

Scientific Name	Common Name
Acroptilon repens	Russian knapweed
Aegilops cylindrica[1]	jointed goatgrass
Alhagi maurorum[1]	camelthorn
Centaurea calcitrapa	purple starthistle
Convolvulus arvensis	field bindweed
Elaeagnus angustifolia	Russian olive
Lepidium draba[1]	hoary cress
Peganum harmala	African rue
Tamarix chinensis	saltcedar
Ulmus pumila	Siberian elm

[1] Found only within Lea County, New Mexico

Source: NMSU 2013.

African rue has been observed in the vicinity of the Ochoa Mine area. The BLM Carlsbad Field Office along with county, state, and federal agencies monitor and treat noxious weed species in the area (BLM 2014a).

3.10 Wildlife and Fish

The following section presents wildlife and fish resources, including special status species. The study area for wildlife and fish resources is defined as the leasing area which includes the preference right lease applications beyond the leases analyzed in the Ochoa Mine Project EIS (BLM 2014a) and is comprised of approximately 43,442 acres in Lea and Eddy counties.

3.10.1 General Wildlife and Fish Resources

Wildlife habitats and species found within the leasing area are typical of the arid landscape of southeast New Mexico.

Terrestrial habitat descriptions and composition are similar to that described for the Ochoa Mine Project EIS (BLM 2014a). As discussed in Section 3.10, Vegetation, seven vegetation cover types (i.e., wildlife habitat) and one land use type are located with the leasing area. The vegetation cover types consist primarily of coppice dune and sand flat scrub, creosote desert scrub, mesquite shrubland, mesquite upland scrub steppe, mixed desert scrub steppe, and shinnery oak shrubland. Mesquite upland scrub steppe is the most common vegetation type within the leasing area.

Water sources, particularly those that maintain open water and riparian vegetation, support a greater diversity and population density of wildlife species than any other habitat type occurring in the leasing area. As identified in Section 3.10, wetlands and WUS were not mapped as part of this EA; however, the USACE determined that there are no waters of the U.S. in the leasing area (BLM 2014a). Playas and ephemeral washes were identified in an area adjacent to the leasing area during surveys conducted as part of the Ochoa Mine Project EIS (BLM 2014a). Therefore, available water for wildlife consumption and the presence of riparian areas utilized by terrestrial wildlife species are limited.

General wildlife and fish species composition including big game, small game, and nongame species are the same as that identified in the Ochoa Mine Project EIS (BLM 2014a). Notably, no fisheries occur within the leasing area.

3.10.2 Special Status Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed species that are protected under the Endangered species Act (ESA) and species designated as sensitive by the BLM. In addition, the State of New Mexico designates threatened and endangered species (NMAC 19.33.6.8) that also are accorded special status.

In accordance with the Endangered Species Act (ESA), the lead agency (BLM) in coordination with the USFWS must ensure that any action that they authorize, fund, or carry out would not adversely affect a federally listed threatened or endangered species. In addition, as stated in Special Status Species Management Policy 6840 (6840 Policy) (Rel. 6-125), it is BLM policy "to conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA provisions are no longer needed for these species, and to initiate proactive conservation measures that reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing of these species under the ESA."

A total of 69 (51 terrestrial and 18 aquatic or semi-aquatic) special status species were identified as potentially occurring within the region of the leasing area (Biota Information System of New Mexico [BISON-M] 2015a, b, c, d; USFWS 2015). The potential for occurrence within the leasing area was evaluated for each species based on habitat requirements and known distribution. According to the Ochoa Mine Project EIS (BLM 2014a), a total of 54 special status species (40 terrestrial and 14 aquatic or semi-aquatic) were identified as potentially occurring. All but three species have the same potential for occurrence for this leasing area. Two species, the black-footed ferret (*Mustela nigripes*) and whooping crane (*Grus americana*), are not considered as potentially occurring within the project region; and the Arizona black-tailed prairie dog (*Cynomys ludovicianus arizonensis*) is considered to potentially occur within the leasing area based on the presence of suitable habitat within the leasing area. The remaining 51 of the 69 special status species identified as potentially occurring for this EA are analyzed the same as presented in Table 3.8-1 of the Ochoa Mine Project EIS (BLM 2014a).

An additional 18 species (14 terrestrial and 4 aquatic species) not analyzed in the Ochoa Mine Project EIS, but considered potentially occurring within the boundaries analyzed for this EA are summarized in **Table 3-17**. An evaluation of these 18 species determined that 12 species are unlikely to occur within the leasing area. Therefore, evaluations determined that 50 of the 68 species identified are unlikely to occur within the leasing area. This includes all 18 aquatic or semi-aquatic species as suitable aquatic habitat is not present within the leasing area.

Table 3-17 Sensitive Wildlife Species Potentially Occurring Within the Leasing Area

Common Nam (Scientific Name)	Status[1]	Habitat Information[2]	Potential for Occurrence within the Leasing area	References
Mammals				
Long-legged myotis (*Myotis volans*)	BLM	This species inhabits coniferous and deciduous forests, basin-prairie and mountain-foothills shrublands, riparian areas. Roosts include tree and rock crevices, snages and buildings.	Yes. Suitable habitat is present within the leasing area.	BISON-M 2015b
Spotted bat (*Euderma maculatum*)	BLM	This species is associated with a variety of habitat types over their range, but prefers subalpine conifer forest within New Mexico. Cliffs over perennial water are an important habitat component.	No. Preferred habitat for this species is not found within the leasing area and potential occurrence by this species within the leasing area would be highly unlikely	BISON-M 2015b
Black-tailed prairie dog (*Cynomys ludovicianus ludovicianus*)	BLM	The black-tailed prairie dog is found on the short and mid-grass plains east of the Rockies. Black-tailed prairie dogs avoid areas with tall grass, heavy sagebrush, and other thick vegetation cover.	Yes. Suitable habitat is present within the leasing area.	BISON-M 2015b
Birds				
Southwestern willow flycatcher (*Empidonax traillii extimus*)	FE; NM-E	This species is associated with woody riparian and wetlands and riparian habitat.	No. Suitable habitat for this species is not found within the leasing area and potential occurrence by this species within the leasing area would be highly unlikely	USFWS 2015; BISON-M 2015b
Piping plover (*Charadrius melodus*)	FT; NM-T	This species occurs on sandflats or along bare shorelines of rivers, lakes, or coasts. In New Mexico, this species is considered a rare migrant with only six documented observation.	No. Suitable habitat for this species is not found within the leasing area and potential occurrence by this species within the leasing area would be highly unlikely	USFWS 2015; BISON-M 2015b
Least tern (*Sternula antillarum*)	FE; NM-E	This species breeds and forages on barren or sparsely vegetated sandbars adjacent to waterbodies.	No. Suitable habitat for this species is not found within the leasing area and potential occurrence by this species within the leasing area would be highly unlikely	USFWS 2015; BISON-M 2015b

Table 3-17 Sensitive Wildlife Species Potentially Occurring Within the Leasing Area

Common Nam (Scientific Name)	Status[1]	Habitat Information[2]	Potential for Occurrence within the Leasing area	References
Mexican spotted owl (*Sternula antillarum*)	FT	The species occupies old growth forest in mixed conifer, pine–oak woodland, deciduous riparian, cliff and canyon areas, or a combination of these habitats that will support a large home range.	No. Suitable habitat for this species is not found within the leasing area and potential occurrence by this species within the leasing area would be highly unlikely	USFWS 2015; BISON-M 2015b
Gray Vireo (*Vireo bellii*)	NM-T	This species is found in montane shrubland, pinyon–juniper, sagebrush shrubland, saltbush shrubland habitats.	Yes. Nesting and foraging habitat for this species could potentially occur within the leasing area.	BISON-M 2015b.
Chestnut-collared longspur (*Calcarius ornatus*)	BLM	This species is associated with grasslands and desert scrub habitats.	Yes. Nesting and foraging habitat for this species could potentially occur within the leasing area.	BISON-M 2015b.
Bendire's thrasher (*Toxostoma bendirei*)	BLM	This species is found in desert scrub habitat with open to dense vegetation of shrubs, low trees, and succulents; as well as riparian woodlands and annual grasslands.	Yes. Nesting and foraging habitat for this species could potentially occur within the leasing area.	BISON-M 2015b.
Pinyon jay (*Gymnorhinus cyanocephalus*)	BLM	This species is found in conifer forest, montane shrubland, and pinyon–juniper habitats.	No. Suitable habitat for this species is not found within the leasing area.	BISON-M 2015b.
Grasshopper sparrow (*Ammodramus savannarum perpallidus*)	BLM	This species generally prefers moderately open grasslands and prairies with patchy bare ground. Within the arid grasslands of the Southwest, this species has been known to occupy lusher areas with shrub cover.	Yes. Nesting and foraging habitat for this species could potentially occur within the leasing area.	BISON-M 2015a,b
Painted bunting (*Passerina ciris*)	BLM	In New Mexico, this species primarily occurs in riparian oases and surrounding desert shrub habitat. Locations include Rattlesnake Springs and other areas along the lower Pecos River valley in Eddy County, and near Jal in Lea County.	No. This species has been documented near Jal in Lea County, however, suitable habitat does not exist in the leasing area.	BISON-M 2015a,b; NMACP 2015

Table 3-17 Sensitive Wildlife Species Potentially Occurring Within the Leasing Area

Common Nam (Scientific Name)	Status[1]	Habitat Information[2]	Potential for Occurrence within the Leasing area	References
Bell's vireo (*Vireo bellii*)	NM-T; BLM	Species occurs in dense shrubland or woodland along lowland stream courses, with willows (*Salix* spp.), mesquite (*Prosopis* spp.), and seepwillows (*Baccharis glutinosa*) being characteristic plant species.	No. The potential occurrence by this subspecies would be highly unlikely, based on its known habitat and distribution in New Mexico.	BISON-M 2015a,b
Fish				
Smallmouth buffalo (*Ictiobus bubalus*)	BLM	This species inhabits larger pools of higher order rivers with low velocity current and lower elevation impoundments. It prefers clean to moderately turbid, deep, warm waters.	No. Suitable habitat for this species is not found within the leasing area.	BISON-M 2015b
Speckled chub (*Macrhybopsis aestivalis*)	BLM	This species inhabits low gradient, main channel streams.	No. Suitable habitat for this species is not found within the leasing area.	USFWS 2015; BISON-M 2015b
Rio Grande chub (*Gila pandora*)	BLM	This species is associated with perennial rivers at higher elevations.	No. Suitable habitat for this species is not found within the leasing area.	USFWS 2015; BISON-M 2015b
Invertebrates				
Texas hornshell (*Popenaias popeii*)	FC; BLM	This species is found in large streams with variable substrates.	No. Suitable habitat for this species is not found within the leasing area.	USFWS 2015; BISON-M 2015b

Status:

FT = Federally listed as threatened.

FE = Federally listed as endangered

FC = Federal candidate.

NM-E = State-listed as endangered in New Mexico.

NM-T = State-listed as threatened in New Mexico.

BLM = BLM sensitive species.

Only one federally listed species under the ESA, the lesser prairie-chicken (*Tympanuchus pallidicinctus*), is analyzed in this EA. Section 3.8.3 of the Ochoa Mine Project EIS (BLM 2014a) details the current distribution within the region. As shown in **Table 3-18**, only 2 percent of the leasing area contains suitable shinnery oak shrubland habitat. According to historic data (BLM 2012) and recent surveys prepared for the 2014 Ochoa Mine Project EIS (BLM 2014a), no known lek sites are located within the leasing area. There has been one sighting buffer identified that overlaps with five leases (NMNM 123691-B, NMNM 124371-A, NMNM 124373-B, NMNM 124374, and NMNM 123694) in the Northwestern portion of the leasing area (**Figure 3-9**). The date of that sighting is unknown.

The project overlaps with the BLM Carlsbad Field Office Isolated Population Area (IPA), designated as a priority location for this species within the RMPA and EIS (BLM 2008, 2007). Located within the IPA are Habitat Evaluation Areas (HEAs) that have been established to serve as potential habitat building blocks for expansion of the lesser prairie-chicken (BLM 2008) (see **Figure 3-9**). **Table 3-18** identifies the leases and amount of acres that overlap with the IPA and HEAs. Further management direction within these areas is detailed in the RMPA and EIS (BLM 2008, 2007). Within the RMPA Planning Area, coordinated efforts to reclaim and restore habitat in previously developed areas will be carried out when and where opportunities arise.

Table 3-18 Acres of the Lesser Prairie Chicken Isolated Population Area and Habitat Evaluation Areas within the Leasing Area

Lease ID	Acres within the Isolated Population Area	Acres within Habitat Evaluation Areas	Total Acres
NMNM 121105-D	549		549
NMNM 121107-B	<1	<1	<1
NMNM 121109-B	558		558
NMNM 121110-B	160		160
NMNM 121112-A	1,444		1,444
NMNM 121112-B	40		40
NMNM 121114-B		1	1
NMNM 121114-C		758	758
NMNM 123690-B	160		160
NMNM 123690-C	80		80
NMNM 123690-D	480		480
NMNM 123691-B	<1	45	45
NMNM 123691-C	1,832		1,832
NMNM 123691-D	46		46
NMNM 123691-E	200		200
NMNM 123692	2,532		2,532
NMNM 123693-B	839		839
NMNM 123693-C	80		80
NMNM 123694	961	1,577	2,539
NMNM 124371-A	1,290	642	1,932
NMNM 124371-B		319	319
NMNM 124372	2,560		2,560
NMNM 124373-A	1,602		1,602

Table 3-18 Acres of the Lesser Prairie Chicken Isolated Population Area and Habitat Evaluation Areas within the Leasing Area

Lease ID	Acres within the Isolated Population Area	Acres within Habitat Evaluation Areas	Total Acres
NMNM 124373-B	662	<1	662
NMNM 124374	815	387	1,202
NMNM 124375-A	28	613	641
NMNM 124375-B	1,157		1,157
NMNM 124375-C	239		239
NMNM 124376-B	1,237		1,237
NMNM 124376-C	663		663
NMNM 124377-A	320		320
NMNM 124377-B	2,168		2,168
NMNM 124378	2,237		2,237
NMNM 124379-B	<1		<1
NMNM 124381-D	639		639
Total Acres	25,578	4,343	29,921

Source: BLM 2012.

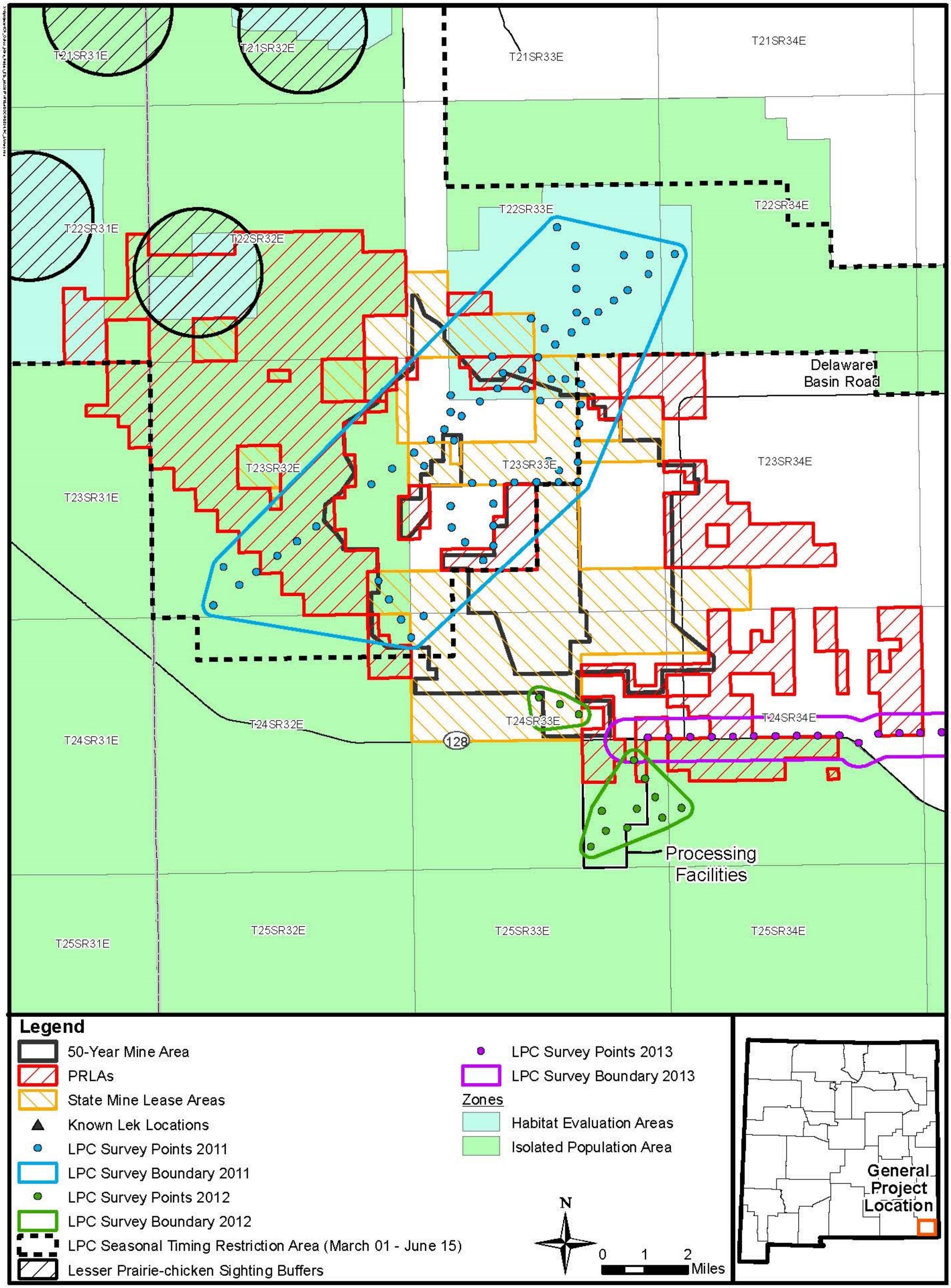


Figure 3-9 Lesser Prairie-chicken Habitat Near Leasing Area

3.11 Cultural Resources

Cultural resources are defined as the specific locations and/or tangible remains and material evidence resulting from, or associated with, past human activity. Cultural resources encompass a diverse array of property types including buildings, structures (e.g., bridges, canals, railroads), sites, objects, and districts. In addition, certain cultural resources may be defined as cultural landscapes, which are classified either as historic sites, historic designed landscapes, historic vernacular landscapes, or ethnographic landscapes (NPS 1998).

3.11.1 Regulatory Framework

Federal historic preservation laws provide a mandate and procedures for the identification, documentation, evaluation, and protection of cultural resources that may be affected by federal undertakings, which can include private undertakings operating under federal license, or on federally managed lands. The NEPA requires federal agencies involved in undertakings to consider the potential effects to the "human environment"—an all-encompassing term which has been interpreted to include cultural resources.

NHPA of 1966, as amended, requires federal agencies to consider an undertaking's effects on historic properties, which are defined as cultural resources (including both historic and archaeological sites) listed or determined officially eligible for listing on the NRHP. Section 106 of the NHPA and accompanying implementing regulations specified in 36 CFR 800 ("Protection of Historic Properties") establish a collaborative consultation/review process and specific sequential procedures which enable federal agencies to identify historic properties that may be directly or indirectly affected by a proposed federal undertaking.

As the lead federal agency, the BLM's compliance with the NHPA is guided by a National Programmatic Agreement (NPA) established between the BLM, the Advisory Council on Historic Preservation (ACHP), and the National Conference of State Historic Preservation Officers (SHPO). The NPA resulted in the development of operational protocols by the BLM offices in each state. In New Mexico, the Protocol Agreement (BLM 2004) between the BLM and New Mexico SHPO defines how the BLM and SHPO will interact and cooperate under the NPA, and provides direction for implementing the NHPA.

The area of potential effects (APE) to cultural resources associated with a specific federal undertaking is defined in 36 CFR 800.16(d) as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. Because no surface disturbance is anticipated for this leasing EA, no impacts to cultural resources are anticipated. For disclosure purposes, however, potential indirect effects to cultural resources within the area of potential effects (APE), defined here as the geographic area enclosing the preference right lease applications (PRLAs), are discussed.

Further guidance on the regulatory frame work as well as the eligibility criterion for listing cultural resources on the NRHP is detailed in the Ochoa Mine Project EIS (BLM 2014a).

3.11.2 Cultural History

The leasing area is located within the Southeastern New Mexico Archaeological Region. Humans have inhabited this area for at least 12,000 years and perhaps longer. This lengthy timespan encompasses several sequential cultural/temporal periods (Paleoindian, Archaic, Ceramic, Protohistoric and Spanish Colonial, and Mexican/American Historical), lasting until the early twentieth century. Sites representing all of these periods are known to occur within the region. Additional details about the regional cultural history and its manifestations in and around the leasing area can be found in *The Human Landscape in Southeastern New Mexico: A Class I Overview of Cultural Resources Within the Bureau of Land Management's Carlsbad Field Office Region* (Railey 2012).

3.11.3 Cultural Resources Investigations

A search of the New Mexico Cultural Resources Information System (NMCRIS) was conducted for all recorded cultural resources within the leasing area. The NMCRIS is maintained by the Archaeological Records Management Section (ARMS) of the New Mexico Historic Preservation Division. Electronic locations of all archaeological sites listed in the NMCRIS that fall within the leasing area were obtained. A tabular summary of these known sites also was provided.

Table 3-19 summarizes all of the known cultural resources within the PRLAs. A total of 64 sites have been documented in the leasing area. The majority (73 percent) or these sites are prehistoric in age and cultural affiliation, followed by historic (11 percent), multi-component with both prehistoric and historic components (3 percent), and unknown (13 percent). Of the total, 40 sites (62 percent) have been evaluated as eligible for listing in the NRHP and 21 (33 percent) are not eligible. The NRHP eligibility for 3 sites (5 percent) has not been determined and one is unevaluated.

Table 3-19 Summary of Recorded Sites in the Leasing Area

NRHP Status and Site Period	Number of Sites
Eligible	
Archaic	1
Early Pithouse (Jornada) and Late Pueblo (Jornada)	1
Early Pueblo (Jornada) and Late Pueblo (Jornada)	1
Late Pithouse (Jornada)	1
Late Pithouse (Jornada) and Early Pueblo (Jornada)	1
Late Pithouse (Jornada) and Late Pueblo (Jornada)	1
Mogollon Early Pithouse (Jornada) and Late Pueblo (Jornada)	2
Mogollon Early Pueblo (Jornada)	2
Mogollon Early Pueblo (Jornada) and Late Pueblo (Jornada)	2
Mogollon Jornada	1
Mogollon Late Pithouse (Jornada)	2
Mogollon Late Pithouse (Jornada) and Early Pueblo (Jornada)	1
Mogollon Late Pithouse (Jornada) and Late Pueblo (Jornada)	4
Mogollon Late Pueblo (Jornada)	1
NM Statehood - WWII	2
Unknown	13
Unspecified Prehistoric and Historic	1
US Territorial and NM Statehood - WWII	2
Eligible Total	**39**
Eligible Prehistoric Component/Undetermined Historic Component	
Unspecified Archaic, Unspecified Jornada Mogollon, Late Pueblo, and NM Statehood to WWII	1

Table 3-19 Summary of Recorded Sites in the Leasing Area

NRHP Status and Site Period	Number of Sites
Not Eligible	
Jornada Mogollon	1
Late Archaic and Jornada Mogollon	1
Mogollon Early Pithouse (Jornada) and Late Pueblo (Jornada)	1
Mogollon Jornada	2
NM Statehood - WWII	3
Unknown	13
Not Eligible Total	**21**
Undetermined	
Mogollon Early Pithouse (Jornada) and Late Pueblo (Jornada)	1
Mogollon Late Pithouse (Jornada) and Late Pueblo (Jornada)	1
Undetermined Total	**2**
Unevaluated and Unknown	1
Grand Total	**64**

Source: NMHPD ARMS 2015.

These known sites are scattered somewhat uniformly across the leasing area, although there is a higher concentration within the northern portion. Several reasons can explain this apparent concentration of sites. First, more cultural resources surveys have been conducted in this area, so the distribution of sites may not be a reflection of any patterns of human behavior. Second, natural resources (water, plants, animals, clay and temper for ceramics, and raw materials for stone tools) may be more abundant in this area. Only further studies can clarify the reasons for this pattern.

3.11.4 Native American Traditional Values

Ethnographic resources are associated with the cultural practices, beliefs, and traditional history of a community. Examples of ethnographic resources include places in oral histories or myths, such as particular rock formations, the confluence of two rivers, or a rock cairn; large areas, such as landscapes and viewscapes; sacred sites and places used for religious practices; social or traditional gathering areas, such as dance areas; natural resources, such as plant materials or clay deposits used for arts, crafts, or ceremonies; and places and natural resources traditionally used for non-ceremonial uses, such as trails or camping locations. Further discussion of Native American Traditional Values is provided in Section 3.13.5 of the Ochoa Mine Project EIS (BLM 2014a).

4.0 Environmental Consequences

4.1 Introduction

This chapter presents the analysis of impacts for each resource that would be affected by approval of the leases. Each section provides an overview of the issues identified during public scoping, discussions with BLM staff, and interviews with industry and local community representatives. The issues and impacts selected for inclusion in each section also are based on the experience and judgment of each resource specialist.

Soils, vegetation, wildlife, and cultural resources are described in Chapter 3.0 to provide context to the setting, but would not be affected by the proposed leasing or subsurface mining anticipated to follow. Because approval of the leases would not result in surface disturbing activities, recreation, lands and realty, livestock grazing, and visual resources would not be affected. .Therefore, these eight resources or resource programs that are often included in a NEPA document will not be analyzed in this chapter.

Each section describes the analysis of projected impacts for each alternative in as much detail as possible. Many resources refer to the recently completed Ochoa Mine Project EIS (BLM 2014a) for more detailed information.

At the end of each resource section is a discussion of cumulative impacts. In its Regulations for Implementing NEPA (40 CFR Parts 1500-1508), the CEQ defines a cumulative impact as follows in Section 1508.7:

"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative impacts are the combination of the individual effects of multiple actions over time in the context of other development in the leasing area or the region. The individual effects may be minor when considered separately, but may be major or significant when considered in combination with all others in the region. A CEQ memorandum issued in 2005 (CEQ 2005) provides additional guidance on the consideration of past actions in cumulative effects analysis. This memorandum stresses the "forward-looking" nature of NEPA analysis. It states that the effects of past actions are only required to be analyzed if they are relevant and useful to determine whether the proposed project "may have a continuing, additive and significant relationship" to projected future impacts in the region.

The relevant past and current actions within the leasing area contributed to the current conditions described as the affected environment in Chapter 3.0. For this reason, the cumulative impact analysis included in this chapter focuses primarily on reasonably foreseeable future actions that are known by the BLM at the time this analysis was performed. The impacts of the proposed project and the reasonably foreseeable future actions, along with the effects of the past and current activities that affect the same resources, would combine to have a cumulative impact on the environment in the region.

4.2 Geology and Minerals

4.2.1 Issues

There would be no geology or mineral effects from approval of the preference right lease applications because no new site-specific disturbance has been requested through submittal of a MPO. If these preference right leases are approved, ICP then has the ability to submit a revised MPO for future development within the leasing area. The effects of any new plans relevant to federal lands or minerals, such as expanding the mine area to the boundaries of the preference right lease applications, would be subject to the NEPA process at that time. The geology and mineral resources issues that would be of concern for an expanded mining proposal would primarily be co-development with oil and gas and the potential for subsidence in the leasing area. Similar effects to those presented in Section 4.2 of the Ochoa Mine Project EIS (BLM 2014a) could be expected to result from future mining.

4.2.2 No Action Alternative

If the preference lease right applications are not approved, previously authorized mining activities would continue. The potential risks and impacts would be present as discussed and analyzed in Section 4.2 of the Ochoa Mine Project EIS (BLM 2014a) but these impacts would not extend into the area beyond the approved 50-year mine area.

4.2.2.1 Geologic Hazards

The natural processes that resulted in evaporite karst features and mining-related subsidence as described and analyzed in Section 4.2.2.4 of the Ochoa Mine Project EIS (BLM 2014a) would continue to pose risks to roads, structures, and surface topography. Protection measures as set forth in the ROD for the Ochoa Mine Project EIS (BLM 2014b) would minimize the risks.

4.2.2.2 Mineral Resources

Under the No Action Alternative, the polyhalite resource in the proposed 50-year mine area would be mined amounting to a potential recovery of 81 million tons. If the preference lease right applications are not approved, resource recovery of a valuable deposit would not occur, resulting in the loss of revenues, taxes, and royalties from mineral development for the foreseeable future.

Oil and gas development would continue according to MOUs with oil and gas operators.

4.2.2.3 Paleontological Resources

Under the No Action Alternative, there would be no impacts to paleontological resources from mining operations. Due to the low PFYC of the geologic formations and few documented paleontological resources, the potential for adverse impacts to paleontological resources is low for any activities that would remove fossil-bearing rocks in the subsurface. Although there is a small potential for discovering important fossils, measures described in the ROD for the Ochoa Mine Project EIS (BLM 2014b) would provide protection to the resource.

4.2.3 Proposed Action

4.2.3.1 Geological Hazards

If the preference lease right applications are approved, natural processes and anthropogenic activities would continue to pose risks to area infrastructure. An indirect effect of approving the preference right leases would be the extension of subsurface mining beyond the 50-year mine area. While the site-specific potential risks and hazards would be analyzed under NEPA if there is a proposed expansion of mining activities beyond the currently approved MPO for the 50-year mine area, it is likely that subsidence can be expected within 1,500 feet of the extent of mining, similar to that described in Section 4.2.5.1 of the Ochoa Mine Project EIS (BLM 2014a).

Subsidence-induced deformations of the rock layers, resulting from subsurface mining, can damage oil and gas wells located within the subsidence area. Subsidence effects on such wells can include distortion of the boreholes, squeezing of casing, and shearing of casing. Well damage could lead to the escape of hydrocarbons along bedding planes or up annular spaces in wells into mine workings. These potential impacts from mining-related subsidence and applicable safety measures to protect the wells, the mine, and aquifers are discussed in more detail in Section 4.2.5.1 of the Ochoa Mine Project EIS (BLM 2014a).

4.2.3.2 Minerals

Under the Proposed Action, there would be the recovery of polyhalite resources. Mining within the boundaries of the preference right lease applications would increase the estimated production of over 2.2 billion tons of ore assuming the maximum 90 percent extraction rate (BLM 2014c) predicted for the 50-year mine area is applicable. If ore were extracted from the leasing area at a lower rate due to safety requirements, the presence of producing, plugged or abandoned oil and gas wells, or in compliance with regulations or other considerations, then the estimated production would be less. This would be determined when a revised MPO is submitted in the future, should the preference right leases be authorized.

With the active oil and gas development and existing wells in the leasing area, it is likely that polyhalite ore extraction would be reduced in some areas to avoid damage to existing wells and to comply with the management requirements for co-development described for the Proposed Action in Section 2.1.2.2 of this EA.

4.2.3.3 Paleontological Resources

Due to the low PYFC system rank of the geologic formations and few documented paleontological resources in the leasing area, the potential for adverse impacts to paleontological resources is low under the Proposed Action. If mining is proposed beyond the 50-year mine boundary, the protection measures set forth in the Ochoa Mine Project ROD (BLM 2014b) could be extended during subsequent NEPA analysis.

4.2.3.4 Cumulative Impacts

The interest in oil and gas targets within and near the leasing area would contribute to cumulative impacts to mineral resources and may affect future mine plans should a mine expansion be approved. Successful coordination and management of co-development of mineral resources would be important to minimize conflicting mineral development opportunities within the region. The approved Ochoa MPO will be implemented according to the terms of the Ochoa Mine Project ROD (BLM 2014b). Mining in the 50-year mine area would contribute to the cumulative impacts in the region through extraction of polyhalite ore.

4.3 Water Resources

4.3.1 Issues

The primary water resources issues that would be of concern, should mining occur in the leasing area include increased surface water runoff and accelerated erosion rates where there is surface disturbance and increased water use for mine processing. This would result in groundwater drawdown that may affect flows in the Pecos River and other water users. Similar effects to those described in Section 4.3 of the Ochoa Mine Project EIS (BLM 2014a) could be expected from future mine expansion.

4.3.2 No Action Alternative

Under the No Action Alternative, the preference right lease applications would not be approved. The effects of mining within the 50-year mine area that are described for surface water and groundwater in Section 4.3 of the Ochoa Mine Project EIS (BLM 2014a) would continue. No additional impacts to surface water and groundwater resources within the leasing area would occur.

4.3.3 Proposed Action

There would be no direct impacts to surface water resources from approval of the preference right lease applications because no new site-specific disturbance would occur. Any surface disturbance required for mining would be evaluated in site-specific NEPA documents that would disclose impacts prior to approval by the BLM.

Should the preference right leases be approved and mining expanded beyond the 50-year mine area approved in the Ochoa Mine Project ROD (BLM 2014b), it is anticipated that the ore processing operations would utilize water from the Capitan Reef wells for a longer period of time than was analyzed in Section 4.3.2.5 of the Ochoa Mine Project EIS (BLM 2014a). A longer period of Capitan Reef water usage is likely to increase the depth of groundwater drawdown identified in the EIS and may extend the Capitan Aquifer recovery period of recharge. However, the effects of expanding the mine area would require submittal of a revised MPO and subsequent NEPA analysis before the BLM would approve this plan.

4.3.4 Cumulative Impacts

Cumulative effects on water resources in the leasing area from approval of the Proposed Action, in combination with present and future actions, would arise when surface disturbance and water use from reasonably foreseeable future projects occurs concurrently with other future development in the region. Relevant cumulative projects include the Proposed Action, approved Ochoa Mine operation and processing within the 50-year mine area as well as future development of the Capitan Reef that has been proposed by the oil and gas industry but specific projects are unknown at this time. Should other uses of the Capitan Aquifer be approved, they are likely to increase groundwater drawdown and could add to effects on the Pecos River flows that were identified in Sections 4.3.5 and 4.3.6 of the Ochoa Mine Project EIS (BLM 2014a).

4.4 Air Quality

4.4.1 Issues

Air quality issues found in Section 4.5.1 of the Ochoa Mine Project EIS (BLM 2014a) would continue to impact the region. These issues include directly emitted criteria pollutants, HAPs, volatile organic compounds (VOCs), and the GHGs, which are CO_2, CH_4, and nitrous oxide (N_2O).

4.4.2 No Action Alternative

Under the No Action Alternative, the preference right leases would not be issued. There would be noair quality impacts associated with the Ochoa Mine Project as discussed in Section 4.5 of the Ochoa Mine Project EIS (BLM 2014a).

4.4.3 Proposed Action

The Proposed Action would result in preference right leases being issued. Additional emission sources are not expected to be added and no surface disturbance is expected due to the lease issuance. The mine and processing operations would continue to be operated as described in Section 2.4.2 of the Ochoa Mine Project EIS (BLM 2014a). However, the Proposed Action would allow the opportunity for mining and processing operations to be extended longer than 50 years. Thus, air quality impacts associated with the Ochoa Mine would be allowed to continue for a longer duration than previously assessed. The length of time the mine and processing facilities remain in operation does not influence the air quality impact assessment, only the length of time the emissions would be generated.

If mining beyond the 50-year mine area are proposed through a revised MPO, federal law requires that new NEPA analyses be performed to disclose potential impacts due to the expansion. Air emissions resulting from processing and mining would be part of that analysis.

4.4.4 Cumulative Impacts

Oil and gas development in the vicinity of the mine would be the major contributor to cumulative air emissions in combination with mining and processing facilities. Other activities in the region identified in Section 2.3 of this EA, such as operation of industrial facilities like the URENCO NEF and agricultural operations, would contribute to the ambient air quality in the region.

4.5 Climate and Greenhouse Gas Emissions

4.5.1 Issues

Recent scientific evidence suggests there is a direct correlation between climate change and emissions of GHGs. Although many GHGs occur naturally in the atmosphere, human-caused sources have substantially increased the emissions of GHGs since the Industrial Revolution. The primary issue related to climate change associated with this project is the potential emissions of GHGs.

4.5.2 No Action Alternative

Under the No Action Alternative, the preference right leases would not be issued. Air quality impacts associated with the Ochoa Mine Project discussed in Section 4.6 of the Ochoa Mine Project EIS (BLM 2014a) would not continue beyond the approved 50 yr. life of mine.

4.5.3 Proposed Action

The Proposed Action would involve the issuance of preference right leases. This would allow the mine to extend the mining and processing operations described in the Ochoa Mine Project EIS (BLM 2014a) longer than 50 years. The mine and processing operations would continue to be operated as described in Section 2.4.2 of the Ochoa Mine Project EIS (BLM 2014a).

Under the Proposed Action, the annual GHG emissions associated with the Ochoa Mine is likely to continue past the 50-year time period analyzed in Section 4.6.4 of the Ochoa Mine Project EIS (BLM 2014a), adding to the total cumulative lifetime GHG gas emissions from mine operations.

4.5.4 Cumulative Impacts

In 2001, the IPCC projected that by the year 2100, global average surface temperatures could increase by 2.5 to 10.4°F above 1990 levels. The National Academy of Sciences (2010) has confirmed these projections, but also indicated that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature would 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 have been observed to increase in the region during the last few decades, while there are no strong indications of increases in daily maximum temperatures. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict.

The scope of the climate change phenomenon is global, so past, present, and reasonably foreseeable actions from around the globe, together with the actions contemplated in the alternatives, affect atmospheric greenhouse gas levels. Actions from around the globe that are generally attributed to increased atmospheric greenhouse gas levels include the burning of fossil fuels for electricity, manufacturing, and transportation; deforestation and land surface change; agricultural and livestock operations; and fugitive methane emissions associated with pipelines and coal/oil/natural gas production. The effects of global climate change may include sea level rise, changing global climate patterns, redistribution of plant and animal species, redistribution of disease vectors, and altered precipitation regimes.

Activities that would continue if the Proposed Action was approved would contribute to global climate change and is likely to extend beyond 50 years. GHGs from oil and gas development in the mine area would also have the potential to contribute to global climate change. However, it is not possible to link any particular set of greenhouse gas emissions to specific climate-related environmental effects.

4.6 Socioeconomics

4.6.1 Issues

The primary issues associated with socioeconomic resources include the potential indirect impacts to the local economy, effects to population, housing markets, public services, and public sector revenue. The impacts would be similar to those described in Section 4.15.1 of the Ochoa Mine Project EIS (BLM 2014a).

4.6.2 No Action Alternative

Circumstances that could result in the selection of the No Action Alternative would be a determination by the BLM that the leases are not in the public interest. Under this determination, the pending preference right leases would not be issued and other leases or other compensation may be offered to ICP. However, given the unknowns regarding the type of compensation, an assessment of the effects of potential development elsewhere would be speculative and beyond the scope of this analysis. Under the No Action Alternative, the economic effects of mining and processing polyhalite ore analyzed in Section 4.15.9 in the Ochoa Mine Project EIS and approved in the associated ROD (BLM 2014a,b) would continue. Additional economic drivers and influences affecting Lea and Eddy counties and the communities in the region resulting from mine expansion would not occur.

4.6.3 Proposed Action

Approval of the Proposed Action would involve approval of ICP's 52 pending preference right lease applications. The preference right lease issuance would be likely to extend mining operations beyond the 50-year timeframe analyzed in the Ochoa Mine Project EIS (BLM 2014a). If mining operations into this leasing area are proposed, the Mine Plan of Operations would be revised and new NEPA analyses would be performed to disclose potential impacts due to the expansion.

4.6.3.1 Population and Demographics

Approval of the Proposed Action would not authorize surface disturbance activities, but would open the door for ICP to submit a mine plan of operations for future mining activity, which would require further NEPA analysis. Any future mining authorization may result in temporary and long-term population increases in the region from work force migration to fill construction and operations-related opportunities. Further population and demographic analysis is detailed in Section 4.15.5.2 of the Ochoa Mine Project EIS (BLM 2014a).

4.6.3.2 Housing

Approval of the Proposed Action would not result in a direct impact to housing resources; however, should ICP submit a revised MPO to expand mining activities in the leasing area, there may be an extension of demand for housing units. Further housing analysis is detailed in Section 4.15.5.3 of the Ochoa Mine Project EIS (BLM 2014a).

4.6.3.3 Public Infrastructure and Services

Approval of the Proposed Action would not result in a direct impact to public infrastructure and services; however should ICP submit a revised MPO to expand mining activities in the leasing area, there may be an increased or extended demand for local government infrastructure and services in Eddy and Lea counties and the local nearby communities. Further public infrastructure and services analysis is detailed in Section 4.15.5.4 of the Ochoa Mine Project EIS (BLM 2014a).

4.6.3.4 Public Sector Revenues

Approval of the Proposed Action would not result in a direct impact to public sector revenues; however should ICP submit a revised MPO to further mining activities in the leasing area, a continuation of federal, state, and local revenues would flow to the public sector beyond the 50-year period currently approved. The major revenue sources would include federal mineral royalties on the value of production and local ad valorem (property) taxes on the value of production and mining equipment and facilities. The state would realize a continuation of severance tax revenue, as well as deriving gross receipts tax on the value of goods and services purchased for construction and operations. Local governments also would benefit from the increase in gross receipts tax. Further analysis of public sector revenues is detailed in Section 4.15.5.5 of the Ochoa Mine Project EIS (BLM 2014a).

4.6.4 Cumulative Impacts

Cumulative effects on socioeconomic conditions in the region from approval of the Proposed Action, in combination with present and future actions, would arise if the employment, economic activity, population, housing, public service demand, and fiscal aspects of reasonably foreseeable future projects occur concurrently with future mine development resulting from the approval of the Proposed Action. Approval of the Proposed action, in combination with present and future actions, would result in cumulative effects on socioeconomic conditions in the region. Moreover, if the employment, economic activity, population, housing, public service demand, and fiscal aspects of reasonably foreseeable future projects occur concurrently with future mine development, cumulative effects will arise. The approved Ochoa Mine and oil and gas development are active and would be the most likely regional activities that would combine with future mining activities to affect socioeconomic conditions in the region. The combination of the two industries would result in competition for housing, community services, and employees. Cumulative socioeconomic impacts have the potential to be both beneficial and adverse. Further cumulative impacts analysis is detailed in Section 4.15.12 of the Ochoa Mine Project EIS (BLM 2014a).

4.7 Environmental Justice

The primary issue associated with environmental justice is the potential for disproportionately high and adverse environmental or human health effects on identified minority or low-income populations.

4.7.1 No Action Alternative

No adverse impacts to Environmental Justice populations were identified in Section 4.16.8 of the Ochoa Mine Project EIS (BLM 2014a). The conditions which prevail under the approved MPO would continue under the No Action Alternative. Consequently, environmental justice concerns would not be expected under the No Action Alternative.

4.7.2 Proposed Action

No potentially affected Environmental Justice populations have been identified for this assessment. Therefore, based on the criteria provided by EO 12898 for NEPA, implementation of the Proposed Action would not be anticipated to result in adverse effects.

4.7.3 Cumulative Impacts

No potentially affected Environmental Justice populations have been identified in the region. Therefore, based on the criteria provided by EO 12898 for NEPA, cumulative impacts to Environmental Justice populations would not be anticipated.

4.8 Soil Resources

Impacts to soil resources will not be analyzed because approval of the preference right leases would not result in direct or indirect impacts to soils.

4.9 Vegetation

Vegetation will not be analyzed because approval of the preference right leases would not result in direct or indirect impacts to vegetation.

4.10 Wildlife and Fish

Wildlife and Fish will not be analyzed because approval of the preference right leases would not result in direct or indirect impacts to wildlife and fish.

4.11 Cultural Resources

Cultural Resources will not be analyzed because approval of the preference right leases would not result in direct or indirect impacts to cultural resources.

5.0 List of Preparers and Reviewers

5.1 EA Preparers

As required by NEPA regulations (40 CFR § 1502.17), **Table 5-1** lists the BLM personnel responsible for preparing this EA. The BLM Carlsbad Field Office retained AECOM as a third-party consultant to assist with the preparation of this EA (**Table 5-2**). AECOM has certified that it does not have any financial or other interest in the decisions to be made pursuant to this EA.

Table 5-1 BLM Carlsbad Field Office Interdisciplinary Team

BLM ID Team Member	Responsibility/Resource	Education and Experience
David Herrell	Project Lead; Hydrology; Air Quality	Bachelor of Geological Science, Graduate Certificate in Environmental Water Science 6 years experience
Craig Cranston	Mining, Solid Minerals	BS Geology; MA Business and Economics 15 years experience in the potash industry as a mine engineer; 24 years experience with BLM as a mining engineer
Steve Daly	Soils; Vegetation	BS Wildlife Science 31 years experience with BLM range staff, 21 years as soil, water, air program lead
John Chopp	Biological Resources	BS Wildlife and Fisheries Management 2 years experience as USDA-FS biological technician; 4 years experience as BLM wildlife biologist
Bruce Boeke	Cultural Resources	BA Anthropology 33 years experience

Table 5-2 AECOM EA Team (Third-party Consultant)

AECOM Team Member	Responsibility/Resource	Education and Experience
Ellen Dietrich	Project Manager	BA Anthropology; Graduate Study Soil Science 38 years experience
Steve Graber	Assistant Project Manager; Socioeconomics	B.S. Natural Resources Management B.A. Economics 11 years experience
Bill Berg	Geology, Minerals, Paleontology	M.S. Geology B.S. Geology 34 years experience
David Fetter	Water Resources	B.S. Watershed Science 10 years experience
Dustin Rapp	Air Quality and Climate Change	B.S. Physics M.S. Atmospheric Science 8 years experience
Terra Mascarenas	Soils Resources	B.S. Soil & Crop Science 16 years experience
Rachel Puttmann	Vegetation and Plant Communities	M.S. Environmental Sciences B.S. Biology 8 years experience
Patti Lorenz	Wildlife/T&E, Aquatic Resources	B.S. Wildlife and Fisheries Science 11 years experience
Gordon Tucker	Cultural Resources	PhD Anthropology (archaeology emphasis) 40 years experience
Scott MacKinnon	GIS Analyst	B.S. Physical Geography 11 years experience

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