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Bureau of Land Management

Pecos District Office Oil and Gas Lease Sale Environmental Assessment Chaves, Eddy and Lea Counties, New Mexico May 2023 DOI-BLM-NM-P000-2022-0001-EA

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The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

DOI-BLM-NM-P000-2022-0001-EA

TABLE OF CONTENTS

Appendices

Figures

Tables

LIST OF ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	micrograms per cubic meter
ACHP	Advisory Council on Historic Preservation
AF	acre-feet
AIB	analyzed in brief
AirToxScreen	Air Toxics Screening Assessment
Annual GHG Report	*2021 BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends*
APD	Application for Permit to Drill
APE	area of potential effects
AQI	Air Quality Index
AQRV	Air Quality Related Value
ARTSD	Air Resources Technical Support Document
bbl	barrel(s)
Bcf/d	billion cubic feet per day
BCR	Bird Conservation Region
BLM	Bureau of Land Management
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
bpd	barrels per day
CAA	Clean Air Act
$CaSO_4 \cdot 2H_2O$	gypsum
CCA	Candidate Conservation Agreement
CCAA	Candidate Conservation Agreements with Assurances
CCNP	Carlsbad Caverns National Park
CEQ	Council on Environmental Quality
CFO	Carlsbad Field Office
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COA	condition of approval
CSU	Controlled Surface Use
DAT	deposition analysis threshold
DSL	dunes sagebrush lizard

EA	Environmental Assessment
EIA	U.S. Energy Information Administration
EJ	environmental justice
EMNRD	New Mexico Energy, Minerals and Natural Resources Department
EOI	Expression of Interest
EOR	enhanced oil recovery
EPA	U.S. Environmental Protection Agency
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
ESM	earth system model
EUR	estimated ultimate recovery
FEMA	Federal Emergency Management Agency
FLAG	Federal Land Managers' Air Quality Related Values Work Group
FLPMA	Federal Land Policy and Management Act of 1976
GCP-O&G	General Construction Permit for Oil and Gas Facilities
GHG	greenhouse gas
GHGRP	Greenhouse Gas Reporting Program
GIS	geographic information system
GMU	Game Management Unit
Gt	gigaton
GUMO	Guadalupe Mountains National Park
H_2S	hydrogen sulfide
HA	Habitat Area
HAP	hazardous air pollutant
HUC	hydrologic unit code
IDT	interdisciplinary team
IM	Instruction Memorandum
IPA	Isolated Population Area
IPaC	Information for Planning and Consultation
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act of 2022
IWG	Interagency Working Group on Social Cost of Greenhouse Gases, United States Government
kg/ha/yr	kilogram per hectare per year
km	kilometer(s)
LANDFIRE	Landscape Fire and Resource Management Planning Tools
LNB	low-NO_X burner

LOC	level of concern
LPC	lesser prairie-chicken
m	meter(s)
M	magnitude
mcf	thousand cubic feet
MCM	Menu of Control Measures
MLA	Mineral Leasing Act of 1920
Mt	megatonne(s)
N/A	not applicable
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NAGPRA	Native American Graves Protection and Repatriation Act
NATA	National Air Toxics Assessment
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act of 1969
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NETL	National Energy Technology Laboratory
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act of 1966
NMAAQS	New Mexico Ambient Air Quality Standards
NMAC	New Mexico Administrative Code
NMCRIS	New Mexico Cultural Resource Information System
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMOCD	New Mexico Oil Conservation Division
NMOSE	New Mexico Office of the State Engineer
NMPM	New Mexico Principal Meridian
NMSO	New Mexico State Office
NO_2	nitrogen dioxide
NO_X	nitrogen oxide(s)
NORM	naturally occurring radioactive material
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	no surface occupancy
NSPS	New Source Performance Standards

NWI	National Wetlands Inventory
O_3	ozone
ONRR	Office of Natural Resources Revenue
OSHA	Occupational Safety and Health Administration
Pb	lead
PBPA	Permian Basin Programmatic Agreement
PDO	Pecos District Office
PFYC	Potential Fossil Yield Classification
PL	Public Law
$PM_{2.5}$	particulate matter equal to or less than 2.5 microns in diameter
PM_{10}	particulate matter equal to or less than 10 microns in diameter
POD	plan of development
PPA	Primary Population Area
ppb	parts per billion
ppm	parts per million
PRPA	Paleontological Resources Preservation Act
PSD	prevention of significant degradation
RRC	Railroad Commission of Texas
RfC	reference concentration
RFD	reasonably foreseeable development
RFFA	reasonably foreseeable future action
RFO	Roswell Field Office
RMP	resource management plan
RMPA	Resource Management Plan Amendment
SC-CH_4	social cost of methane
SC-CO_2	social cost of carbon dioxide
SC-GHG	social cost of greenhouse gases
SC-N_2O	social cost of nitrous oxide
SCR	selective catalytic reduction
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Office
SIP	New Mexico State Implementation Plan
SMA	Special Management Area
SO	Secretarial Order
SO_2	sulfur dioxide
SOPA	Secretarial Order Potash Area
SRMA	Special Recreation Management Area

STEO	short-term energy outlook
SQI	Sky Quality Index
SWD	saltwater disposal
TCP	traditional cultural property
UIC	Underground Injection Control
URS	URS Group Inc.
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
VRM	Visual Resource Management
WESTAR-WRAP	Western States Air Resources Council-Western Regional Air Partnership
WIPP	Waste Isolation Pilot Plant
WO	Washington D.C. Office

CHAPTER 1. INTRODUCTION

1.1 BACKGROUND

This Environmental Assessment (EA) documents the Bureau of Land Management (BLM) Pecos District Office (PDO) (Carlsbad Field Office [CFO] and Roswell Field Office [RFO]) review of 19 parcels (3,279.49 acres) nominated for auction in the BLM PDO May 2023 Competitive Oil and Gas Lease Sale (the Proposed Action). Of the 19 nominated lease parcels, one parcel (413) was originally nominated for the Quarter 2 2022 Competitive Oil and Gas Lease Sale. Nominated lease parcel 413 is now incorporated into the May 2023 Competitive Oil and Gas Lease Sale. The nominated lease parcels contain federal minerals managed by the BLM and consist of BLM-administered surface land and private land (Table 2.1). For detailed information on the leasing process, see the following website: https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/parcel-nominations.

1.2 PURPOSE AND NEED

The BLM's purpose is to respond to Expressions of Interest (EOIs) to lease federal oil and gas resources through a competitive leasing process. The need for the action is established by the BLM's responsibility under the Mineral Leasing Act of 1920 (MLA), as amended, to promote the exploration and development of oil and gas on the public domain.

1.3 DECISION TO BE MADE

The BLM Authorized Officer will decide whether to make available for lease the nominated lease parcels with or without constraints, in the form of lease stipulations, as provided for in the approved land use plans. If the decision is to make the lands available for lease, and to subsequently issue a lease, standard terms and conditions under Section 6 of the BLM Lease Form (Form 3100-11, Offer to Lease and Lease for Oil and Gas), herein referred to as standard terms and conditions, would apply. The BLM Authorized Officer also has the authority to defer the parcels, based on the analysis of potential effects presented in this EA. The Decision Record will identify whether the BLM decided to lease the nominated lease parcels and the rationale for the decision.

1.4 CONFORMANCE WITH BLM LAND USE PLANS, OTHER STATUES, REGULATIONS, AND PLANS

1.4.1 BLM Land Use Plan Conformance

The BLM's mandate, as derived from various laws, including the MLA and the Federal Land Policy and Management Act of 1976 (FLPMA), as amended, is to promote the exploration and development of oil and gas on the public domain. Additionally, the Federal Onshore Oil and Gas Leasing Reform Act of 1987 states that lease sales shall be held for each state where eligible lands are available at least quarterly and more frequently if the Secretary of the Interior determines such sales are necessary.

Under the FLPMA, the BLM must manage public lands, resources, and resource values according to its multiple-use sustained-yield mandate in a manner that will best meet the present and future needs of the public, and in accordance with an approved land use plan or resource management plan (RMP).
For split-estate lands where the mineral estate is an interest owned by the United States, the BLM has no authority over use of the surface estate; however, the BLM is required to declare how the federal mineral estate will be managed, including identification of all appropriate lease stipulations (43 Code of Federal

Regulations [CFR] 3101.1 and 43 CFR 1601.0-7(b); BLM Handbook H-1601-1 and H-1624-1 [BLM 2005, 2018a]).

This Proposed Action aligns with the following RMPs:

- Carlsbad Approved RMP (BLM 1988), as amended (BLM 1997a, 2008a)
- Roswell Approved RMP and Record of Decision (BLM 1997b), as amended (BLM 2008a)

The nominated lease parcels fall within areas that are open to leasing under the RMPs indicated above, as amended, and are subject to certain stipulations. The nominated lease parcels, lease parcel surface ownership, lease parcel legal description and total acreage, and lease stipulations and notices that apply are detailed in Table 2.1. Appendix A contains parcel maps. Stipulation and lease notice descriptions are detailed in Appendix B.

The BLM is currently revising the RMP for the CFO planning area. Should the BLM finalize this RMP between the lease sale and lease issuance, lease parcels in the CFO planning area would be subject to the lease stipulations adopted in the revised RMP following the provisions in 43 CFR 3120. If new stipulations as a result of finalization of the RMP are added to the lease after the lease sale but prior to lease issuance, the successful bidder would be given the opportunity to accept the modified lease or reject it and receive a refund. If the bidder declines the lease terms due to additional or revised stipulation(s), the BLM would refund all monies, including the administrative fee, and include the parcel(s) with all the appropriate stipulations in a subsequent sale notice for future auction. In either case, the BLM would update the analysis to reflect the additional or revised stipulation(s). For more information, see *BLM Oil and Gas Adjudication for Competitive Leases*, Handbook 3120-1 (BLM 2013).

1.4.2 Relationship to Statutes, Regulations, Policies, and Other Plans

Purchasers of oil and gas lease parcels are required to comply with all applicable federal, state, and local laws and regulations, including obtaining all necessary permits prior to any lease development activities. The BLM is also required to comply with all applicable federal, state, and local laws and regulations, as well as U.S. Department of the Interior policies when leasing mineral estate and responding to EOIs. A listing of applicable statutes, regulations, directives, and other plans to the leasing decision is provided in Table 1.1.

Table 1.1. Relationship to Statutes, Regulations, Policies, and Other Plans

Relevant Statute, Regulation, or Plan	Relationship to the Proposed Action
Federal Land Policy and Management Act (FLPMA)	The FLPMA established guidelines to provide for the management, protection, development, and enhancement of public lands (Public Law [PL] 94-579). Section 103 of FLPMA defines public lands as any lands and interest in lands owned by the United States. For split-estate lands where the mineral estate is an interest owned by the United States, the BLM has limited authority over use of the surface by the surface owner; however, the BLM is required to disclose potential effects connected to the authorization to lease and develop federal mineral estate and to declare how federal mineral estate is managed in the RMP, including identification of all appropriate lease stipulations (43 CFR 3101.1 and 43 CFR 1601.0-7(b); BLM Handbook H-1601.09 and H-1624-1 [BLM 2005, 2018a]).
Mineral Leasing Act (MLA)	The MLA establishes that deposits of oil and gas owned by the United States are subject to disposition in the form and manner provided by the MLA under the rules and regulations prescribed by the Secretary of the Interior, where consistent with FLPMA; the National Environmental Policy Act of 1969, as amended (NEPA) (PL 91-90, 42 United States Code [USC] 4321 et seq.); and other applicable laws, regulations, and policies.

Relevant Statute, Regulation, or Plan	**Relationship to the Proposed Action**
43 CFR 3100	These regulations govern onshore oil and gas leasing, development, and production of federal minerals.
Federal Onshore Oil and Gas Leasing Reform Act	This act directs the BLM to conduct quarterly oil and gas lease sales whenever eligible lands are available for leasing.
New Mexico Surface Owner Protection Act	This act requires operators to provide the surface owner at least 5 business days' notice prior to initial entry upon the land for activities that do not disturb the surface, and at least 30 days' notice prior to conducting actual oil and gas operations. Included in this policy is the implementation of a Notice to Lessees, a requirement of lessees and operators of onshore federal oil and gas leases within the state of New Mexico to provide the BLM with the names and addresses of the surface owners of those lands where the federal government is not the surface owner, not including lands where another federal agency manages the surface.
Endangered Species Act (ESA)	The ESA requires all federal departments and agencies to conserve threatened, endangered, and critical and sensitive species and the habitats on which they depend, as well as consult with the U.S. Fish and Wildlife Service on all actions authorized, funded, or carried out by the agency to ensure that the action will not likely jeopardize the continued existence of any threatened and endangered species or adversely modify critical habitat. See the text of stipulation HQ-TES-1 in Appendix B for details.
National Historic Preservation Act (NHPA)	Leasing is considered an undertaking pursuant to 54 USC 300101 et seq., commonly known as the National Historic Preservation Act of 1966, as amended (NHPA), and 54 USC Section 306108, commonly known as Section 106 of the NHPA (Section 106). Agencies may follow a phased approach to Section 106 compliance. At the leasing level, existing records reviews, and consultation drive identification of historic properties. Class III field inventories are an important part of identification at the lease-development level. See the text of stipulation HQ-CR-1 in Appendix B for details.
Federal Cave Resource Protection Act	Secures and protects significant caves on federal land for the benefit and enjoyment of all people and directs the Secretary of the Interior to inventory and list significant caves on federal lands. Details regarding general cave management, the significant cave nomination, evaluation, and designation process, and cave and karst resource confidentiality noted within the Federal Cave Resource Protection Act are located in 43 CFR 37 (Cave Management).
Inflation Reduction Act of 2022 (IRA)	The IRA made the following major changes to BLM's oil and gas leasing program: • Rescinded the BLM's authority to issue noncompetitive leases under the MLA by striking 30 USC 226(c) • Removed BLM's authority to issue reversionary noncompetitive leases • Updated the royalty rate and rental rate lease terms for competitive leases • Changed the grounds and conditions for certain reinstatements In addition, Section 50265 of the IRA states that the BLM may not issue a right-of-way for wind or solar energy development on federal land unless it has 1) held an onshore oil and gas lease sale during the past 120 days and 2) offered the lesser of a "sum total" of either 2,000,000 acres or 50 percent of the acreage for which EOIs have been submitted for lease sales during the previous 1-year period. The BLM has issued policy guidance to implement the oil and gas leasing provisions in the IRA and provided updated direction on other program components (i.e., Instruction Memorandum [IM] 2023-006, IM 2023-007, IM 2023-008, and IM 2023-010).
IM 2023-006 - Implementation of Section 50265 in the Inflation Reduction Act for Expressions of Interest for Oil and Gas Lease Sales	This IM provides guidance regarding BLM's implementation of IRA Section 50265 with regard to EOIs.
IM 2023-007 - Evaluating Competitive Oil and Gas Lease Sale Parcels for Future Lease Sales*	This IM provides guidance to BLM offices in selecting parcels to be offered in oil and gas lease sales, and it also supplements IM 2023-010, *Oil and Gas Leasing – Land Use Planning and Lease Parcel Reviews*. This IM informs the agency's organization, procedures, and practice.

Relevant Statute, Regulation, or Plan	Relationship to the Proposed Action
IM 2023-008 - Impacts of the Inflation Reduction Act of 2022 (Pub. L. No. 117-169) to the Oil and Natural Gas Leasing Program	This IM provides the BLM State Offices with guidance for implementing the provisions of the IRA pertaining to EOIs, noncompetitive lease offers, pending competitive leases, and reinstatements. This IM updates expired policy IM 2014-004, *Oil and Gas Informal Expressions of Interest*.
IM 2023-010 - Oil and Gas Leasing – Land Use Planning and Lease Parcel Reviews	This IM sets out the policy of the BLM to ensure that oil and gas lease sales are held in accordance with the MLA (30 USC 226), IRA (PL 117-169), and other applicable laws. This policy addresses land use planning, lease parcel review, lease sales, lease issuance, and IM implementation and directs the BLM to incorporate the revised policy, as appropriate, into the affected BLM handbooks and manuals.

* See Appendix C for BLM's evaluation of the nominated lease sale parcels in accordance with IM 2023-007.

1.5 PUBLIC INVOLVEMENT AND ISSUES

1.5.1 Internal Scoping

The BLM PDO interdisciplinary team (IDT) conducted internal scoping to identify issues, potential alternatives, and data needs by reviewing the leasing actions within the context of the applicable RMP under the National Environmental Policy Act of 1969 (NEPA) framework. IDT meetings were held at the BLM CFO and RFO on November 2, 2022. Weekly meetings were held with additional BLM IDT members during the parcel review process. Additionally, other resource-specific meetings with resource specialists were held to aid in refining issues related to the proposed lease sale.

1.5.2 External Scoping

A project summary page for the PDO May 2023 Competitive Oil and Gas Lease Sale was posted on the BLM's National NEPA Register website (https://eplanning.blm.gov). The nominated lease parcel information (draft parcel list) was posted on that website for a public scoping period from October 6 to November 7, 2022.

The BLM PDO received 104 comment letters via ePlanning or duplicate hand-delivered submittals during the scoping period for the May 2023 Competitive Oil and Gas Lease Sale. The majority of comment letters received were form letters that raised concerns about multiple lease sales across the New Mexico State Office (NMSO) area and were not specific to the PDO May 2023 lease sale. Concerns and comments presented by the public and non-governmental organizations are summarized below:

- Concerns regarding the effects of lease sales on greenhouse gas (GHG) emissions and climate change
- Concerns regarding air quality and associated health impacts
- Request for an extension of the public scoping period
- Concerns regarding compliance with the Inflation Reduction Act (IRA)
- Requests to defer parcels with no or low potential for oil and gas development and/or with resource concerns
- Concerns regarding compliance with BLM Instruction Memorandum (IM) 2021-027
- Concerns regarding tribal consultation and public participation
- Requests for BLM to analyze potential effects on big game, cultural resources, special status species, and wilderness

- Concerns regarding the cumulative impacts of BLM's leasing program and other similar actions nationwide
- Requests to complete a programmatic environmental impact statement for the BLM's federal oil and gas program
- Concerns regarding public health
- Concerns regarding cave and karst resources
- and environmental justice
- Concerns regarding big game habitat and migration corridors
- Concerns regarding lesser-prairie chicken
- Concerns regarding impacts to groundwater quality and quantity from hydraulic fracturing and injection wells
- Requests to consider and recommendations for a reasonable range of alternatives
- Request to incorporate climate costs
- Request to impose climate change impacts requirements and GHG emissions mitigation on leasing
- Request for BLM to consult with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service pursuant to Section 7 of the Endangered Species Act (ESA) Draft EA Public Comment and Response

The draft May 2023 Competitive Oil and Gas Lease Sale EA will be made available for a public comment period from January 4 to February 2, 2023. All comments received will be reviewed and analyzed. Substantive comments will be extracted and responded to appropriately.

1.5.3 Recent Court Decisions

On January 27, 2022, the United States District Court for the District of Columbia issued a decision in *Friends of the Earth v. Haaland*, vacating offshore oil and gas lease sale 257 because the Department of Interior did not quantify the effects of that sale on emissions from the foreign consumption of oil and gas, despite (in the Court's view) possessing the tools and methodology to do so (2022 WL 254526 [D.D.C. Jan. 27, 2021]). Given the analysis presently available to the BLM, *Friends of the Earth* does not affect BLM's analysis of this proposed lease sale.

Unlike the Bureau of Ocean Energy Management (BOEM)—the agency responsible for sale 257—the BLM has not traditionally used simulation tools like MarketSim (the tool at issue in *Friends of the Earth* and used by BOEM in preparation for sale 257) when evaluating effects on foreign consumption from proposed BLM State Office lease sales. Indeed, the *Friends of the Earth* court recognized that it had previously upheld BLM's decision not to consider foreign effects where the BLM had "refused to quantify emissions resulting from particular lease parcels, and thus could not conceptualize the extent to which the lease sales would contribute to the local, regional, and global climate change" (2022 WL 254526, at *13 n.13 [quotation omitted]). Likewise, the court ruled against BOEM for forgoing the foreign consumption analysis for sale 257 in part because BOEM shortly thereafter applied that analysis to a draft NEPA analysis for proposed offshore sale 258. The court's reasoning does not apply to the BLM, which, as noted above, lacks access to any historic or imminent foreign effects analysis at the level of individual BLM State Office lease sales. If and when the BLM undertakes this or similar analysis in the future, it may be appropriate to include and consider that analysis when proposing onshore lease sales.

1.5.4 Public Protest Period

The Oil and Gas Lease Sale Notice will be made available for a protest period from March 15 to April 13, 2023. If there are any protests, the BLM shall resolve protests prior to issuing leases.

1.5.5 Issues

The Council on Environmental Quality (CEQ) regulations at 40 CFR 1500.4(i) state that the scoping process should be used "not only to identify significant environmental issues deserving of study, but also to deemphasize insignificant issues narrowing the scope of the [NEPA] process accordingly." 40 CFR 1501.9 (f)(1) indicates the lead agency "shall identify and eliminate from detailed study the issues that are not significant or have been covered by prior environmental review(s), narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere."

Through scoping, four issues were identified for detailed analysis in this EA:

- How would future potential development of the nominated lease parcels affect air quality (particularly with respect to National Ambient Air Quality Standards [NAAQS] and volatile organic compounds [VOCs]) in the New Mexico portion of the Permian Basin?
- How would future potential development of the nominated lease parcels contribute to greenhouse gas (GHG) emissions and climate change?
- How would future potential development of the nominated lease parcels affect surface and groundwater quantity?
- How would future potential development of the nominated lease parcels affect BLM designated special status species, specifically the dunes sagebrush lizard (*Sceloporus arenicolus*) (DSL) and lesser prairie-chicken (*Tympanuchus pallidicinctus*) (LPC)?

An additional 27 issues were identified, considered, and analyzed in brief (AIB) during review of the Proposed Action. These issues are presented in Chapter 3, Section 3.5.

Table 1.2 lists resources or concerns that were considered but determined to not warrant analysis in this EA and provides rationale for the determination.

Table 1.2. Issues Considered but not Analyzed in this EA

Resource or Concern	Rationale for not Analyzing in EA
Special designations	Special designations include National Trials, Lands with Wilderness Characteristics, Research Natural Areas, Special Management Areas, wilderness areas, Wilderness Study Areas, Wild and Scenic Rivers, wildlife areas, etc. There are no special designations located within or adjacent to the nominated lease parcels. The Pecos River Canyons Complex Research Natural Area is approximately 4.77 miles north of nominated lease parcel 6132 and is the closest special designation to the nominated lease parcels. Therefore, analysis of potential effects to special designations is not warranted.
Forestry and woodlands	Woodland areas within the nominated lease parcels do not occur at levels where management is implemented specifically for the woodland. Additionally, no woodland vegetation types were found to occur within the nominated lease parcels (see AIB-5).
Fuels and fire management	The potential for ignition of wildland fire from activities associated with future potential development of the nominated lease parcels would be minimized to the extent practicable through adherence to all applicable federal, state, and local fire safety requirements. No specific concerns or conflicts were identified through internal scoping relating to the effects of future potential development following lease reinstatement on fuels and fire management.

Resource or Concern	Rationale for not Analyzing in EA
Lands and realty	Future potential development of the nominated lease parcels would be subject to existing land rights and interests (e.g., easements and water rights). Any potential land use conflicts would be resolved through other processes, such as administrative or legal proceedings, independent from this NEPA review.

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

Under the Proposed Action, the BLM would offer for lease federal minerals associated with the 19 nominated lease parcels. Surface management, the legal land description of the nominated lease parcels totaling 3,279.49 acres, and lease stipulations and notices attached to the parcels are included in Table 2.1. Appendix A contains parcel maps. Appendix B provides a summary of stipulations and lease notices. Under the Proposed Action, the BLM Authorized Officer has the authority to lease the parcels, or to defer the parcels, based on the analysis of potential effects presented in this EA.

Table 2.1. PDO May 2023 Lease Sale Nominated Lease Parcels

Lease Parcel Number	Surface Ownership	Legal Description	Acres	Lease Notices and Stipulations
NM-2023-05-0413	Private	T. 24 S., R. 34 E., NMPM Sec. 9 SE1/4SE1/4. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00016885	40	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **SENM-S-22-CSU** BLM Stipulations for PDO - CSU – Lesser Prairie-Chickens **HQ-TES-1**[1] BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1**[1] BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-0419	Private	T. 24 S., R. 35 E., NMPM Sec. 14 W1/2SE1/4, SE1/4SE1/4. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00018151	120	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **SENM-S-22-CSU** BLM Stipulations for PDO - CSU – Lesser Prairie-Chickens **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance

[1] [1] Stipulations HQ-TES-1 and HQ-CR-1 were formerly referred to as WO-ESA 7 and WO-NHPA, respectively. While the titles of these stipulations have changed, the content of the stipulations have not (see stipulation text in Appendix B).

Lease Parcel Number	Surface Ownership	Legal Description	Acres	Lease Notices and Stipulations
NM-2023-05-0420	BLM	T. 20 S., R. 34 E., NMPM Sec. 20 S1/2SW1/4. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00018136	80	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **SENM-LN-2** BLM Lease Notice Stipulations for PDO - LN – Dunes Sagebrush Lizard **SENM-LN-6** BLM Lease Notice Stipulations for PDO - LN – OG Development Within Designated Potash Area **SENM-S-1-CSU** BLM Stipulations for PDO - CSU - Potash Area Stipulation **SENM-S-22-CSU** BLM Stipulations for PDO - CSU – Lesser Prairie-Chickens **SENM-S-23-CSU** BLM Stipulations for PDO - CSU – Dunes Sagebrush Lizard **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6132	BLM	T. 23 S., R. 29 E., NMPM Sec. 35 S1/2N1/2, NW1/4NW1/4, N1/2SW1/4. Eddy County BLM CFO 100 % US Mineral Interest EOI# NM00015319	280	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-1-LN** BLM Lease Notice Stipulations for NMSO-LN-Potential, Suitable and Occupied Habitat for Special Status Plant Species **NM-14-LN** BLM Lease Notice Stipulations for NMSO-LN – Paleontological Resources **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-LN-6** BLM Lease Notice Stipulations for PDO - LN – OG Development Within Designated Potash Area **SENM-S-1-CSU** BLM Stipulations for PDO - CSU - Potash Area Stipulation **SENM-S-17-CSU** BLM Stipulations for PDO - CSU - Slopes and Fragile Soils **SENM-S-18-CSU** BLM Stipulations for PDO - CSU – Streams, Rivers and Floodplains **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance

Lease Parcel Number	Surface Ownership	Legal Description	Acres	Lease Notices and Stipulations
NM-2023-05-6751	Private	T. 18 S., R. 32 E., NM PM Sec. 1 Lot 1. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00018138	40.01	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **SENM-LN-2** BLM Lease Notice Stipulations for PDO - LN – Dunes Sagebrush Lizard **SENM-S-22-CSU** BLM Stipulations for PDO - CSU – Lesser Prairie-Chickens **SENM-S-23-CSU** BLM Stipulations for PDO - CSU – Dunes Sagebrush Lizard **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6752	BLM	T. 20 S., R. 29 E., NMPM Sec. 24 NE1/4, E1/2SW1/4, W1/2SE1/4. Eddy County BLM CFO 100 % US Mineral Interest EOI# NM00017883	320	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-1-LN** BLM Lease Notice Stipulations for NMSO-LN-Potential, Suitable and Occupied Habitat for Special Status Plant Species **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-LN-6** BLM Lease Notice Stipulations for PDO - LN – OG Development Within Designated Potash Area **SENM-S-1-CSU** BLM Stipulations for PDO - CSU - Potash Area Stipulation **SENM-S-17-CSU** BLM Stipulations for PDO - CSU - Slopes and Fragile Soils **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6753	BLM	T. 20 S., R. 29 E., NMPM Sec. 23 NW1/4NE1/4, E1/2NW1/4. Eddy County BLM CFO 100 % US Mineral Interest EOI# NM00017883	120	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-LN-6** BLM Lease Notice Stipulations for PDO - LN – OG Development Within Designated Potash Area **SENM-S-1-CSU** BLM Stipulations for PDO - CSU - Potash Area Stipulation **SENM-S-17-CSU** BLM Stipulations for PDO - CSU - Slopes and Fragile Soils **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance

Lease Parcel Number	Surface Ownership	Legal Description	Acres	Lease Notices and Stipulations
NM-2023-05-6789	BLM	T. 20 S., R. 28 E., NMPM Sec. 29 NE1/4. Eddy County BLM CFO 100 % US Mineral Interest EOI# NM00018485	160	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-LN-1** BLM Lease Notice Stipulations for NMSO-LN-Potential, Suitable and Occupied Habitat for Special Status Plant Species **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6790	BLM	T. 19 S., R. 3 E., NMPM Sec. 22 S1/2SW1/4; Sec. 27 NW1/4. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00018468	240	**NM-13-LN** BLM Lease Notice Stipulations for NMSO-CSU – Paleontological Resources **NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-14-LN** BLM Lease Notice Stipulations for NMSO-LN – Paleontological Resources **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-LN-6** BLM Lease Notice Stipulations for PDO - LN – OG Development Within Designated Potash Area **SENM-S-1-CSU** BLM Stipulations for PDO - CSU - Potash Area Stipulation **SENM-S-22-CSU** BLM Stipulations for PDO - CSU – Lesser Prairie-Chickens **SENM-S-23-CSU** BLM Stipulations for PDO – Protection of Dunes Sagebrush Lizard **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance

Lease Parcel Number	Surface Ownership	Legal Description	Acres	Lease Notices and Stipulations
NM-2023-05-6795	BLM	T. 21 S., R. 26 E., NMPM Sec. 32 Lots 1,2. Eddy County BLM CFO 100 % US Mineral Interest EOI# NM00018142	83.14	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-LN-1** BLM Lease Notice Stipulations for NMSO-LN-Potential, Suitable and Occupied Habitat for Special Status Plant Species **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-S-18-CSU** BLM Stipulations for PDO - CSU – Streams, Rivers and Floodplains **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **SENM-S-25-CSU** BLM Stipulations for PDO – Visual Resource Management **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6797	BLM	T. 15 S., R. 28 E., NMPM Sec. 27 S1/2NE1/4. Chaves County BLM RFO 100 % US Mineral Interest EOI# NM00018142	80	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-S-19-CSU** BLM Stipulations for PDO - CSU – Playas and Alkali Lakes **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6798	BLM	T. 15 S., R. 28 E., NMPM Sec. 34 E1/2. Chaves County BLM RFO 100 % US Mineral Interest EOI# NM00018142	320	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-S-18-CSU** BLM Stipulations for PDO - CSU – Streams, Rivers and Floodplains **SENM-S-19-CSU** BLM Stipulations for PDO - CSU – Playas and Alkali Lakes **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance

Lease Parcel Number	Surface Ownership	Legal Description	Acres	Lease Notices and Stipulations
NM-2023-05-6799	BLM	T. 20 S., R. 27 E., NMPM Sec. 14 SW1/4SW1/4. Eddy County BLM CFO 100 % US Mineral Interest EOI# NM00018194	40	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-LN-1** BLM Lease Notice Stipulations for NMSO-LN-Potential, Suitable and Occupied Habitat for Special Status Plant Species **SENM-S-19-CSU** BLM Stipulations for PDO - CSU – Playas and Alkali Lakes **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6800	BLM	T. 20 S., R. 27 E., NMPM Sec. 17 NE1/4, N1/2SE1/4, SE1/4SE1/4. Eddy County BLM CFO 100 % US Mineral Interest EOI# NM00018194	280	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-1-LN** BLM Lease Notice Stipulations for NMSO-LN-Potential, Suitable and Occupied Habitat for Special Status Plant Species **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6801	BLM	T. 18 S., R. 27 E., NMPM Sec. 33 ALL. Eddy County BLM CFO 100 % US Mineral Interest EOI# NM00017997	640	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-LN-1** BLM Lease Notice Stipulations for NMSO-LN-Potential, Suitable and Occupied Habitat for Special Status Plant Species **SENM-LN-1** BLM Lease Notice Stipulations for NMSO-LN Potential Cave or Karst Occurrence **SENM-S-17-CSU** BLM Stipulations for PDO - CSU - Slopes and Fragile Soils **SENM-S-18-CSU** BLM Stipulations for PDO - CSU – Streams, Rivers and Floodplains **SENM-S-21-CSU** BLM Stipulations for PDO – Protections of Caves and Karst **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance

Lease Parcel Number	Surface Ownership	Legal Description	Acres	Lease Notices and Stipulations
NM-2023-05-6803	BLM	T. 19 S., R. 32 E., NMPM Sec. 14 NE1/4 NE1/4. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00018591	40	**NM-13-LN** BLM Lease Notice Stipulations for NMSO-CSU – Paleontological Resources **NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-14-LN** BLM Lease Notice Stipulations for NMSO-LN – Paleontological Resources **SENM-LN-2** BLM Lease Notice Stipulations for PDO - LN – Dunes Sagebrush Lizard **SENM-S-17-CSU** BLM Stipulations for PDO - CSU - Slopes and Fragile Soils **SENM-S-22-CSU** BLM Stipulations for PDO - CSU – Lesser Prairie-Chickens **SENM-S-23-CSU** BLM Stipulations for PDO - CSU – Dunes Sagebrush Lizard **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6804	BLM	T. 19 S., R. 32 E., NMPM Sec. 14 SE1/4 SW1/4. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00018591	40	**NM-13-LN** BLM Lease Notice Stipulations for NMSO-CSU – Paleontological Resources **NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **NM-14-LN** BLM Lease Notice Stipulations for NMSO-LN – Paleontological Resources **SENM-LN-2** BLM Lease Notice Stipulations for PDO - LN – Dunes Sagebrush Lizard **SENM-S-17-CSU** BLM Stipulations for PDO - CSU - Slopes and Fragile Soils **SENM-S-22-CSU** BLM Stipulations for PDO - CSU – Lesser Prairie-Chickens **SENM-S-23-CSU** BLM Stipulations for PDO - CSU – Dunes Sagebrush Lizard **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance
NM-2023-05-6805	BLM/	T. 24 S., R. 36 E., NMPM Sec. 6 NE1/4, SE1/4. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00018467	320.96	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **SENM-S-22-CSU** BLM Stipulations for PDO - CSU – Lesser Prairie-Chickens **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance

Lease Parcel Number	Surface Ownership	Legal Description	Acres	Lease Notices and Stipulations
NM-2023-05-6806	Private	T. 21 S., R. 36 E., NMPM Sec. 31 Lot 4. Lea County BLM CFO 100 % US Mineral Interest EOI# NM00015993	35.38	**NM-11-LN** BLM Lease Notice Stipulations for NMSO – LN – Special Cultural Resource **HQ-TES-1** BLM Stipulations for WO – Endangered Species Act Sec 7 Consultation **HQ-CR-1** BLM Stipulations for Cultural Resources and Tribal Consultation **HQ-MLA-1** BLM Lease Notice for MLA Section 2(a)(2)(A) Compliance

* All acreages contained in the EA analysis were calculated using geographic information system (GIS) data sets for resources and parcels which may differ slightly from the acreages contained in legal descriptions above. Difference in total acres between parcels can vary due to geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall impact analysis conclusions presented in this EA.

The drilling of wells on lease parcels is not permitted until the leaseholder submits, and the BLM approves (subsequent to additional site-specific environmental review documentation), a complete Application for Permit to Drill (APD) package (Form 3160-3) following the requirements specified under Onshore Oil and Gas Orders listed in 43 CFR 3162 (BLM 2017). The BLM has authority, according to the standard terms and conditions of the leases, to attach conditions of approval (COAs) to the APD that reduce or avoid impacts to public land, resources, and/or resource values. Under 43 CFR 3101-1-2, such reasonable measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Measures shall be deemed consistent with lease rights granted provided that they do not require relocation of proposed operations by more than 200 meters (m); require that operations be sited off the leasehold; or prohibit new surface-disturbing operations for a period in excess of 60 days in any lease year.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM would not offer the nominated parcels for competitive leasing in the May 2023 Competitive Oil and Gas Lease Sale. As a result, there would not be any development of the parcels at this time. The parcels would have the potential to be nominated again for a future oil and gas lease sale.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 INTRODUCTION

Chapter 3 contains the effects analysis related to the issues. Section 3.2 describes the analysis assumptions related to future potential development of the nominated lease parcels. Section 3.3 presents an overview of reasonably foreseeable environmental trends and planned actions considered in the effects analysis. Section 3.4 describes the effects of the No Action Alternative for all issues. Section 3.5 presents the issues that are AIB. Section 3.6 presents the issues that are analyzed in detail.

3.2 ANALYSIS ASSUMPTIONS

While leasing in itself would not directly authorize any oil and gas development or production, future oil and gas development and production is a reasonable outcome of a granted lease right. Because there are

currently no development proposals for the nominated lease parcels, the BLM is unable to complete an analysis that uses information related to a specific proposed project or projects. However, for the purpose of this analysis, Sections 3.2.1 and 3.2.2 outline the methodology for estimating number of wells, potential production volumes, and surface disturbance associated with the future potential development of the nominated lease parcels.

3.2.1 Methodology for Estimating Number of Oil and Gas Wells and Production Volumes

Reasonably foreseeable quantitative well development estimates were derived from the well densities identified in the BLM PDO Reasonably Foreseeable Development (RFD) (Engler et al. 2012; Engler and Cather 2014; herein incorporated by reference). The projected number of wells for each nominated lease parcel is based on the horizontal and vertical well densities (in wells per acre) for each field office, as identified in the RFD. To calculate the volumes of oil, natural gas, and water expected to be produced from the parcels, the projected number of wells (calculated as described above) was multiplied by the estimated ultimate recoveries (EURs) of oil, natural gas, and produced water per well. These EURs are generated by performing decline curve analyses of existing production within the PDO.

The projected number of wells and associated oil, gas, and produced water production for the nominated lease parcels are summarized in Table 3.1.

Table 3.1. Estimated Well Count and Production for the Nominated Lease Parcels

Parcel Number (acres)*	Field Office	Surface Management (acres)	Total Horizontal Wells†	Surface Disturbance (acres)	Oil Production (bbl)	Gas Production (mcf)	Produced Water Production (bbl)
NM-2023-05-0413 (40)	BLM CFO	Private	1	4.5	168,000	979,600	581,400
NM-2023-05-0419 (120)	BLM CFO	Private	1	4.5	168,000	979,600	581,400
NM-2023-05-0420 (80)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6132 (280)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6751 (40.01)	BLM CFO	Private	1	4.5	168,000	979,600	581,400
NM-2023-05-6752 (320)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6753 (120)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6789 (160)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6790 (240)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6795 (83.14)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6797 (80)	BLM RFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6798 (320)	BLM RFO	BLM	1	4.5	168,000	979,600	581,400

Parcel Number (acres)*	Field Office	Surface Management (acres)	Total Horizontal Wells†	Surface Disturbance (acres)	Oil Production (bbl)	Gas Production (mcf)	Produced Water Production (bbl)
NM-2023-05-6799 (40)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6800 (280)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6801 (640)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6803 (40)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6804 (40)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6805 (320.96)	BLM CFO	BLM	1	4.5	168,000	979,600	581,400
NM-2023-05-6806 (35.83)	BLM CFO	Private	1	4.5	168,000	979,600	581,400
Total BLM CFO (2,879.49)	–	–	**17**	**76.5**	**2,856,000**	**16,653,200**	**9,883,800**
Total BLM RFO (400)	–	–	**2**	**9**	**336,000**	**1,959,200**	**1,162,800**
Total BLM PDO (3,279.49)	–	–	**19**	**85.5**	**3,192,000**	**18,612,400**	**11,046,600**

Note: bbl = barrels; mcf = thousand cubic feet.

* All acreages contained in the EA analysis were calculated using geographic information system (GIS) data sets for resources and the parcels, which may differ slightly from the acreages contained in legal description here and in Table 2.1. Difference in total acres between the parcels and acres analyzed in the EA can vary slightly due to geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall impact analysis conclusions presented in this EA.

† In cases where the methodology used for estimating the number of wells per nominated lease parcel resulted in a fractional value of less than one well per nominated lease parcel (because of low anticipated drilling rate), the fractional value was adjusted upward to the next whole number to represent a rational outcome of the number of potential wells that could be drilled and developed on the nominated lease parcel, as well as to provide meaningful inputs to the oil, gas, and produced water production projections.

3.2.2 Methodology for Estimating Surface Disturbance

It is unknown when, where, or to what extent subsequent well sites, roads, and associated infrastructure would be proposed in the event the BLM decides to lease the nominated lease parcels. Future potential development of the nominated lease parcels could include the following phases (Appendix D provides a summary of the phases of oil and gas development):

- Construction of new access roads or expansion of existing roads
- Pad construction
- Drilling of a well
- Hydraulically fracturing a well
- Installation of pipeline
- Production, including vehicle traffic; hauling of produced fluids such as oil or produced water; compression to move gas through pipeline systems; potential venting from storage tanks; regular well monitoring; and work-over tasks for the life of the well
- Well plugging and abandonment

- Reclamation and remediation

Based on surface disturbance values identified in the RFD (Engler et al. 2012), supplemented by recent oil and gas development in the BLM PDO, the BLM estimates 4.5 acres of surface disturbance comprising up to two wells on one pad, an access road, and a pipeline corridor. The CFO RMP projects 5,825 federal wells on 2,700,000 acres of land and the RFO RMP projects 575 federal wells on 4,547,000 acres of land. The BLM calculated a well density (wells per acre) using these RFD projections. Using the calculated well density, acres of land and number of parcels available for leasing, and rounding to ensure that the number of wells per parcel is a nonzero, whole number, one well per parcel was estimated for this lease sale. Future potential development of the nominated lease parcels is anticipated to comprise 19 horizontal wells and approximately 85.5 total acres of new surface disturbance. Estimated surface disturbance from future potential development of the nominated lease parcels is provided in Table 3.1. Disturbance would remain on the landscape until final abandonment and reclamation of facilities (generally assumed to occur after 20 years). Interim/ongoing reclamation procedures must be completed within 6 months of well completion and would be used to limit impacts by restoring disturbed areas as soon as they are no longer required for operations.

3.3 REASONABLY FORESEEABLE ENVIRONMENTAL TRENDS AND PLANNED ACTIONS

The BLM PDO encompasses over 20 million acres within the planning area boundary. This includes 3.6 million acres of BLM surface and 7.6 million acres of federally managed minerals. The following sections outline the reasonably foreseeable environmental trends and planned actions within the PDO planning area that are closely related to the Proposed Action and the reasonably foreseeable development of the nominated lease parcels. The BLM is able to identify, analyze, and disclose reasonably foreseeable environmental trends and planned actions expected to occur over the next 20 years, as this time period is aligned with RMP and RFD scenario information available. Additional information related to environmental impacts of BLM management decisions can be found in the Carlsbad Approved RMP (BLM 1988), as amended (BLM 1997a, 2008a), and Roswell Approved RMP and Record of Decision (BLM 1997b), as amended (BLM 2008a). More information related to air resources environmental trends is available in the *Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas, and Kansas* (BLM 2022a); the BLM acknowledges that this document is incorporated by reference into the EA.

3.3.1 Energy Development and Other Land Uses

3.3.1.1 *Mineral and Energy Development*

The PDO planning area consists of surface topography, climate conditions, and mineral deposits that are conducive to energy development including those of both oil and gas and renewable energy sectors. These natural conditions have led to the utilization of suitable lands for various forms of energy development on federal and state managed surface as well as those privately owned. It is expected that land and mineral estates within the PDO will continue to be utilized for energy development, resulting in a trend of increased total land use and resource impacts attributed to these activities.

The PDO, analogous to the New Mexico portion of the Permian Basin, contains a mineral estate that is rich in accessible oil and gas reserves that has led to heavy development of these resources, starting in the early 1900s and resulting in the area becoming one of the most productive land-based fields in the country. The majority of the Permian Basin open to oil and gas leasing is already leased for fluid mineral development. The BLM estimates that there are currently approximately 41,006 active wells (primarily

vertical wells) within the PDO, of which approximately 18,690 are federal. These numbers are based on information contained in in the BLM 2021 *Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas, and Kansas*, which considered Petroleum Recovery Resource Center data (BLM 2022a) (Table 3.2). The RFD scenario for oil and gas in the PDO (Engler et al. 2012; Engler and Cather 2014) projects that 800 oil and gas wells would be completed within the PDO each year for the 20-year scenario (2015–2035), for a total of approximately 16,000 new wells (federal and non-federal), most of which are expected to be horizontally drilled. Additionally, the BLM is currently revising the RMP for the CFO planning area, and as part of that, is revising its RFD well projections.

Additionally, the desert climate and low-slope profile topography existing across a majority proportion of the PDO lends itself to being highly suitable for renewable energy development. Over the past 20 years, the PDO has shown an increase in both solar and wind development projects along with supporting infrastructure such as transmission lines, facilities, and access roads. Also, the PDO has naturally occurring saleable and locatable mineral reserves that have past and present development, with the understanding that development activities will continue at a similar rate. This includes but is not limited to land use and associated surface disturbance associated with seismic exploration and potash mining, such as tailings piles and mine development.

Past and planned actions of energy and mineral development within the PDO is estimated to be 427,740 acres of surface disturbance (see Section 3.3.1.3; see Table 3.2). Energy and mineral development on federal lands or mineral estate are expected to continue under the management and conditions outlined in the CFO and RFO RMPs (BLM 1988, 1997a, 1997b, 2008a). This represents a continued trend of human use of land and mineral resources. Such effects would correspond to the resources present at the location of development with contribution to landscape-level conditions and could result in landscape modifications over time, including habitat loss or degradation, changes in plant communities, fluctuating but generally increasing levels of emissions of pollutants, changes in land use patterns and the amount of landscape unaltered by human activities, changes to the visual landscape, and changes in the quantity or quality of water resources. The analyses presented in Sections 3.5 and 3.6 disclose the effects of these environmental trends and planned actions related to oil and gas development on resource issues analyzed in brief and in detail, respectively.

3.3.1.2 *Municipal and Other Land Uses*

Existing municipal and other land uses within the PDO planning area, such as urban development, grazing, recreation, off-road travel, and transmission or pipeline rights-of-way, are expected to continue at current or slightly increased levels This includes municipal and urban development, including expanded footprints of cities such as Carlsbad, Roswell, and Artesia. Presently, livestock grazing is estimated to occur on 88% (17,600,000 acres) of the PDO planning area, and it is assumed this use will continue at existing levels. Furthermore, other land uses, such as recreation on federal lands, is expected to continue under the management and conditions of the Carlsbad Approved RMP (BLM 1988), as amended (BLM 1997a, 2008a), and Roswell Approved RMP and Record of Decision (BLM 1997b), as amended (BLM 2008a). Associated effects would correspond to the resources present at the specific development location with contribution to landscape-level conditions and could result in landscape modifications over time. The analyses presented in Sections 3.5 and 3.6 disclose the effects of these environmental trends and planned actions related to oil and gas development on resource issues analyzed in brief and in detail, respectively.

3.3.1.3 *Quantification of Landscape Disturbance*

To provide a focused and quantitative analysis of the contribution of the Proposed Action to the identified landscape-level environmental trends and planned actions, Table 3.2 summarizes the estimated acreage of landscape disturbance associated with energy and mineral development as well as other land uses within

the PDO. The information provided in Table 3.2 presents a quantification of past and planned actions that are associated with surface disturbance and correlated contribution to effects and environmental trends described above. Additional information related to environmental impacts of current BLM management decisions can be found in the applicable RMP and environmental impact statement (BLM 1988, 1997a, 1997b, 2008a). More information related to air and water resources environmental trends is also available in the *Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas, and Kansas* (BLM 2022a) and *2022 BLM Water Support Document for Oil and Gas Development in New Mexico* (BLM 2022b); the BLM incorporates these documents by reference into the EA.

Table 3.2. Estimated Landscape Disturbance Associated with Environmental Trends and Planned Actions within the PDO

Analysis Area	Number of Wells	Acreage	Percent of PDO Analysis Area (acreage)
PDO analysis area	N/A	20,000,000	-
Estimated Surface Disturbance	**Number of Wells**	**Acreage**	**-**
Past construction of gas plants, potash mines, oil and gas well pads, access roads, transmission lines, and other linear features*	41,006	317,000*	1.59%
Oil and gas RFD†	16,000	72,000	0.36%
Mining‡	N/A	2,400	-
Other linear infrastructure	N/A	4,200	-
Seismic explorations	N/A	32,000	-
Agriculture (non-grazing)	N/A	140	-
Total	**57,006**	**427,740**	**2.14%**
Contribution of surface disturbance of future potential development under the Proposed Action	19	85.5	0.0004%
Contribution of the future potential development under the Proposed Action to the oil and gas RFD	0.12%	0.12%	-
Contribution of the future potential development under the Proposed Action to total estimated landscape disturbance	0.03%	0.02%§	-

* Source: BLM (2018b). Value includes estimates of existing disturbance from past construction of gas plants, potash mines, oil and gas well pads, access roads, transmission lines, and other linear features. Of this total, and assuming an average disturbance of 4.5 acres per well, there would be approximately 184,527 acres of existing surface disturbance in the analysis area from all oil and gas well pads and related infrastructure including roads, electric lines, and pipelines (0.92% of the 20 million-acre PDO). There is no reliable estimate for past wells that are no longer in use, and were either plugged, reclaimed, and abandoned or, in some cases, abandoned without full reclamation. Note that past and present well count and estimated disturbance include some wells that are also projected in the 2012 and 2014 RFD (Engler et al. 2012; Engler and Cather 2014). As a result, the total well count and total disturbance figures likely include some double counting.

† Sources: Engler et al. (2012); Engler and Cather (2014). New surface disturbance from potential wells in the RFD scenario is estimated at 4.5 acres per well.

‡ Sources: BLM (2014, 2018b).This estimate includes approximately 2,400 acres of surface disturbance predicted from the proposed Ochoa Mine (BLM 2014), 4,200 acres of surface disturbance from development of transmission lines and pipelines/associated infrastructure (BLM 2018b), 140 acres of surface disturbance from agriculture (BLM 2018b), and 32,000 acres of short-term disturbance from seismic exploration, with reclamation occurring within 3 years (BLM 2018b).

§ The analysis contained in this EA generally provides percentage contribution rounded to two decimal points.

3.3.2 Land Restoration and Conservation Activities

A multifaceted network of federal and state agencies as well as non-governmental organizations reclaim, restore, and conserve land and resources in the PDO. The BLM NMSO has partnered with the State of New Mexico, ranchers, industry, and other local partners on a restoration initiative called Restore New Mexico. Since 2005, the initiative has restored over 3 million acres of grasslands, woodlands, and riparian

areas across the state that had been degraded by invasive species and woodland encroachment in New Mexico (U.S. Geological Survey [USGS] 2019). This program has also resulted in the reclamation of some oil and gas legacy well pads, roads, and caliche pits within the PDO analysis area (USGS 2019). Restore New Mexico's rehabilitation efforts and continued work is considered an ongoing countervailing effect to present and future landscape-level surface disturbance as legacy oil and gas development and ecosystems are gradually restored.

Additionally, BLM management decisions have a continued focus on conserving lands (habitat) for special status species, including LPC and DSL, as disclosed in the 2008 Resource Management Plan Amendment (RMPA) and those managed by candidate conservation agreements (BLM 2007, 2008a, 2008b; USFWS et al. 2008; USFWS et al. 2014; USFWS and Texas Comptroller of Public Accounts 2019). It is anticipated that the BLM, and other agencies, would also continue to treat lands within the PDO with prescribed fire, mechanical treatments, and herbicide according to the Carlsbad Approved RMP (BLM 1988), as amended (BLM 1997a, 2008a) and Roswell Approved RMP and Record of Decision (BLM 1997b), as amended (BLM 2008a).

3.3.3 Changes to Regional Environmental Conditions Related to Climate Change

Climate change, as further discussed in Section 3.6.2, is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. Currently, global climate models are unable to forecast local or regional effects on resources (Intergovernmental Panel on Climate Change [IPCC] 2013). However, there are general projections regarding potential impacts to natural resources and plant and animal species that may be attributed to climate change from GHG emissions over time. These effects are likely to be varied, including those in the southwestern United States (Karl 2009). Climate models project robust differences in regional changes related to precipitation patterns, average temperatures, and frequency or severity of drought (IPCC 2013). Impacts of climate change to regionally variable ecosystem processes have also been observed and have been used to make general projections regarding potential future effects of climate change on natural resources and plant and animal species for different regions (Karl 2009).

The PDO planning area is included in the Upper Rio Grande Basin (southern Colorado to central-southern New Mexico) and Texas-Gulf Basin (eastern New Mexico to southeastern Texas), which is expected to be affected in both the short and long term by variations in global and regional environmental conditions related to climate change. There have been observable trends in warming temperatures for both New Mexico and Texas, in which average annual temperatures have increased by almost 2°F and 1.5˚F, respectively, since the beginning of the twentieth century, and the number of extremely hot days, warm nights, and extreme heat events have also increased. Droughts are a serious threat in water scarce New Mexico and wildfire frequency and severity are projected to increase. The summer monsoon rainfall, which provides much needed water for agricultural and ecological systems, varies greatly from year to year and future trends in such precipitation are highly uncertain. In Texas, increases in extreme precipitation events are projected. Higher temperatures will increase soil moisture loss during dry spells, increasing the intensity of naturally occurring droughts. Also, as the climate warms, increases in hurricane rainfall rates, storm surge height due to sea level rise, and the intensity of the strongest hurricanes are projected (BLM 2022a). Additional information related to global, regional, and state climate change projections can be found in the *BLM Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas and Kansas* (BLM 2022a) and the 2021 BLM *Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends* (herein referred to as the Annual GHG Report [BLM 2022c]). Lastly, information on climate impacts to ecoregions within the nominated lease parcels (see AIB-5) can be found in the USGS Southern Great Plains Rapid Ecological Assessment (Reese et al. 2017).

3.4 NO ACTION ALTERNATIVE FOR ALL ISSUES

Under the No Action Alternative, the BLM would not lease the nominated lease parcels and the existing conditions and trends related to each issue would continue. Potential impacts associated with future potential development of the nominated lease parcels would not occur under this alternative, current land and resource uses would continue, and the federal mineral acreage would remain open to future oil and gas lease development. In the 20 million-acre PDO, there are approximately 7.6 million acres of federal mineral estate. Oil and gas development would continue on leased land surrounding the nominated lease parcels. No natural gas or crude oil from the nominated lease parcels would be produced, and no royalties would accrue to federal or state treasuries. A choice on the part of the BLM not to lease the nominated lease parcels would eliminate 19 oil and gas development opportunities in the BLM PDO. Reduction or elimination of total oil and gas development opportunities in the area is likely to incrementally reduce local and regional employment and revenue opportunities related to the oil and gas and service support industries over time. This is because the oil and gas sector of the economy relies on both ongoing operational activities (development of existing leases) and new development opportunities (acquisition and development of new leases) to continue to provide local and regional jobs and revenue on a sustained basis.

3.5 ISSUES ANALYZED IN BRIEF

Following internal and external scoping, 27 issues were identified, considered, and analyzed in brief by members of the IDT in review of the Proposed Action. Each of these issues is outlined below with a concise discussion regarding the context and intensity of the impact related to each issue. Stipulations HQ-TES-1 and HQ-CR-1 and Lease Notice NM-11-LN, as well as standard terms and conditions as described in the lease form, would apply to all nominated lease parcels. For all issues analyzed in brief that follow, it is assumed that effects of reasonably foreseeable environmental trends and planned actions to relevant elements of the environment would be consistent with the landscape disturbance acreages presented in Table 3.2.

For the purposes of this analysis, short-term effects are considered those that cease after well construction and completion (30–60 days) or cease after interim reclamation (2–5 years). Long-term effects are considered those associated with operation production activities over the life of the well (for example, noise) or that otherwise extend beyond the short-term time period (for example, surface disturbance subject to final reclamation). As such, some long-term effects would cease immediately upon the end of operations, whereas other long-term effects would remain until successful landscape reclamation is accomplished. Note that the time frame for successful reclamation would vary by vegetation type and other factors such as the amount and timing of annual precipitation (see AIB-5 for more information).

AIB-1 Groundwater Quality

How would future potential development of the nominated lease parcels affect groundwater quality?

Leasing and future potential development of the nominated lease parcels would result in oil and gas activities, including well pad construction, drilling, and completion for an estimated 19 wells. The wells would be horizontal wells that would employ standard industry practices related to well completion (i.e., perforation and hydraulic fracturing). Types of chemical additives used in well completion activities may include acids, hydrocarbons, thickening agents, gelling agents, lubricants, and other additives that are operator- and location-specific. The largest components in hydraulic fracturing fluid are water and sand.

Reasonably foreseeable well development associated with the RFD scenario (see Section 3.3) would most likely pass through a usable groundwater aquifer currently or potentially supplying stock, residential, and/or irrigation water. If proper cementing and casing programs are not followed, there may be a loss of well integrity, surface spills, or loss of fluids in the drilling and completion process that may result in large volumes of high concentrations of chemicals reaching groundwater resources.
If contamination of usable water aquifers (resulting in total dissolved solids greater than 10,000 parts per million [ppm]) from any source occurs, springs and water wells that are sourced from the affected aquifers could be subject to long-term decreases in water quality depending on the severity of the contamination event. According to New Mexico Administrative Code (NMAC) 19.15.16, operators are required to seal and isolate strata containing fresh water from oil- and gas-bearing strata (including sealing the annulus). BLM regulations (including those covered under 43 CFR 3160, Onshore Orders 1, 2, and 7; 43 CFR 3162.3-3, and 43 CFR 3162.3-5); New Mexico Oil Conservation Division (NMOCD) regulations (NMAC 19.15.26); and the state's primacy agreement under the Safe Drinking Water Act (SDWA) include requirements for hydraulic fracturing, including casing specifications, monitoring and recording, and management of recovered fluids (wastewater or produced water). The safeguards that are in place to prevent these situations from occurring are responsibilities managed in the Inspection and Enforcement department within the BLM.

The *2022 BLM Water Support Document for Oil and Gas Development in New Mexico* (BLM 2022b) (hereafter referred to as the Water Support Document and incorporated by reference) contains a detailed summary of the regulatory program associated with hydraulic fracturing and measures to protect groundwater quality. A further list of the potential environmental effects of hydraulic fracturing can be found in the U.S. Environmental Protection Agency (EPA) report, *Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States* (EPA 2016). In summary, this report examines six different scenarios in which drinking water resources may be affected by hydraulic fracturing: 1) water withdrawals during periods of low water availability; 2) spills of hydraulic fracturing fluids/chemicals and/or produced water; 3) release of hydraulic fracturing fluids from wells with inadequate casing; 4) direct injection of hydraulic fracturing fluids into groundwater; 5) discharge of insufficiently treated wastewater to surface water; and 6) contamination of groundwater from unlined storage/disposal pits.

Of the number of wells identified in the RFD scenario, 19 wells (0.12% of the RFD scenario) would be attributable to future potential development of the nominated lease parcels (see Section 3.3). The future potential development of nominated lease parcels (85.5 acres) would comprise 0.02% of the total landscape-level surface disturbance trends (427,740 acres) (see Table 3.2) identified in Section 3.3.
The nominated lease parcels are within six groundwater basin aquifers (10-digit hydrologic unit codes [HUC-10]) (Table 3.3).

Table 3.3. HUC-10 Watershed Impact Summary

Groundwater Basin (total basin size in acres)	Parcel(s) (total parcel acreage, percent of parcel within each basin)
Capitan 1965 (1,008,885)	419 (120, 100%), 420 (80, 100%), 6751 (40, 98%), 6752 (320, 100%), 6753 (120, 100%), 6789 (160, 100%), 6790 (240, 100%), 6803 (40, 100%), 6804 (40, 100%), 6805 (321.9, 100%), 6806 (35.4, 100%)
Carlsbad 1947 (318,310)	6795 (83.1, 100%)
Carlsbad 1975 (299,133)	6132 (280, 100%)
Carlsbad 1993 (250,879)	413 (20, 100%)
Roswell 1946 (139,985)	6799 (40, 100%), 6800 (280, 100%), 6801 (640, 100%)
Roswell 1993 (1,498,163)	6751 (40, 2%), 6797 (80, 100%), 6798 (320, 100%)

Nominated lease parcels 419, 420, 6751, 6790, 6803, 6804, 6805, and 6806 are within the Lea County portion of the Capitan 1965 Basin aquifer, which has an approximate maximum thickness of 2,300 feet and occurs roughly 3,000 to 5,500 feet below ground level (Hiss 1975). Total parcel acreage (917.3 acres) within this groundwater basin is 0.09% of the total acreage of this groundwater basin (1,008,885.18 acres). Nominated lease parcels 6799, 6800, and 6801 are within the Roswell 1946 Basin aquifer. Total parcel acreage (960 acres) within the Roswell 1946 groundwater basin is 0.69% of the total acreage of this groundwater basin (139,985 acres). Nominated lease parcels 6751, 6797, and 6798 are within the Roswell 1993 Basin aquifer. Total parcel acreage (440 acres) within the Roswell 1993 groundwater basin is 0.03% of the total acreage of this groundwater basin (1,498,162.65 acres). The Roswell Basin aquifer has an approximate maximum thickness of 1,600 to 2,000 feet and begins approximately 0 to 200 feet below ground level (New Mexico Office of the State Engineer [NMOSE] 2004). Nominated lease parcel 413 is within the Carlsbad 1993 Basin aquifer. Total parcel acreage (20 acres) within this groundwater basin is 0.008% of the total acreage of this groundwater basin (250,879 acres). Nominated lease parcel 6132 is within the Carlsbad 1975 Basin aquifer. Total parcel acreage (280 acres) within this groundwater basing is 0.09% of the total acreage of this groundwater basin (299,133 acres). Nominated lease parcel 6795 is within the Carlsbad 1947 Basin aquifer. Total parcel acreage (83.1 acres) within this groundwater basin is 0.03% of the total acreage of this groundwater basin (318,310 acres). The Carlsbad Basin aquifer has an approximate maximum thickness of 1,600 to 2,000 feet and begins approximately 0 to 200 feet below ground level (NMOSE 2004). The average oil and/or gas well depth within Chaves, Eddy, and Lea Counties is 5,376 feet, 9,100 feet, and 9,624 feet, respectively (Mineral Answers 2022a, 2022b, 2022ca). Based on estimated aquifer thicknesses and depths within the analysis area, future potential development of the nominated lease parcels would likely result in wells drilled beyond (deeper than) the regional aquifers. Although wells drilled would likely pass through these aquifers, the evidence indicates that the regulatory programs described previously would protect these water resources.

Nominated lease parcel 6801 (640 acres) contains two groundwater wells; one well is used for livestock watering (active), and the other is used for exploration (type and status unknown). Nominated lease parcel 6801 is also within 656 feet of two groundwater wells, as is parcel 6795. Nominated lease parcels 6800 and 6805 are within 656 feet of one groundwater well. Nominated lease parcel 6132 is 1.81 miles east of one active Voluntary Remediation Site, and nominated lease parcel 6795 is 4.62 miles east of one active Voluntary Remediation Site. Nominated lease parcel 6795 is 3.75 miles northwest of one Septic System Groundwater Contamination Site (Carlsbad Standpipe Road). The closest nominated lease parcel to the Jal Water Well Field is nominated lease parcel 419, which is located 10.84 miles northwest of the Jal Water Well Field. Lastly, there is one petroleum tank site (tank) registered within 10 miles of nominated lease parcels 6752 and 6753, three tanks registered within 10 miles of nominated lease parcel 6801, four tanks registered within 10 miles of nominated lease parcel 6132, five tanks registered within 10 miles of nominated lease parcel 6806, 11 tanks registered within 10 miles of nominated lease parcel 6800, 18 tanks registered within 10 miles of nominated lease parcel 6799, 32 tanks registered within 10 miles of nominated lease parcel 6789, and 44 tanks registered within 10 miles of nominated lease parcel 6795. Standard terms and conditions would apply to all leases, which allows for siting of wells to minimize potential impacts to existing groundwater wells and groundwater resources. For more information regarding livestock wells and range improvements, see AIB-13.

Protection of groundwater is enforced in concert with the State of New Mexico and any other applicable entities with jurisdiction (e.g., tribal entities or the EPA), and mitigation of any water-contaminating event would occur in addition to the enforcement of applicable regulations. If effects were to occur, lessees and operators would be obligated by the standard terms of the lease, as well as the approved APD and applicable BLM and NMOCD regulations to report, respond to, and mitigate the spill or release. Additionally, all injection wells permitted by the NMOCD (including injection wells and producing wells and all related surface facilities) are subject to a surface injection pressure limitation. Wells are required

to be equipped with a pressure-limiting device, which ensures that the maximum surface injection pressure is not exceeded (NMOCD 2004). The BLM District Office inspection and enforcement personnel periodically inspect wells and surface facilities to ensure that all wells and related surface facilities are in good repair and leak free (NMOCD 2004). The NMOCD is also responsible for oversight of hydraulic fracturing wastewater pits. NMAC 19.15.17 regulates the use of liners as well as depth restrictions to protect groundwater resources.

Spill occurrences could affect groundwater on-site or during material transport. The Water Support Document (BLM 2022b) notes a total of 14,924 spills in the Permian Basin in 2021. The rate of recovery varies by spill type, but the average loss rate for all liquid spill types was approximately 67%. Spills that are not recovered are remediated, which may include removal of contaminated soil. Six natural gas liquid spills were reported as having affected groundwater in Eddy, Lea, and Chaves Counties (BLM 2022b; NMOCD 2022a). Should a spill occur, the BLM would work with the NMOCD to immediately remediate spills on BLM lands in accordance with federal and state standards, including NMAC 19.15.29.11. According to NMAC 19.15.29.11, the operator shall complete division-approved corrective action for releases that endanger public health or the environment in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with NMAC 19.15.30. The remaining contaminates from unrecovered spills are remediated in accordance with federal and state standards. Such remediation could consist of removal of contaminated soil, replacement with uncontaminated soil, and subsequent chemical testing. See the Water Support Document (BLM 2022b) for further information on spills.

In summary, the BLM, New Mexico Environment Department (NMED), and the NMOCD have put in place numerous requirements for oil and gas producers so that drilling fluids, hydraulic fracturing fluids, and produced water and hydrocarbons remain within the well bore and do not enter groundwater or any other formations. These include BLM regulations covered under 43 CFR 3160, Onshore Orders 1, 2, and 7, 43 CFR 3162.3-3, 43 CFR 3162.3-5, and NTL-3A; NMOCD regulations under NMAC 19.15.26; and the state's primacy agreement under the SDWA. With these requirements in place, including the use of casing and cementing measures, contamination of groundwater resources from the nominated lease parcels is highly unlikely. There have been no documented instances of groundwater contamination attributed to well drilling and completion in the Pecos District (BLM 2022b), which further supports this conclusion. In addition, the BLM has authority under standard terms and conditions to require additional measures to protect water quality if site-specific circumstances require them. Site-specific mitigation tools would be developed as appropriate for the individual circumstances, including groundwater-quality monitoring studies. The regulations at 43 CFR 3162.5-2(d) give the BLM the authority to require an operator to monitor water resources to ensure that the isolation procedures utilized to protect water and other resources are effective.

AIB-2 Surface Water Quality

How would future potential development of the nominated lease parcels affect watershed hydrology and surface water quality?

The PDO encompasses 12 HUC-10 watersheds. Current surface disturbance of all types within the 20 million-acre analysis area is estimated at 317,000 acres (BLM 2018b), and there are approximately 41,006 active well bores of all well types (BLM 2022b). The total existing surface disturbance comprises about 1.6% of the analysis area.

Reasonably foreseeable environmental trends and planned actions within the PDO (which include the RFD scenario) would result in approximately 427,740 acres of surface disturbance. This equates to 2.14% of the approximately 20 million-acre PDO. These actions would disturb vegetation, soils, and mineral

substrate, which would create dust and increase runoff rates during precipitation events. By increasing runoff and removing vegetation, disturbed areas would become more susceptible to erosion. Soil that is carried downgradient by runoff due to upslope erosion may create sedimentation issues in streams. Sedimentation would be most likely to occur during construction of stream crossings for access roads and flowlines, and at disturbance nearest streams; however, effects would remain until disturbed areas are restored to pre-construction conditions. Development of the RFD scenario also carries a risk of spills that could result in the delivery of contaminants to surface water depending on the proximity of development activities to surface water and the measures applied to address the possibility of spills reaching surface water bodies. However, as noted in the Water Support Document (BLM 2022b), only three of the 14,924 spills in 2021 (0.02%) in the Permian Basin were reported as having affected surface water.

The nominated lease parcels (3,279.49 acres collectively) fall within ten HUC-10 watersheds (Table 3.4). The nominated lease parcels do not contain any Clean Water Act 303(d) Impaired Waters. Future potential development of the nominated lease parcels would result in approximately 85.5 acres of surface disturbance (approximately 2.61% of the total nominated lease parcel acreage). This surface disturbance would result in long-term disturbance to vegetation, soils, and mineral substrate, which in turn would increase the potential for dust, runoff, salination, and sedimentation of nearby water bodies. Future potential development of the lease parcels would also result in a small, albeit present, risk of spills. For detailed discussion of risk of spills associated oil and gas development, see Section 3.2 of the Water Support Document (BLM 2022b).

Based on desktop review of the USGS's National Hydrography Dataset (NHD) and the USFWS's National Wetlands Inventory (NWI) dataset,[2] surface water features are present on six of the 19 nominated lease parcels (parcels 6132, 6795, 6797, 6798, 6799, and 6801), and surface water features are not present on the remaining 13 nominated lease parcels. Table 3.4 lists the previously mapped surface water features for nominated lease parcels 6132, 6795, 6797, 6798, 6799, and 6801. None of the nominated lease parcels contain perennial streams, artificial paths,[3] swamps/marshes, or Federal Emergency Management Agency (FEMA) Zone A mapped floodplains.[4]

Stipulation SENM-S-18-CSU (Controlled Surface Use), which states that surface disturbance will not be allowed within up to 200 m from the edge of streams, rivers, or floodplains, is applied to parcels 6132, 6795, 6798, and 6801 (see Appendix B). Stipulation SENM-S-19-CSU, which states that surface disturbance will not be allowed within up to 200 m from the edge of playa (see AIB-22 for more information regarding playas) or alkali lakes, is applied to parcels 6797, 6798, and 6799 (see Appendix B).

For further information on measures that may be required, see the Water Support Document (BLM 2022b). The NMOCD expressly prohibits pollution of any surface or subsurface fresh water from well completion activities, or treatment, transportation, and disposal of produced water, and provides management of hydraulic fracturing operations. Finally, NMAC 19.15.16 contains minimum casing and cementing standards. Site-specific mitigation tools would be developed as appropriate for the individual circumstances and could include surface water monitoring studies. For example, in the event that the process of hydraulic fracturing were to occur in an area that had potential to connect to water resources, NMAC regulations would apply to ensure that water is not contaminated during the process by requiring the operator to test the water resource before, during, and after operations.

[2] Delineation size of surface water features varies between the NHD and NWI data sets. Site-specific analysis of the nominated lease parcels would identify aquatic features and wetlands at the time of future potential development of the nominated lease parcels.

[3] Artificial paths are used to complete the stream network through NHD water bodies and NHD areas where there is no obvious channel. Isolated NHD water body features may not contain artificial paths (USGS 2019b).

[4] FEMA defines zone A floodplains as 100-year floodplains that have a 1% change of being inundated in a given year.

Table 3.4. Surface Water Feature Impact Summary

Parcel (total parcel acres)	Water Features Present in Parcel (acres or miles)*	HUC-10 Watershed (total parcel acres within each watershed; percent total watershed acreage)	Applicable Stipulations
413 (20)	No mapped surface water features	Antelope Draw (39.9; 0.02%)	-
419 (120)	No mapped surface water features	Antelope Draw (119.7; 0.05%)	-
420 (80)	No mapped surface water features	Laguna Plata (80.2; 0.05%)	-
6132 (280)	Ephemeral Streams (1.07 mile)	Delaware River-Pecos River (3.72; 0.003%); Salt Lake (280.5; 0.12%)	SENM-S-18-CSU
6751 (40.01)	No mapped surface water features	Williams Sink (40.0; 0.04%)	-
6752 (320)	No mapped surface water features	Clayton Basin (250.6; 0.16%); Pamilla Draw (70.6; 0.03%)	-
6753 (120)	No mapped surface water features	Clayton Basin (120.2; 0.08%)	-
6789 (160)	No mapped surface water features	Pamilla Draw (161.2; 0.07%)	-
6790 (240)	No mapped surface water features	Williams Sink (62.1; 0.07%); Laguna Plata (178.3;0.11%)	-
6795 (83.1)	Ephemeral streams (0.17 mile) Riverine wetland (0.41 acre [<0.01% of parcel])	Dark Canyon-Pecos River (83.2; 0.04%)	SENM-S-18-CSU
6797 (80)	Freshwater emergent wetland (2.65 acres [0.05% of parcel])	Ishee Lake (79.4; 0.04%)	SENM-S-19-CSU
6798 (320)	Lake/pond (6.2 acres [2% of parcel]) Riverine wetland (1.13 acres [0.35% of parcel]) Freshwater emergent wetland (2.15 acres [1% of parcel]) Playa (8.90 acres [2.8% of parcel])	Ishee Lake (318.3; 0.16%)	SENM-S-18-CSU; SENM-S-19-CSU
6799 (40)	Playa (1.37 acres [3.42% of parcel])	Pamilla Draw (17.32; 0.01%); Dark Canyon-Pecos River (22.6; 0.01%)	SENM-S-19-CSU
6800 (280)	No mapped surface water features	Dark Canyon-Pecos River (283.9; 0.15%)	-
6801 (640)	Ephemeral streams (2.27 miles) Connector (0.14 mile) Riverine wetland (5.67 acres [1% of parcel])	Dark Canyon-Pecos River (651.6; 0.35%)	SENM-S-18-CSU
6803 (40)	No mapped surface water features	Laguna Plata (40.0; 0.03%)	-
6804 (40)	No mapped surface water features	Laguna Plata (40.0; 0.03%)	-
6805 (320.96)	No mapped surface water features	Antelope Draw (320.7; 0.12%)	-

Parcel (total parcel acres)	**Water Features Present in Parcel (acres or miles)***	**HUC-10 Watershed (total parcel acres within each watershed; percent total watershed acreage)**	**Applicable Stipulations**
6806 (35.4)	No mapped surface water features	City of Eunice-Monument Draw (35.4; 0.01%)	-

Note: See Appendix B for summaries of stipulations and lease notices.

Previously mapped surface water features have been identified based on desktop review analysis of the USGS's NHD and the USFWS's NWI. Additional surface water features may be identified during site-specific analysis at the lease development stage, and the lessee would be required to follow applicable standard terms and conditions, as well as COAs as determined by the BLM.

* Wetlands may overlap or surround other surface water features depending on site-specific delineation. Acreage of wetlands may therefore be included in other surface water features presented in this table.

The BLM's authority to require additional protective measures, and the low level of surface disturbance relative to the total watersheds (85.5 acres of the total 10 applicable watersheds [1,900,925.01 acres, or less than 0.1% of the applicable watershed acreage]) would all serve to minimize the risk of effects on watershed hydrology and surface water quality. Should a spill occur, the BLM would work with the NMOCD to immediately remediate spills in accordance with federal and state standards, including NMAC 19.15.29.11. Per NMAC 19.15.29.11, the responsible person shall complete division-approved corrective action for releases that endanger public health or the environment in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with NMAC 19.15.30. The remaining contaminates from unrecovered spills are remediated in accordance with federal and state standards. Some remediation consists of removal of contaminated soil, replacement with uncontaminated soil, and subsequent chemical testing. See the Water Support Document (BLM 2022b) for further information on spills. Additionally, as groundwater is mostly used for oil and gas operations, surface water quantity is not expected to be impacted (see AID-3).

AIB-3 Induced Seismicity

How would future potential development of the nominated lease parcels affect the potential for induced seismicity in the Permian Basin?

Approximately 11,046,600 barrels (bbl) of produced water are projected from future potential development of the estimated 19 wells within the nominated lease parcels. Assuming a 20-year production time frame, this equates to an average of approximately 46,028 bbl of produced water per month across the nominated lease parcels. Disposal of produced water is the primary cause of anthropogenic felt earthquakes in New Mexico. However, well drilling and completion activities associated with future potential development of the nominated lease parcels are not anticipated to noticeably contribute to induced seismicity in the Permian Basin because these activities—minor in the context of existing oil and gas development in the region—will not occur in geologic areas of concern.

Produced water may be dealt with in the following ways:

- injection into enhanced oil recovery (EOR) injection wells (typically shallower wells drilled into the hydrocarbon producing zone) to enhance oil recovery in producing oil and gas wells,
- disposal in saltwater disposal (SWD) wells (typically deeper wells drilled to depths below the hydrocarbon producing zone),
- disposal in evaporation ponds, or
- reuse in the hydraulic fracturing process elsewhere.

Currently, evaporation ponds are used sparingly for disposal of produced water due to wildlife and habitat disturbance concerns. Reuse of produced water for hydraulic fracturing is also not widespread because the chemical makeup of produced water is often not compatible with hydraulic fracturing procedures. Thus, the majority of produced water ends up in EOR or SWD wells.

As of November 2022 (NMOCD 2022b, 2022c),[5] 158 active SWD wells are located within 5 miles of the nominated lease parcels. SWD wells were identified within 5 miles of the nominated lease parcels because use and disposal of produced water is likely to occur near development activity.

Table 3.5 provides a summary of produced water disposal within active SWD wells within 5 miles of nominated lease parcels in 2021. As shown in the table, a total of 4,799,505 bbl of produced water were

[5] NMOCD (2022b, 2022c) data were downloaded in November 2022 and processed to obtain a full-year 2021 dataset.

disposed into 158 active SWD wells within 5 miles of the nominated lease parcels in 2021 (NMOCD 2022c). This equates to an average of 719,752 total bbl of produced water per SWD well for 2021 (or an average of 6,983 bbl per month per well). Six of these SWD wells did not receive any produced water for disposal in 2021. For the remaining SWD wells, the minimum disposal amount in 2021 was 3 bbl (API Number 30-025-27068). The maximum disposal amount in a single SWD well (API Number 30-025-44189) in 2021 was 502,988 bbl. The median injection volume per well in 2021 was 83,798 bbl, and the median injection volume per well per month in 2021 was 6,983 bbl.

Table 3.5. Produced Water Disposal Summary

Active SWD wells within 5 miles of nominated lease parcels in 2021	158 wells
Total injection volume within those wells in 2021	4,799,505 bbl
Lowest non-zero well injection volume within those wells in 2021	3 bbl
Highest well injection volume within those wells in 2021	5,014,897 bbl
Average injection volume per well in 2021	719,752 bbl
Average injection volume per well per month in 2021	59,479 bbl
Median injection volume per well in 2021	83,798 bbl
Median injection volume per well per month in 2021	6,983 bbl
Projected total disposal volume across all 158 active SWD wells assuming 2021 total injection volume is a constant annual disposal rate over a 20-year period	14,395,040 bbl
Total produced water projected from future potential development of the nominated lease parcels	11,046,600 bbl
Percent contribution of future potential development of the nominated lease parcels to total 20-year anticipated disposal in the 158 active SWD wells	43.40%
Monthly produced water projected from future potential development of the nominated lease parcels assuming a 20-year development time frame	46,028 bbl
Total per well projected monthly injection volume (monthly volume from future potential development of the nominated lease parcels + average per well per month injection volume in 2021)	136,999 bbl
Monthly per SWD well percent increase in injection volume from future potential development of the nominated lease parcels	33.5%

Assuming constant injection rates consistent with 2021 total injection volume rates, the projected total disposal volume across all active SWD wells within 5 miles of the nominated lease parcels would be 14,395,040 bbl over a 20-year time frame. Assuming all 11,046,600 bbl of produced water estimated from future potential development of the nominated lease parcels are ultimately, over time, disposed of in the active SWD wells within 5 miles of the nominated lease parcels, it would represent 43.4% of the approximated total injection of produced water over a 20-year period. Depending on the SWD well used for disposal of produced water, the monthly average of 46,028 bbl of produced water projected as a result of future potential development of the nominated lease parcels would result in a monthly per-SWD well increase of approximately 2,423 bbl (4.1%) on top of the approximated monthly average injection volumes for these wells in 2021 (59,479 bbl in total) (see Table 3.5 above).

The risk of induced seismicity increases with long-term and high-volume injections into deep wells carried out through SWD (Ellsworth 2013). A combination of factors is necessary to induce felt earthquakes: the injection rate and total volume injected, the presence of faults that are large enough to produce felt earthquakes, stresses that are large enough to produce earthquakes, and the presence of pathways for the fluid pressure to travel from the injection point to faults (Machette et al. 2000; USGS 2021a). High injection rates of greater than 300,000 bbl per month are much more likely to be associated with earthquakes, and any earthquake within approximately 15 kilometers (km) (9.3 miles) of an active SWD well could be associated with that well (Weingarten et al. 2015). Even relatively extreme seismic

events associated with hydraulic fracturing are well below the damage threshold for modern building codes (Petersen et al. 2018; USGS 2021a).

Within the Permian Basin, an area of increased risk of induced seismicity has been identified in the Dagger Draw Field, which has had an increase in seismic events correlated with increased injection activity (Pursley et al. 2013). Between December 2012 and December 2022, approximately 53 earthquakes with a magnitude (M) of 2.5 or greater (minimum 2.5, maximum 4.0) were measured at area seismographs around the Permian Basin in New Mexico (USGS 2022). Of these 53 earthquakes, five occurred approximately 12-16 km (7-10 miles) northeast of Jal, New Mexico, ranging from M 2.5 to M 3.2 and occurring between 2021 and 2022 (USGS 2022). Over 50 SWD wells exist within 15 km (9.3 miles) of those seismicity events. None of the aforementioned SWD wells near Dagger Draw are also within 8 km (5 miles) of the nominated lease parcels (NMOCD 2022b) and therefore are not expected to undergo injection of produced water as a result of this action.

Earthquakes within or near the Dagger Draw Field (approximately 15 miles northwest of Carlsbad) are particularly notable because this is the main area of concern for induced seismicity within the Permian Basin. The Dagger Draw Field falls within the Delaware Basin portion of the Permian Basin (Snee and Zoback 2018). The New Mexico Institute of Mining and Technology catalog of earthquakes in the Dagger Draw region shows increasing seismic events with increasing injection activity (Pursley et al. 2013). A normal faulting stress field is observed throughout the Delaware Basin (Snee and Zoback 2018), giving the region a natural tendency toward seismicity. In the past, oil and gas operations have injected produced water into the basal Ellenburger carbonate reservoir, which rests unconformably on the crystalline basement (Zhang et al. 2016). In southeastern New Mexico, the Ellenburger carbonate reservoir is estimated to reside between 8,760 and 9,110 feet below ground surface and to be approximately 400 feet thick (Lloyd 1949). High-volume deep injection of wastewater fluid can bring deep formations closer to failure. Large increases in pore pressure can leave formations that rest on the crystalline basement susceptible to faulting triggers, such as additional injection activity or shock transmitted from a remote (<300 miles distant) earthquake (Herzog 2014). SWD wells typically inject into the deepest sedimentary formations (EPA 2020), where the proximity of fluid injection to basement rock makes this activity particularly capable of inducing earthquakes. Unlike the more viscous and ductile mantle, the earth's crust has a brittle structure where naturally occurring stress can accumulate (Ellsworth 2013). Currently within the Permian Basin, none of the active injection wells are injecting into the Ellenburger carbonate reservoir (NMOCD 2022b).

Since February 2020, seven felt earthquakes of M 3.5 or greater have occurred in west Texas, near the New Mexico portion of the Permian Basin (USGS 2022). These earthquakes occurred in an area of the Midland Basin from northeast Ector County to southwest Martin County known as the Gardendale Seismic Response Area (SRA) (RRC 2022). These included two earthquakes northwest of Midland (M 3.5 and 3.7) in 2021, two earthquakes northeast of Gardendale (M 3.6 and 3.7) in 2021, two earthquakes northeast of Odessa (M 3.5 and 3.6) in 2021, and one M 5.4 earthquake in Range Hill, Texas, in 2022 (USGS 2022). Additionally, between February 2020 and December 2022, 1,328 earthquakes of M 2.5 or greater were detected in western Texas within approximately 65 km (40 miles) of the New Mexico border (USGS 2022). The majority of these earthquakes occurred west of Orla, in an area known as the Northern-Culberson Reeves SRA, approximately 15 to 35 miles south of the New Mexico border. In response to increasing seismic activity in the Northern-Culberson Reeves SRA, the RRC issued an operator-led response plan in March 2022, which was subsequently updated in December 2022, and calls for reducing injection volumes to 162,000 bpd by June 30, 2023 (RRC 2022).

The projected increase of SWD within the 158 SWD wells within 5 miles of the nominated lease parcels would increase the total monthly per-well estimated average injection volume to 61,902 bbl/month, which is well below the 300,000-bbl/month level strongly associated with induced seismicity. The projected

increase of SWD within the 158 SWD wells within 5 miles of the nominated lease parcels would increase the total daily per-well estimated average injection volume to 2,063 bpd, 20.6% of the 10,000-bpd injection limit that RRC has established as a threshold of increased risk of induced seismicity.

There are no active SWD wells in the Dagger Draw Field within 5 miles of any nominated lease parcels. Therefore, the associated development is not likely to contribute to injection activity associated with increased seismicity events in the New Mexico portion of the Permian Basin.

The BLM's regulations state that "for an injection well proposed on Federal or Indian leases, the operator shall obtain an Underground Injection Control (UIC) permit pursuant to 40 CFR parts 144 and 146 from the EPA or the State/Tribe where the State/Tribe has achieved 'primacy'" (BLM 1993). The EPA classifies these wells as Class II injection wells, which are wells used for disposal of fluids associated with the production of oil and natural gas (hydrocarbons), to inject fluids for EOR, or for the storage of liquid hydrocarbons. New Mexico's UIC Program monitors and regulates the injection of fluids into the subsurface. New Mexico regulations set limits on maximum allowable injection pressures and require mechanical integrity testing of the boreholes, pressure monitoring, and reporting. All injection wells permitted by NMOCD are subject to limitations on surface-injection pressure. Wells are required to be equipped with a pressure-limiting device that ensures that the maximum surface injection pressure is not exceeded (NMOCD 2004). Compliance officers from the NMOCD periodically inspect wells and surface facilities to ensure wells and related surface equipment are in good repair and meet regulations.

Based on the New Mexico regulatory program for injection wells, the amount of produced water anticipated from future potential development of the nominated lease parcels, the volume of injection documented for injection wells within 5 miles of the nominated lease parcels, and the current risk of large-magnitude earthquakes in the Permian Basin outside of the Dagger Draw Field, leasing and future potential development of the nominated lease parcels are not expected to result in induced seismicity of M 2.5 or greater.

AIB-4 Sensitive Soils

How would future potential development of the nominated lease parcels affect fragile soils, soil stability, and/or prime and unique farmlands?

Soil movement disrupts the existing structure of the soil horizons to the depth of disturbance. Soil-forming processes are halted, and compaction of underlying horizons and loss or degradation of soil microbes may occur. These issues are compounded when fragile and/or sensitive soils are present. Fragile soils are soil types that are easily damaged by use or disturbance and/or are those that are difficult to reclaim to pre-disturbance condition. Additionally, sensitive soils may include those that have components that can be characterized as susceptible to compaction or other mechanical damage and/or are highly erodible when disturbed. Surface disturbance of fragile and/or sensitive soils occurring on increased slope profiles has the potential to affect soil stability and may lead to accelerated soil erosion and potential sedimentation to proximal water bodies (see AIB-2 for more information).

Within the BLM PDO, examples of managed fragile soils include gypsum soils (a limited and fragile soil type that is difficult to reclaim to pre-disturbance condition), biological soil crusts, active sand dunes, and those on slopes greater than 30 percent. Gypsum soils are scattered throughout the analysis area and comprise approximately 156,479 acres, or 0.78% of the 20 million-acre PDO. The potential for significant adverse effects on fragile and/or sensitive soils would depend on site-specific locations. Soil effects are generally considered long term due to the amount of time it takes for soil to be rebuilt through deposition. Approximately 1,839,549 acres of the BLM PDO are prime and unique farmlands. According to the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), prime farmlands are

considered lands that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses (NRCS 2022a). Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables (NRCS 2022a).

Reasonably foreseeable environmental trends and planned actions within the PDO would result in a total of 110,740 acres of new surface disturbance for a total of 427,740 acres of landscape-level surface disturbance. Future potential development of the nominated lease parcels would affect the physical and biological integrity of soils and prime and unique farmlands within the area of surface disturbance. Surface disturbance associated with future potential development of the nominated lease parcels (85.5 acres) would comprise 0.02% of total landscape-level surface disturbance (427,740 acres) (see Table 3.2) associated with reasonably foreseeable environmental trends and planned actions and 2.61% of the total nominated lease parcel acreage of 3,279.49 acres. These actions would result in long-term disturbance to soils and prime and unique farmlands, with related reductions of soil-forming processes and compaction of underlying horizons, and potential loss or degradation of soil microbe communities.

Sensitive soils that occur within the nominated lease sale parcels were determined based on review of NRCS soils data and BLM site-specific knowledge of the parcels (Telles 2022). Nominated lease parcels 6132 (280 acres) and 6801 (640 acres) contain 0.02 acre (0.009% of total parcel acreage) and 2.7 acres (0.4% of total parcel acreage) of mapped units with slopes greater than 30%. Nominated lease parcels 6752 (320 acres, 100% of total parcel acreage), 6753 (120 acres, 100% of total parcel acreage), and 6801 (640 acres, 43% of total parcel acreage) contain mapped units of gypsum soils. Active dune fragile soils are found within nominated lease parcels 6751 (13.90 acres, 34.8% of total parcel acreage), 6790 (29.90 acres, 12.4% of total parcel acreage), and 6803 (15.18 acres, 38% of total parcel acreage).

Additionally, prime and unique farmlands have been identified on nominated lease parcels 6795 (83.14 acres) as Reagan-Upton association, 0 to 9 percent slopes, well drained (83.14 acres, 100% of total parcel acreage); 6798 (320 acres) as Sotim fine sandy loam, well drained (2.6 acres, 0.8% of total parcel acreage), and 6800 (280 acres) as Reagan-Upton association, 0 to 9 percent slopes, well drained (158.6 acres, 57% of parcel).

Stipulation SENM-S-17-CSU is applied to nominated lease parcels 6132, 6752, 6753, 6801, 6803, and 6840 to prevent potential impacts to slopes and active dune fragile soils. This stipulation would not allow surface disturbance on slopes 30 percent or greater, and occupancy or use of fragile soils would be considered on a case-by-case basis (see Appendix B). Site-specific analysis would occur at the lease development level, and the lessee would be required to follow applicable COAs and reclamation measures as determined by the BLM to reduce impacts to or avoid sensitive soils. These may include measures such as topsoil stockpiling and pad placement in respect to topography and other factors to further mitigate effects on the physical and biological integrity of soils during the development of a lease.

AIB-5 Vegetation

How would future potential development of the nominated lease parcels affect vegetation?

Surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the 20 million-acre PDO would remove surface vegetation, altering the plant community composition, increasing potential for erosion and soil compaction, and increasing the likelihood for the introduction of noxious weeds (see AIB-6). In these arid plant communities, low rainfall (13 inches per year) combined with limited soil organic matter contributes to communities with low disturbance level thresholds and lack of resilience. Removal of vegetation may leave fragmented plant communities that would not recover to pre-disturbance levels without reclamation measures, which may take years to

achieve (BLM 2018b). Consequently, this would be a long-term effect. Vegetation resources may also be subject to increased fragmentation of vegetative types, the introduction of invasive species, and the potential for monocultures to develop. Many of the significant adverse effects on landscape vegetation density and type resulting from surface disturbances would also be long term. At the landscape level, vegetation rehabilitation efforts such as Restore New Mexico (USGS 2019) would continue to offset the impacts of surface disturbance to vegetation by plugging and reclaiming existing and active wells to their former vegetative conditions.

Reasonably foreseeable environmental trends and planned actions within the PDO would result in a total of 110,740 acres of new surface disturbance for a total of 427,740 acres of total landscape-level surface disturbance, of which the future potential development of the nominated lease parcels would compose approximately 85.5 acres (0.02% of total landscape-level surface disturbance associated with reasonably foreseeable environmental trends and planned actions, and approximately 0.0004% of the 20 million-acre PDO) (see Table 3.2). This surface disturbance may contribute to landscape-level variations in plant communities dependent on success of reclamation activities and concurrent effects of climate change.

The nominated lease parcels are within the Chihuahuan Deserts: Chihuahuan Basins and Playas Level 4 Ecoregion (6132, 6752, 6753, 6789, 6795, and 6797 through 6801), the Chihuahuan Deserts: Chihuahuan Desert Grassland Level 4 Ecoregion (413, 419, and 6795) and the High Plains: Shinnery Sands Level 4 Ecoregion (419, 420, 6751, 6790, and 6803 through 6806) (Griffith et. al 2006). Based on review of Landscape Fire and Resource Management Planning Tools (LANDFIRE) geographic information system (GIS) data, the nominated lease parcels are covered by the vegetation types listed in Table 3.6.

Table 3.6. Vegetation Types within the Nominated Lease Parcels

Land Cover Vegetation Types*	Total Area of Vegetation Type Intersected by Parcels (acres)	Parcel within Vegetation Types* (percent of parcel containing vegetation type)
Apacherian-Chihuahuan Semi-Desert Grassland	46.01	6132 (0.35%), 6751 (1.24%), 6752 (1.15%), 6789 (1.52%), 6795 (13.44%), 6798 (0.07%), 6799 (13.37%), 6800 (3.20%), 6801 (3.20%)
Apacherian-Chihuahuan Semi-Desert Shrub-Steppe	623.41	413 (6.84%), 419 (21.91%), 420 (71.55%), 6132 (3.67%), 6751 (2.53%), 6752 (3.53%), 6753 (6.06%), 6789 (4.63%), 6790 (10.73%), 6795 (0.53%), 6797 (91.45%), 6798 (17.41%), 6800 (2.50%), 6801 (3.15%), 6804 (73.56%), 6805 (83.84%), 6806 (55.34%)
Chihuahuan Creosotebush Desert Scrub	532.26	6132 (3.51%), 6752 (11.60%), 6753 (15.39%), 6789 (5.16%), 6795 (3.44%), 6797 (0.28%), 6798 (36.93%), 6799 (5.93%), 6800 (21%), 6801 (42.3%)
Chihuahuan Loamy Plains Desert Grassland†	19.06	6795 (13.53%), 6798 (0.28%), 6799 (2.23%). 6801 (0.93%)
Chihuahuan Mixed Desert and Thornscrub	803.96	413 (0.56%), 419 (0.74%), 6132 (19.48%), 6751 (5.81%), 6752 (10.02%), 6753 (18.87%), 6789 (24.30%), 6790 (12.84%), 6795 (47.27%), 6797 (1.37%), 6798 (39.51%), 6799 (73.03%), 6800 (54.93%), 6801 (40.74%), 6806 (10.04%)
Chihuahuan Mixed Salt Desert Scrub	187.20	6132 (1.80%), 6752 (14.89%), 6753 (23.70%), 6789 (12.01%), 6795 (5.56%), 6798 (2.92%), 6800 (8.76%), 6801 (7.31%)
Chihuahuan Sandy Plains Semi-Desert Grassland†	2.50	419 (1.53%), 6132 (0.23%)
Chihuahuan Succulent Desert Scrub†	1.24	6132 (0.05%), 6798 (0.35%)

Land Cover Vegetation Types*	**Total Area of Vegetation Type Intersected by Parcels (acres)**	**Parcel within Vegetation Types* (percent of parcel containing vegetation type)**
Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub	14.27	413 (22.39%), 419 (0.74%), 6132 (1.58%)
Madrean Juniper Savanna†	0.22	6801 (0.03%)
North American Warm Desert Bedrock Cliff and Outcrop†	4.20	6800 (1.48%)
North American Warm Desert Cienega†	0.44	6795 (0.53%)
North American Warm Desert Pavement†	0.44	6800 (0.16%)
North American Warm Desert Playa†	3.11	6752 (0.07%), 6789 (1.24%), 6795 (0.80%), 6800 (0.08%)
North American Warm Desert Riparian Herbaceous†	2.08	6795 (2.51%)
North American Warm Desert Riparian Mesquite Bosque Shrubland†	0.40	6795 (0.48%)
North American Warm Desert Riparian Shrubland†	0.14	6798 (0.04%)
North American Warm Desert Riparian Woodland†	0.22	6795 (0.27%)
North American Warm Desert Ruderal & Planted Grassland†	0.89	419 (0.37%), 6799 (1.11%)
North American Warm Desert Ruderal & Planted Scrub	530.73	413 (4.89%), 419 (0.89%), 6132 (67.16%), 6752 (54.83%), 6753 (33.20%), 6789 (48.90%), 6795 (8.78%), 6797 (3.02%), 6798 (0.14%), 6799 (0.42%), 6800 (9.24%), 6801 (0.85%)
Quarries-Strip Mines-Gravel Pits-Well and Wind Pads	13.50	413 (0.94%), 6752 (2.26%), 6753 (0.15%), 6790 (0.09%), 6798 (0.84%), 6801 (0.05%), 6806 (6.90%)
Western Great Plains Mesquite Shrubland	47.01	419 (0.37%), 6805 (14.31%), 6806 (1.88%)
Western Great Plains Sandhill Steppe	401.90	413 (61.22%), 419 (70.99%), 420 (25.65%), 6132 (0.31%), 6751 (86.30%), 6790 (74.82%), 6803 (96.42%), 6804 (22.26%), 6805 (0.49%), 6806 (22.03%)
Western Warm Temperate Urban Herbaceous†	2.67	6801 (0.41%)

Note: The analysis contained in this EA generally provides percentage contribution rounded to two decimal points. As such, percentages may not always sum to 100 due to rounding.

* Source: LANDFIRE geographic information system (GIS) data.

† Indicates rare and unique vegetation types. Rare and unique vegetation types are based on existing vegetation types that encompass 1% or less of the 20 million-acre analysis area (Sandbom 2020).

‡ All acreages contained in the EA analysis were calculated using geographic information system (GIS) data sets for resources and the parcels, which may differ slightly from the acreages contained in legal description here and in Table 2.1. Difference in total acres between the parcels and acres analyzed in the EA can vary slightly due to geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall effect analysis conclusions presented in this EA.

Nine nominated lease parcels (419, 6132, 6752, 6789, 6795, 6798, 6799, 6800, and 6801) contain rare and unique vegetation types (see Table 3.6). These vegetation types are categorized as rare and unique because they comprise less than 1% of present vegetation in the PDO planning area. The coverage of rare and unique vegetation types comprises less than 1% of total parcel acreage for parcels 6132 (0.28%), 6752 (0.07%), and 6798 (0.67%); less than 2% of total parcel acreage for parcels 419 (1.19%), 6789 (1.24%), 6800 (1.71%), and 6801 (1.54%); 3.34% for parcel 6799; and 18.13% for parcel 6795. Therefore, it is expected that rare and unique vegetation types are less likely to be impacted during lease development. Additionally, protections to surface water features applied to nominated lease parcels 6132, 6795, 6798, and 6801 (see AIB-2); protections to slopes and fragile soils applied to nominated lease

parcels 6132, 6752, 6753, 6801, 6803, and 6840 (see AIB-4); protections to special status plant species applied to nominated lease parcels 6132, 6752, 6789, 6795, 6799, 6800, and 6801 (see AIB-8); protections to paleontological resources applied to nominated lease parcel 6132 (see AIB-10); protections to potash resources applied to nominated lease parcels 6132 and 6752 (see AIB-12); protections to visual resources applied to nominated lease parcel 6795 (see AIB-16); protections to cave and karst resources applied to nominated lease parcels 6132, 6752, 6789, 6795, 6798, 6799, 6800, and 6801 (see AIB-21); protections to playa wetlands applied to nominated lease parcels 6798 and 6799 (see AIB-22), and protections to LPC applied to nominated lease parcel 419 (see AID-4) may provide protections to rare and unique vegetation types found on the nominated lease parcel where the resources and features.

In the event that all surface disturbance associated with development of nominated lease parcels 419, 6132, 6752, 6789, 6795, 6798, 6799, 6800, and 6801 were to occur in a single common vegetation type, the level of estimated disturbance (40.5 acres collectively) would not result in a substantial change to the overall characteristics or availability of the said vegetation type across the analysis area. This surface disturbance may contribute to landscape-level variations in plant communities dependent on success of reclamation activities and concurrent effects of climate change, such as warmer temperatures, changes in rainfall and runoff, and the resulting shifts in vegetation communities. Note that the time frame for successful reclamation would vary by vegetation type and other factors such as the amount and timing of annual precipitation. Thus, the estimated level of disturbance would not pose a threat to the viability of species composing these communities or ecoregions, nor to any species utilizing common vegetation for habitat.

Standard lease terms and conditions provide the BLM with the authority to determine site-specific vegetation management strategies, including relocating wells up to 656 feet (200 m), at the lease development stage for any future actions within the lease parcels to determine whether effects on rare and unique or otherwise sensitive vegetation would occur. Under standard terms and conditions, which would apply to the nominated lease parcels, pre-disturbance surveys would be required at the time of the proposed lease development. The surveys would identify occurrence of rare or unique vegetation types, special status plant species, and/or vegetation providing habitat for special status wildlife species for avoidance during project siting and construction (see AIB-8 for more information). Avoidance, minimization, and/or mitigation measures would also be determined at that time.

AIB-6 Invasive Species (Noxious Weeds)

How would future potential development of the nominated lease parcels affect the introduction and/or spread of noxious weeds and invasive plants?

The 20 million-acre PDO has experienced an increase in noxious weed/invasive plant populations in recent years, and there appears to be a direct correlation between development and associated disturbed areas and the establishment and spread of noxious and/or invasive plants. African rue (*Peganum harmala*), a perennial deep-rooted noxious weed, has proven especially difficult to control because it colonizes every soil type and easily outcompetes native plants for soil nutrients and available water (BLM 2018b).

Invasive and noxious weeds invade disturbed sites, spread into adjacent areas, compete with and potentially displace native vegetation, and can contribute to the degradation of soil health by overutilizing soil nutrients. Surface disturbance, construction equipment, and source materials brought on-site (e.g., caliche, gravel) associated with reasonably foreseeable environmental trends and planned actions within the PDO (427,740 acres of surface disturbance) would likely increase the spread and density of invasive plants and noxious weeds over the long term. Additionally, livestock grazing may potentially spread noxious, invasive, or non-native species through equipment, feed products, and on livestock

themselves (BLM 2018b). On a landscape level, the Carlsbad and Chaves Soil and Water Conservation Districts have operated a joint county venture (Chaves, Eddy, and Lea Counties) to target certain species for eradication (Chaves Soil and Water Conservation District 2019; USGS 2019).

Reasonably foreseeable environmental trends and planned actions within the PDO would result in a total of 110,740 acres of new surface disturbance for a total of 427,740 acres of total landscape-level surface disturbance, of which the future potential development of the nominated lease parcels would comprise approximately 85.5 acres (0.02% of total landscape-level surface disturbance; see Table 3.2). This would also result in a concomitant increase in risk of establishment of noxious weeds. All disturbed acreage would be vulnerable to the long-term establishment and spread of noxious weeds/invasive plants until successful reclamation. A review of the BLM PDO spatial data of known noxious weed treatment acres concluded that there are known noxious weed occurrences of African rue within nominated lease parcels 6752, 6753, and 6789.

Within the BLM PDO, there are ongoing efforts to reduce the presence and spread of these unwanted species by way of prevention and treatment. The most common treatment method is the application of herbicides. In general, the effectiveness of treatments is variable depending on location, species, treatment type, timing of treatment, and size of population. If noxious weeds are discovered at any time during future potential development, standard lease terms and conditions hold the operator responsible for weed treatment and prevention activities, such as herbicide application and washing vehicles coming from areas with known weed populations.

Reclamation is intended to restore previously disturbed sites to a properly functioning natural ecological state. The effectiveness of reclamation efforts varies based upon a number of factors such as soil type, precipitation, herbicide treatments, and additional disturbance. Once physical reclamation of the site has taken place, seeding of native species is intended to reestablish the native plant community and protect the disturbed area from potential establishment of noxious weeds. While reclamation has been shown to increase and restore the health of disturbed sites, the complete eradication of noxious weed species is challenging, and initiation of large-scale control efforts is not feasible at this time (BLM 2018b).

Together with the standard lease terms and conditions, site-specific approval requirements that require permit holders to treat weeds help to offset the effects of development by limiting the spread of noxious weeds across Chaves, Eddy, and Lea Counties and contributes to controlling the spread on a landscape level. Some of the significant adverse effects from development remain, including potential introduction of new species. These remaining effects would be long term if full eradication of certain introduced species is not achieved.

AIB-7 Threatened and Endangered Species

How would future potential development of the nominated lease parcels affect threatened and endangered (T&E) species?

Analysis of potential for occurrence of ESA-listed threatened and endangered species within the 20 million-acre BLM PDO was conducted through desktop review of the best available data to assess the potential for habitat to be present within the nominated lease parcels coinciding with known habitat requirements of the species listed in Table 3.7. Desktop analysis included review of LANDFIRE vegetation data, NHD data (see AIB-2 for further information), USFWS NWI data, USFWS descriptions of species habitat requirements and current mapped critical habitat (USFWS 2021a), and BLM-mapped potential habitat for special status plant species. Surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the PDO (427,740 acres of surface disturbance) may reduce suitable habitat and increase fragmentation, which could affect ESA-listed

species occurring within the planning area, including those listed in Table 3.7. At the landscape level, implementation of land restoration and conservation activities listed in Section 3.3.2 would continue to help offset the impacts of surface disturbance on habitats and may result in beneficial impacts to habitat dependent on the site-specific success of restoration activities and concurrent effects of climate change.

Table 3.7. USFWS IPaC System ESA-listed Threatened and Endangered Species with Suitable Habitat on or in the Vicinity of the Nominated Lease Parcels

Species (*Scientific Name*) (Status)*	Suitable Habitat within Nominated Lease Parcels	Discussion†, ‡
Birds		
Piping plover (*Charadrius melodus*) (T)	6132, 6795, 6797, 6798, 6799, and 6801	The nominated lease parcels are outside of critical habitat for this species (USFWS 2022a, 2022b). Surface water features have been identified within nominated lease parcels 6132, 6795, 6797, 6798, and 6801 (see AIB-2). Additionally, playa features have been identified on nominated lease parcels 6797, 6798, and 6799 (see AIB-22), which, along with the surface water features, may provide wetland and shoreline habitat for this species.
Southwestern willow flycatcher (*Empidonax traillii extimus*) (T)	6132, 6795, 6797, 6798, 6799, and 6801	The nominated lease parcels are outside of critical habitat for this species (USFWS 2022a, 2022b). Surface water features have been identified within nominated lease parcels 6132, 6795, 6797, 6798, and 6801 (see AIB-2). Additionally, playa features have been identified on nominated lease parcels 6797, 6798, and 6799 (see AIB-22), which, along with the surface water features, may provide riparian habitat for this species.
Plants		
Pecos sunflower (*Helianthus paradoxus*) (T)	6132, 6795, 6797, 6798, 6799, and 6801	The nominated lease parcels are outside of critical habitat for this species (USFWS 2022a, 2022b). Surface water features have been identified within nominated lease parcels 6132, 6795, 6798, and 6801 (see AIB-2). Additionally, playa features have been identified on nominated lease parcels 6797, 6798, and 6799 (see AIB-22), which, along with the surface water features, may provide wetland habitat for this species.
Wright's marsh thistle (*Cirsium wrightii*) (C)	6132, 6795, 6797, 6798, 6799, and 6801	The nominated lease parcels are outside of critical habitat for this species (USFWS 2022a, 2022b). Surface water features have been identified within nominated lease parcels 6132, 6795, 6797, 6798, and 6801 (see AIB-2). Additionally, playa features have been identified on nominated lease parcels 6797, 6798, and 6799 (see AIB-22), which, along with the surface water features, may provide wetland habitat for this species.

*C = Candidate species undergoing USFWS review; E = Endangered; EX = Experimental Population, Non-Essential; T = Threatened

† The nominated lease parcels are not within species-specific critical habitat.

‡ See Appendix B for summaries of stipulations and lease notices.

According to the USFWS Information for Planning and Consultation (IPaC) system (USFWS 2022a, 2022b, 2022c), 13 species were evaluated for the potential to occur within the nominated lease parcels—four bird species: Mexican spotted owl (*Strix occidentalis lucida*), northern aplomado falcon (*Falco femoralis septentrionalis*), piping plover (*Charadrius melodus*), and southwestern willow flycatcher (*Empidonax traillii extimus*); two fish species: Pecos bluntnose shiner (*Notropis simus pecosensis*) and Pecos gambusia (*Gambusia nobilis*); one clam species: Texas hornshell (*Popenaias* popeii); one insect species: monarch butterfly (*Danaus plexippus*); and five plant species: gypsum wild buckwheat (*Eriogonum gypsophilum*), Lee's pincushion cactus (*Coryphantha sneedii* var. *leei*), Pecos sunflower (*Helianthus paradoxus*), Sneed's pincushion cactus (*Coryphantha sneedii* var. *sneedii*), and Wright's marsh thistle (*Cirsium wrightii*). The nominated lease parcels are outside of critical habitat for these species. See Section 4.1 for additional information.

Four ESA-listed species were determined to have the potential to occur within six of the nominated lease parcels based on present suitable habitat and species distribution information (see Table 3.7).

According to stipulation HQ-TES-1, which is applied to the nominated lease parcels, the BLM would not approve any ground-disturbing activity that may affect species or critical habitat until it completes its obligations under applicable requirements of the ESA. In addition, the BLM may require modifications to or disapprove a proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species, or result in the destruction or adverse modification of a designated or proposed critical habitat (see Table 2.1 and Appendix B). Section 4.1 further discusses how the Proposed Action would comply with threatened and endangered species management guidelines outlined in the 1988 CFO RMP (BLM 1988), as amended in 1997 (BLM 1997a), and the 2008 BLM PDO Special Status Species RMPA (BLM 2008a), as well as ESA Section 7 consultation requirements.

Stipulation SENM-S-18-CSU (preventing surface disturbance within up to 200 m from the edge of streams, rivers, or floodplains; see Appendix B) is applied to nominated lease parcels 6132, 6795, 6798, and 6801, and stipulation SENM-S-19-CSU (preventing surface disturbance within 200 m of playa features; see Appendix B) is applied to nominated lease parcels 6797, 6798, and 6799, which may provide secondary protections to associated potential habitat for piping plover, southwestern willow flycatcher, Pecos sunflower, and Wright's marsh thistle. Standard terms and conditions also provide the BLM with the authority to move future potential development to avoid surface water features and playas within any lease; this, in turn, protects shoreline habitat that may be utilized by piping plover, southwestern willow flycatcher, Pecos sunflower and Wright's marsh thistle.

Nominated lease parcels 6132, 6795, 6797, 6798, 6799, and 6801 contain suitable habitat for ESA-listed riparian obligate species. Based on review of aerial imagery, the present habitat is marginally suitable but lacks the presence of perennial wetland and shoreline habitat, which are more common characteristics of habitat occupied by these species. Therefore, the likelihood of adverse impacts to or removal of available habitat by development of nominated lease parcels 6132, 6795, 6797, 6798, 6799, and 6801 is relatively low. Additionally, future potential development is not anticipated to create short- or long-term significant adverse effects for the following reasons: 1) stipulations and lease notices facilitate the reduction or avoidance of effects, 2) site-specific analysis at the lease development stage provides an additional opportunity to evaluate effects and develop measures to reduce or avoid effects, and 3) the standard lease terms and conditions that apply to the nominated lease parcels provide the BLM with the authority to require reasonable measures that reduce or avoid effects. However, as discussed in Section 3.6.2, the GHG emissions resulting from future potential development of the lease sale parcels would incrementally contribute to national and global climate change projections.

The BLM continues to review the available climate science in connection with its statutory responsibilities, including under NEPA, and has found that despite advances in climate science, "global climate models are unable to forecast local or regional effects on resources as a result of specific emissions." Any contribution to global climate processes from the issuance of leases is simply too remote, speculative, and undetectable to trigger ESA Section 7 consultation, given accumulated and persisting GHG already in the atmosphere, the annual volume of GHG emissions that will occur globally regardless of additional lease issuance, and projected continued climate change. See, for example, the BLM 2021 Annual GHG Report (finding that, "[u]nlike other common air pollutants, the ecological impacts that are attributable to the GHGs are not the result of localized or even regional emissions but are entirely dependent on the collective behavior and emissions of the world's societies"; and noting "the lack of climate analysis tools and techniques that lend themselves to describing the physical climate or earth system responses, such as changes to sea level, average surface temperatures, or regional precipitation rates, that could be attributable to emissions associated with any single [land management] action or decision" [BLM 2022c:18, 65]); see also USFWS, Threatened Species Status for Emperor Penguin With Section 4(d) Rule, 87 Federal Register 64,700, 64,704 (October 26, 2022) ("based on the best scientific data available we are unable to draw a causal link between the effects of specific GHG emissions and take of the emperor penguin in order to promulgate more specific regulations under [ESA Section] 4(d)").

AIB-8 Sensitive Species

How would future potential development of the nominated lease parcels affect sensitive species?

Analysis of potential for occurrence of sensitive species within the 20 million-acre BLM PDO was conducted in a desktop review format utilizing best available data to assess the potential for habitat to be present within the nominated lease parcels coinciding with known habitat requirements of the sensitive species. Desktop analysis included review of LANDFIRE vegetation data (see AIB-5), NHD (see AIB-2), published descriptions of species habitat requirements (BLM 2008), and USFWS-mapped critical habitat.

Surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the PDO (110,740 acres of new surface disturbance for a total of 427,740 acres of total landscape-level surface disturbance) is not anticipated to create significant adverse effects. Depending on the proximity of ground disturbance and development activity to sensitive species habitat and/or populations, there may be short-term effects (i.e., temporary displacement from habitat due to noise and construction) or long-term effects on sensitive species and the ecological processes that sustain them related to changes in the following habitat conditions: ground cover, soil nutrient flows and processes, hydrological flows and processes, solar exposure, thermal cover, fugitive dust loads, non-native species dispersal, habitat connectivity, noise levels and human activity, light pollution, forage availability, and pollinator and dispersal agents' visitation behaviors; these include both direct and indirect impacts. If detected and avoided, actual impacts to special status plant species would be less than the potential effects estimated in this analysis. It is not certain that detected occupied habitat could be avoided, given valid existing lease rights and other resource conflicts in the vicinity of proposed development locations. However, methods to minimize impacts to sensitive species and habitats would be applied for foreseeable environmental trends and planned actions whenever applicable and consistent with valid existing lease rights. Effects may also be lower than the estimated potential when single pads host multiple wells. The remaining surface disturbance across the landscape would contribute to additional potential for habitat loss and fragmentation that could affect sensitive species. At the landscape level, implementation of land restoration and conservation activities listed in Section 3.3.2 would continue to offset the effects of surface disturbance on habitats and may result in beneficial impacts to habitat dependent on the success of restoration activities and concurrent effects of climate change.

As described in AIB-7, the BLM continues to review the available climate science in connection with its statutory responsibilities, including under NEPA, and has found that despite advances in climate science, global climate models are unable to forecast local or regional effects on resources as a result of specific emissions(such as emissions resulting from the future potential development of the nominated lease sale parcels)given accumulated and persisting GHGs already in the atmosphere, the annual volume of GHG emissions that will occur globally regardless of additional lease issuance, and projected continued climate change.

The BLM has identified potential habitat within the 19 nominated lease parcels for 13 sensitive species (Table 3.8); therefore, sensitive species have the potential to occur within the 19 nominated lease parcels. No additional sensitive species are known to occur on, or in the vicinity of, the nominated lease parcels, though parcel-specific data are limited. Site selection of the 85.5 acres of potential surface disturbance associated with the development of the nominated lease parcels would occur after pre-disturbance biological surveys and additional analysis and disclosure of potential effects on sensitive species at the time of lease development. For more information regarding general wildlife, including game species and the New Mexico State Wildlife Action Plan, see AIB-15. Detailed analysis of potential impacts to the DSL and LPC and/or their habitats can be found in Section 3.6.4.

Table 3.8. Potential Sensitive Species Habitat within Nominated Lease Parcels

Species (*Scientific Name; status*)	**Potential Habitat**	**Parcel Number**	**Discussion**
Birds			
Baird's sparrow (*Ammodramus bairdii; sensitive**)	Y	419, 6751, 6752, 6789, 6795, 6797, 6799, 6801	This species is a winter resident in New Mexico. It generally prefers dense, extensive grasslands with few shrubs, and avoids heavily grazed areas. The nominated lease parcels contain semi-desert grassland habitat, which may indicate potential habitat for this species (see AIB-5).
Bald eagle (*Haliaeetus leucocephalus; unknown*)	Y	419, 6751, 6805, 6806	This species occurs in New Mexico year-round. Breeding is restricted to a few areas mainly in the northern part of the state along or near lakes. In migration and during winter months, the species is found chiefly along or near rivers and streams and in grasslands associated with large prairie dog (*Cynomys* sp.) colonies. Typically perches in trees. The nominated lease parcels contain potential prairie dog habitat, which indicates potential foraging habitat for bald eagles (see AIB-5).
Chestnut-collared longspur (*Calcarius ornatus; sensitive**)	Y	419, 6751, 6752, 6789, 6795, 6797, 6799, 6801	This species migrates and winters in the eastern part of New Mexico and migrates westward locally to the vicinity of the Rio Grande valley, and occasionally farther in the Southwest. This species is considered uncommon to abundant and is most numerous in the southernmost area of the Rio Grande valley and is regular in the Mogollon Plateau (Hubbard 1978). Chestnut-collared longspurs were often seen within, or in association with, open grassland habitats. The sites that were used most often were dominated by desert saltgrass (*Distichlis spicata*), with occasional clumps of fourwing saltbush (*Atriplex canescens*) interspersed. Adjacent sites having an even greater shrub component were also occasionally used (Baltosser 1991). The nominated lease parcels contain semi-desert grassland habitat, which may indicate potential habitat for this species (see AIB-5).
McCown's longspur (*Calcarius mccownii; sensitive**)	Y	413, 419, 420, 6132, 6751, 6752, 6753, 6789, 6790, 6795, 6797, 6798, 6800, 6801, 6803, 6804, 6805, 6806	This species is found in Sonoran desert scrub, Chihuahuan desert scrub, annual grassland, farms, and mountain and alpine meadows. It is associated with open to dense vegetation of shrubs, low trees, and succulents, dominated by paloverde (*Cercidium microphyllum*), pricklypear (*Opuntia* sp.), and giant saguaro (*Cereus giganteus*) (DeGraaf et al. 1991). The nominated lease parcels contain Chihuahuan desert scrub and semi-desert grassland habitat, which may indicate potential habitat for this species (see AIB-5).
Sprague's pipit (*Anthus spragueii; sensitive**)	Y	419, 6751, 6752, 6789, 6795, 6797, 6799, 6801	This species occurs in New Mexico only as a sporadic winter resident. It is associated with southern desert grasslands of the state. The species as a whole prefers dry, open grasslands. The nominated lease parcels contain semi-desert grassland habitat, which may indicate potential habitat for this species (see AIB-5).
Western burrowing owl (*Athene cunicularia hypugaea; sensitive**)	Y	419, 6751	This species is found in grasslands, especially in association with prairie dog colonies, in desert scrub, and in agricultural and semi-urban environments. The nominated lease parcels contain several suitable vegetation communities as well as potential habitat for black-tailed prairie dog (*Cynomys ludovicianus*), which may indicate potential habitat for this species (see AIB-5).
Mammals			
Black-tailed prairie dog (*Cynomys ludovicianus arizonensis; sensitive**)	Y	419, 6751, 6752, 6789, 6795, 6797, 6799, 6801, 6805, 6806	This species prefers grasslands, including short- and mixed-grass prairie, sagebrush steppe, and desert grasslands. It is also known to occur in mesquite–creosote bush, grama–needlegrass, tarbush–creosote bush, and burrograss–cholla type habitats. The nominated lease parcels contain several suitable vegetation communities, which may indicate potential habitat for this species (see AIB-5).

Species (*Scientific Name; status*)	**Potential Habitat**	**Parcel Number**	**Discussion**
Least shrew (*Cryptotis parva; watch**)	Y	6795, 6798, 6801	In New Mexico, this species is found in mesic grassland and wetland habitats characterized by dense grass cover, often along the borders of streams or lakes within otherwise relatively arid habitats. Most active at night. Vulnerable to habitat loss from drought, water diversion, agriculture, and grazing. The nominated lease parcels contain riverine wetlands, which may indicate potential habitat for this species (see AIB-2).
Reptiles and Amphibians			
Desert massasauga (*Sistrurus tergeminus; sensitive**)	Y	419, 6751, 6752, 6789, 6795, 6797, 6799, 6801, 6803	This species primarily inhabits desert grasslands or shortgrass prairies with sandy soil in valleys, on low sloping alluvial fans, and on rolling grass-covered hills within semidesert grassland habitats. The nominated lease parcels contain semi-desert grassland habitat, which may indicate potential habitat for this species (see AIB-5).
Plain-bellied water snake (*Nerodia erythrogaster; unknown*)	Y	6801	In New Mexico, this snake is known only from the lower Pecos Valley area (Eddy County), including along the Black River. The plain-bellied water snake is a highly aquatic species, swimming and diving with ease, and seeking prey in water. Normally confined to areas of permanent water, it may wander short distances inland, especially in wet weather. The preferred habitat is ponds and streams, the latter including fairly large rivers. This snake often hides under rocks or other objects during the day and becomes active at night. The young tend to occupy areas of shallower, more dappled water than the adults, including in inlets of small streams. The nominated lease parcels contain streams with connectivity to the Pecos River, which may indicate potential habitat for this species (see AIB-2).
Plants			
Scheer's beehive cactus (*Coryphantha robustispina* ssp. *scheeri; sensitive†)*	Y	6132, 6752, 6753, 6789, 6795, 6799, 6800, 6801	This species is typically associated with gravelly or silty soil in desert grassland and Chihuahuan desert scrub communities. May also be found on rocky benches or bajadas on limestone or gypsum soils; the elevation range of this cactus is 3,300–3,600 feet amsl. The nominated lease parcels contain semi-desert grassland habitat and Chihuahuan desert scrub communities, as well as gypsum soils, which may indicate potential habitat for this species (see AIB-5). Additionally, the nominated lease parcels are within the BLM-mapped potential habitat for this species.
Tharp's blue-star (*Amsonia tharpii; sensitive†*)	Y	6795, 6800, 6801	The species occurs in well-drained gypsum, caliche, and dolomite sedimentary outcrops and alluvium deposits between 3,000 and 3,800 feet amsl. The species' range occurs within Eddy County, New Mexico, and Pecos County, Texas. The nominated lease parcels contain gypsum soils, which may indicate potential habitat for this species (see AIB-5).
Wright's waterwillow (*Justicia wrightii; sensitive†*)	Y	6132, 6795, 6800	This species is found on limestone benches in Chihuahuan desert scrub at 3,900 feet amsl. The nominated lease parcels are within the BLM-mapped potential habitat for this species.

* Source: BLM (2018c).

† Source: BLM (2019).

The BLM has applied stipulation SENM-S-18-CSU (streams, rivers, and floodplains) to parcels 6132, 6795, 6798, and 6801 (see Appendices A and B), which may provide protections to sensitives species that utilize this habitat. The BLM has also applied stipulation SENM-S-19-CSU (playas and alkali lakes) to parcels 6797, 6798, and 6799 (see Appendices A and B), which may provide protections to sensitives species that use this habitat. Standard terms and conditions would apply to all nominated lease parcels, including a requirement of pre-disturbance surveys at the time of proposed lease development. The surveys would identify occurrences of special status plant species and special status wildlife habitat for avoidance during project siting and construction. The BLM would conduct site-specific evaluations at the lease development stage for any reasonably foreseeable environmental trends and planned actions within the lease parcels to determine whether effects on sensitive species would occur. Avoidance, minimization, and/or mitigation measures would also be determined at that time. The BLM is working with other land management agencies to restrict and manage development through establishment of management protocols to identify and map potential and occupied habitat requiring species-specific inventories and studies, as well other requirements, ahead of locating well pads and infrastructure.

AIB-9 Migratory Birds

How would future potential development of the nominated lease parcels affect migratory birds?

Habitat fragmentation, alteration, and/or loss within the 20 million-acre PDO has changed how birds move through landscapes and use the remaining habitat. Loss, alteration, or fragmentation of habitat are among the main reasons why biodiversity is decreasing in many places worldwide (Taylor and Stutchbury 2016). The primary drivers of habitat loss and fragmentation within this area are oil and gas development, livestock grazing, and mining (see Table 3.2).

Reasonably foreseeable environmental trends and planned actions within the 20 million-acre PDO would result in a total of 110,740 acres of new surface disturbance (0.55% of the 20 million-acre PDO), for a total of 427,740 acres of total landscape-level surface disturbance (2.14% of the 20 million-acre PDO) (see Table 3.2). This landscape-level disturbance would further contribute to migratory bird habitat loss and fragmentation. Additionally, land restoration and conservation projects (outlined in Section 3.3) have improved habitat, in which migratory birds have benefitted from the improved herbaceous cover associated with these activities. Future restoration projects would likely produce similar effects where they are implemented.

Habitat loss, alteration, or fragmentation that occurs outside of the PDO can also contribute to population declines in respective migratory bird populations within PDO. Taylor and Stutchbury (2016) state “that habitat loss in one region can effect sub-populations in regions that are not directly connected.” Habitat loss on wintering grounds south of the United States–Mexico border, as well as local drought conditions, can contribute to population declines in migratory birds that occur within the PDO. This regional habitat continues to provide for the life cycles of these birds notwithstanding known drivers of habitat loss as described above.

Most of the effects associated with reasonably foreseeable environmental trends and planned actions within the PDO would occur at the initial stages of lease development. These disturbances include construction and drilling, human presence, traffic, heavy equipment, and noise associated with lease development activities. Bird species not tolerant of noise and human disturbance may exhibit vigilance or flight behaviors, or abandon the area altogether for the duration of construction; this is especially true in areas with high densities of development (New Mexico Department of Game and Fish [NMDGF] 2016). Habitat loss effects would be long term, and in some cases, reclamation would not fully rehabilitate migratory bird habitat to pre-development conditions. For more information regarding general wildlife, including game species, and the New Mexico State Wildlife Action Plan, see AIB-15.

Nominated lease parcels 413, 419, 420, 6751, 6790, and 6803 through 6806 fall within the North American Bird Conservation Initiative Bird Conservation Region (BCR) 18 (Shortgrass Prairie), and nominated lease parcels 6132, 6752, 6753, 6789, 6795, and 6797 through 6801 fall within BCR 35 (Chihuahuan Desert) (Partners in Flight 2021; USFWS 2022a, 2022b, 2022c). The New Mexico Avian Conservation Partners developed two species conservation lists of the highest conservation concern in New Mexico (Level 1 and Level 2) based on distribution, threats, global population size, New Mexico population trend, and importance of New Mexico to breeding or wintering (New Mexico Avian Conservation Partners 2016; Partners in Flight 2021). Some of the continent's highest-priority birds of conservation concern breed in BCR 18 and include the mountain plover (*Charadrius montanus*), long-billed curlew (*Numenius americanu*s), ferruginous hawk (*Buteo regalis*), and LPC (New Mexico Avian Conservation Partners 2016). Playa lakes habitat consists of numerous shallow wetlands that support many wintering ducks, migrant shorebirds, and some breeding species, such as snowy plover (*Charadrius nivosus*) (New Mexico Avian Conservation Partners 2016). Species of highest conservation concern found in BCR 35, which require desert scrub and grassland habitats, include aplomado falcon, prairie falcon (*Falco mexicanus*), scaled quail (*Callipepla squamata*), Bendire's thrasher (*Toxostoma bendirei*), wintering Sprague's pipit (*Anthus spragueii*), and wintering McCown's longspur (*Calcarius mccownii*) (New Mexico Avian Conservation Partners 2016). In riparian areas, species of highest concern include southwestern willow flycatcher, Bell's vireo (*Vireo bellii*), and Lucy's warbler (*Oreothlypis luciae*) (New Mexico Avian Conservation Partners 2016).

Future potential development of the nominated lease parcels would result in approximately 85.5 acres of total surface disturbance (0.02% of total landscape-level surface disturbance; 427,740 acres). Future potential development of nominated lease parcels 413, 419, 420, 6751, 6790, and 6803 through 6806 would result in 40.5 acres (0.00004%) of surface disturbance for BCR 18 (95,063,465.03 acres), and future potential development of nominated lease parcels 6132, 6752, 6753, 6789, 6795, and 6797 through 6801 would result in 31.5 acres (0.00002%) of surface disturbance for BCR 35 (141,738,865.81 acres). This surface disturbance could result in long-term habitat loss and fragmentation, depending on the proximity of disturbance to migratory bird habitat.

Stipulation SENM-S-18-CSU, which provides protections for streams, rivers, and floodplains (see AIB-2), is applied to nominated lease parcels 6132, 6795, 6798, and 6801; stipulation SENM-S-19-CSU, which provides protections to playa features (see AIB-22), is applied to nominated lease parcels 6797, 6798, and 6799. These stipulation may also provide protections to migratory birds on the associated nominated lease parcels.

Compliance with the Migratory Bird Treaty Act would be required for any future potential developments and would follow the BLM PDO Migratory Bird Policy, which could include timing limitation constraints on developments within the nominated lease parcels during migration and nesting seasons, or requirements for netting over open water containing fluids that are harmful to migratory birds. The BLM applies measures to mitigate effects on migratory birds at the leasing stage. Developmental constraints during spring and fall migrations and nesting seasons, as well as nest surveys, may be required prior to implementation of lease development activities. Some of these include the application of netting over open tanks, raptor-safe power line construction standards, and sound mufflers. In addition, the BLM may require avoidance of active avian nests and burrows or delays of development activities to accommodate migratory birds.

AIB-10 Paleontological Resources

How would future potential development of the nominated lease parcels affect paleontological resources?

The Potential Fossil Yield Classification (PFYC) is a tool that allows the 20 million-acre BLM PDO to predict the likelihood of a geologic unit to contain paleontological resources. The PFYC is based on a numeric system of 1–5. An area identified as PFYC 1 has very low likelihood of containing paleontological resources, whereas an area identified as PFYC 5 is a geologic unit that has a very high likelihood to contain scientifically significant paleontological resources. Within areas identified as PFYC 2 or 3, paleontological resource management concern is generally low to moderate because the likelihood of encountering scientifically significant fossils is relatively low to moderate. Within areas identified as PFYC 4, paleontological resource management concerns are moderate to high, as the probability of affecting scientifically significant paleontological resources is generally moderate to high.

Surface disturbance and risk of effects on paleontological resources associated with reasonably foreseeable environmental trends and planned actions within the PDO (110,740 acres of new surface disturbance, added to 317,000 acres of previous surface disturbance for a total of 427,740 acres of total landscape-level surface disturbance; see Table 3.2) would depend on the locations of proposed disturbance relative to PFYC class. As currently mapped, nearly the entire PDO analysis area is PFYC 2 and 3, and there are no PFYC 5 areas identified in the area. As such, the risk would be low to moderate, and the same measures for minimizing effects at the site-specific level as described above would be followed for resources associated with reasonably foreseeable environmental trends. Effects would result in the immediate physical loss of fossils and their contextual data. Ground disturbance could also subject fossils to long-term damage or destruction from erosion and create improved access to the public and increased visibility, potentially resulting in unauthorized collection or vandalism. Ground disturbance can also reveal scientifically significant fossils that would otherwise remain buried and unavailable for scientific study. Such fossils can be collected properly and curated into the museum collection of a qualified repository, making them available for scientific study and education. Future potential development of the nominated lease parcels would be analyzed further through separate NEPA processes, as directed by regulations and current policy.

Utilizing currently available geological mapping at 1:500,000 scale, the BLM has determined that all 19 of the nominated lease parcels are in areas of mapped geologic units with PFYC 2 designation (Table 3.9). Fifteen of the nominated lease parcels are in areas mapped as Quaternary piedmont deposits with a PFYC 2 designation. However, spread throughout the PDO are smaller outcrops of late-Pleistocene deposits associated with ancient lakes that have produced scientifically important paleontological resources, such as the Hackberry Lake fossil area located between the nominated parcels and the Jal fossil area to the southeast (Morgan and Harris 2015). At this scale, many of these smaller outcrops that do contain scientifically important fossils are not represented in the map data. With refined geologic mapping, these smaller outcrops, which are often partially covered by younger eolian dunes, would be assigned a PFYC 4 or U (unknown). Additionally, refined geologic mapping of the area near lease parcel 6132 includes the Pleistocene-age Gatuña Formation (PFYC 3) and unnamed Pleistocene-age spring deposits that have produced scientifically important paleontological resources including horse and camel bones in the Nash Draw area (PFYC 4 or U) (Bachman 1981; Morgan and Harris 2015; Powers and Holt 1993).

Table 3.9. Geologic Units and PFYC Designations of the Nominated Lease Parcels

Mapped Geologic Unit	PFYC Class	Parcel number: acres of PFYC class (percent of total parcel acreage)	Total Acres of Geologic Unit within Parcels	Estimated Acres of Surface Disturbance
Quaternary alluvium	Class 2	6797: 80 (100%) 6798: 243.99 (77%)	79.43	7.95
Quaternary eolian deposits	Class 2	6789: 82.66 (51%)	82.66	2.31
Quaternary older alluvial deposits and piedmont	Class 2	6799: 40 (100%)	39.92	4.50
Quaternary Piedmont deposits	Class 2; may contain localized unmapped areas of PFYC Class 4 or U (unknown)	413: 40 (101%) 419: 120 (100%) 420: 80 (100%) 6132: 280 (100%) 6751: 40.01 (100%) 6752: 320 (100%) 6753: 120 (100%) 6789: 78.58 (49%) 6790: 240 (100%) 6795: 83.14 (100%) 6803: 40 (100%) 6804: 40 (100%) 6805: 320.96 (100%) 6806: 35.38 (100%)	1,843.5	60.69
Permian Rustler Formation	Class 2	6798: 74.34 (23%)	74.34	1.05
Permian Yates and Tansill Formations	Class 2	6800: 280 (100%) 6801: 640 (100%)	935.47	9.00

There are no known paleontological localities within the nominated lease parcels. However, three lease parcels (6790, 6803, and 6804) are within 8 miles of the important Hackberry Lake fossil area, and while these lease parcels are mapped as PFYC Class 2 Quaternary pediment deposits, they could contain deposits similar to those containing fossils at Hackberry Lake or Jal. Additionally, one parcel (6132) is approximately 10 miles south of the Nash Draw spring locality (Bachman 1981; Morgan and Harris 2015). There are exposures in the southern portion of this parcel (6132) that may contain the Gatuña Formation, as well as the Rustler Formation. Future potential development of all nominated lease parcels would result in up to 85.50 acres of surface disturbance, 18 acres of which would occur within the four nominated parcels (6132, 6790, 6803, and 6804) with higher potential for paleontological resources, at approximately 4.5 acres per parcel.

Effects on paleontological resources can be mitigated by standard terms and conditions, which require a lessee to conduct inventories or special studies at the discretion of the BLM. Site-specific projects that would cause surface disturbance in areas with unknown or moderate to high potential may require a paleontological survey and/or monitoring conducted at time of proposed lease development in accordance with NEPA, Paleontological Resources Preservation Act (PRPA), and FLPMA. Specifically, the BLM has applied stipulation NM-13-CSU to parcels 6790, 6803, and 6804, in which lease development would be subject to compliance with the PRPA, NEPA, and FLPMA, and surface occupancy or use is subject to special operating constraints (see Appendix B). Additionally, Lease Notice NM-14-LN—in which lease development would also be subject to compliance with the PRPA, NEPA, and FLPMA, and the lessee shall immediately notify the BLM Authorized Officer of any paleontological resources discovered as a result of approved surface-disturbing operations, and shall suspend all activities in the vicinity of such discovery until notified to proceed by the Authorized Officer and shall protect the discovery from damage or looting (see Appendix B)—is applied to the nominated lease parcels 6132, 6790, 6803, and 6804.

Additional mitigation measures may be applied as COAs based on the results of the survey. If, during operations within the nominated lease parcels, paleontological resources are discovered and a permitted paleontological monitor is not on-site, the lessee must cease any operations that would result in the destruction of such specimens and contact the BLM Authorized Officer. Scientifically significant paleontological resources discovered through surveys or monitoring would be collected by a permitted paleontologist and curated at an appropriate repository. These same measures for minimizing effects at the site-specific level would be followed for resources associated with reasonably foreseeable environmental trends and planned actions. With consideration of these protections, potential effects on paleontological resources of scientific interest would be avoided or mitigated.

AIB-11 Fluid Minerals

How would future potential development of the nominated lease parcels affect fluid minerals and energy production?

There are currently 2,362,024.14 acres leased within the BLM PDO. Current annual production within the analysis area is estimated to be 352,748,683 bbl of oil and 1,357,143,266 thousand cubic feet (mcf) of gas (NMOCD 2022b). Reasonably foreseeable environmental trends and planned actions (which includes the RFD scenario) would result in potential for development of 16,000 wells in addition to other mineral development. Development of all reasonably foreseeable wells would produce 1,817,700,000 bbl of oil and 6,981,800,000 mcf of gas over 20 years. As with the future potential development of the nominated lease parcels, development of the RFD scenario is consistent with laws mandating development of mineral resources on public lands. Oil and gas development associated with reasonably foreseeable environmental trends and planned actions, including development of the nominated lease parcels, is consistent with various laws, including FLPMA (43 USC 1701 et seq.), that mandate that the BLM administer for the exploration and development of these mineral resources on public lands for the benefit of the citizens of the United States.

Future potential development of the nominated lease parcels would include 85.5 acres of surface disturbance and would add 3,279.49 acres (a 0.14% increase) to the total amount of the 20 million-acre PDO analysis area that is leased. The total future estimated production from the nominated lease parcels is 3,192,000 bbl of oil and 18,612,400 mcf of gas (see Table 3.1) and would contribute an additional 0.23% oil and 0.35% gas production within the analysis area. Future potential development of the nominated lease parcels (19 wells) would comprise 0.03% of all past and reasonably foreseeable future oil and gas development (57,006 wells) and depending on the success of oil and gas well drilling, non-renewable natural gas and/or oil would be extracted and delivered to market.

Seven of the nominated lease parcels contain oil and gas wells: parcels 6789 and 6800 contain one oil and/or gas well each, parcels 413 and 6806 contain three oil and/or gas wells each, parcel 6790 contains four oil and/or gas wells, parcel 6752 contains seven oil and/or gas wells, and parcel 6801 contains nine oil and/or gas wells. However, none of the aforementioned oil and/or gas wells are currently active.

AIB-12 Potash, Solid, and Leasable Minerals

How would future potential development of the nominated lease parcels impact solid and other leasable minerals, such as potash?

Potash resources in southeastern New Mexico are located in an area governed by the rules of the Secretary of the Interior's 2012 Order dated December 4, 2012. This area is commonly called the Secretarial Order Potash Area (SOPA). The Secretary's 2012 Order was written to establish rules for concurrent operations in prospecting for, development of, and production of oil and gas and potash deposits owned by the United States within the SOPA. The SOPA completely encompasses the Known

Potash Leasing Area, which was established for the administration of potassium leasing. The SOPA is composed of four classifications respective to the density of core holes or geophysical inference: Measured Ore (Potash Enclave), Indicated Ore, Inferred Ore, and Barren of Potash Ore. Oil and gas development within Measured Ore (Potash Enclave) reserves would affect economical potash resources. Development in areas that are Indicated, or Inferred Ore may affect economical potash reserves or resources. Oil and gas development in areas that are barren of potash reserves would not affect economical potash reserves or resources.

Reasonably foreseeable environmental trends and planned actions (which includes the RFD scenario) would result in potential development of 16,000 wells over 20 years (see Section 3.3) (Engler et al. 2012; Engler and Cather 2014) in addition to other mineral development. Of the number of wells identified in the RFD scenario, 19 wells would be attributable to future potential development of the nominated lease parcels. This is 0.12% of the RFD scenario (see Section 3.3). While it is assumed that some portion of development associated with the RFD would occur in the SOPA, the majority of wells (14 of the 19) associated with the nominated lease parcels would occur outside the SOPA and not result in reductions of available potash resources. Impacts of the RFD scenario would vary depending on the area of the SOPA in which the reasonably foreseeable future wells would be developed. Potential impacts would be examined at the site-specific development stage. Table 3.10 lists potash impacts for potash leases, the SOPA, and potash probability classes.

Table 3.10. Potash Impact Summary

Nominated Lease Parcel (total parcel acres)	Potash Lease Within Parcel (acres, percent of total parcel acreage)	Parcel within SOPA (acres, percent of total parcel acreage)	Potash Probability Class (acres, percent of parcel)	Applicable Stipulations and Lease Notices
419 (120)	NMNM 129927 (120, 100%)	-	-	-
420 (80)	-	Yes (80, 100%)	Measured Ore (Potash Enclave) (80, 100%)	SENM-LN-6, SENM-S-1-CSU
6132 (280)	-	Yes (280, 100%)	Indicated Ore (88, 31%); Measured Ore (Potash Enclave) (284, 100%)	SENM-LN-6, SENM-S-1-CSU
6752 (320)	NMLC 0050063F (320, 100%); NMNM 0036791 (0.79, 0.24%)	Yes (320, 100%)	Measured Ore (Potash Enclave) (158, 49%)	SENM-LN-6, SENM-S-1-CSU
6753 (120)	NMLC 0050063F (120, 100%)	Yes (120, 100%)	Measured Ore (Potash Enclave) (120, 100%)	SENM-LN-6, SENM-S-1-CSU
6790 (240)		Yes (160.2, 67%)	-	SENM-LN-6, SENM-S-1-CSU
6805 (321.92)	NMNM 122279 (320.51, 99.96%)	-	-	-

Five of the 19 nominated lease parcels are within the SOPA, four nominated lease parcels are within the Measured Ore (Potash Enclave) probability class, and one nominated lease parcel is within the Indicated Ore probability class (see Table 3.10). There are five potash leases within four of the nominated lease parcels (see Table 3.10). Nominated lease parcel 6752 is approximately 0.37 mile south of the National Potash Eddy Mine underground shaft mine (potash). Future potential development of these nominated lease parcels is not expected to interfere with operations of the underground mine, and these facilities would remain open for use. Stipulations SENM-LN-6 and SENM-S-1-CSU, which notify the lessee that the nominated lease parcel is within the SOPA and that the lease parcel is subject to certain requirements (see Appendix B), are applied to nominated lease parcels 420, 6132, 6752, 6753, and 6790. The BLM has

the authority under standard terms and conditions to attach COAs at the site-specific level to minimize significant adverse effects on resource values at the time operations are proposed.

AIB-13 Livestock Grazing

How would future potential development of the nominated lease parcels impact livestock grazing?

There are currently 8,727,888 acres of livestock grazing allotments (644 allotments) within the 20 million-acre PDO. Surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the 20 million-acre PDO would involve vegetation removal and changes in forage conditions, altering the grazing availability for livestock. Additionally, alterations to existing range improvements are also possible. Consequently, this would be a long-term effect.

Reasonably foreseeable environmental trends and planned actions within the PDO would result in a total of 110,7400 acres of new surface disturbance for a total of 427,740 acres of total landscape-level surface disturbance (see Table 3.2). Proposed vegetation treatments and reclamation projects may offset surface disturbance as new forage for livestock grazing is made available through revegetation.

Eighteen nominated lease parcels are located within grazing allotments (Table 3.11). The future potential development of these nominated lease parcels would comprise approximately 81 acres (0.014% of total landscape-level surface disturbance within the PDO). This surface disturbance would contribute to reduced forage availability, which would affect grazing success. Nominated lease parcels 6800 and 6801 contain one livestock watering well each, and parcel 6801 contains one livestock water trough (see AIB-1 for more information). Surface disturbance for future potential development of each nominated lease parcel would affect between 0.004% and 0.09% of the allotments.

Table 3.11. Grazing Allotments by Parcel

Grazing Allotment(s)	Parcel Number(s) (parcel acreage within grazing allotment)	Estimated Area of Surface Disturbance (acres)	Percent of Grazing Allotment that would be Disturbed
Angell Draw No. 77015 14,275.41 acres	6789 (160)	4.5	0.03%
Deep Wells No. 76030 4,955.77 acres	6805 (320.96)	4.5	0.09%
Dipper No. 77011 11,320.99 acres	6801 (640)	4.5	0.04%
Laguna Tanto No. 76011 101,336.46 acres	6790 (240) 6803 (40) 6804 (40)	13.5	0.01%
Lea Townsite No. 76020 19,627.52 acres	420 (80)	4.5	0.02%
Maljamar South No. 76007 18,226.71 acres	6751 (40.01)	4.5	0.02%

Grazing Allotment(s)	Parcel Number(s) (parcel acreage within grazing allotment)	Estimated Area of Surface Disturbance (acres)	Percent of Grazing Allotment that would be Disturbed
North Turkey Track No. 65075 256,332.64 acres	6797 (80) 6798 (320)	9.0	0.004%
Oil Center-North No. 76025 15,583.68 acres	6806 (35.38)	4.5	0.03%
Pierce Canyon No. 77036 25,561.64 acres	6132 (186.88)	4.5	0.02%
Railroad No. 77018 13,651.30 acres	6799 (40) 6800 (280)	9.0	0.07%
Remuda Basin No. 77034 10,200.75 acres	6132 (97.13)	4.5	0.04%
Three Twins No. 78068 12,400.86 acres	6795 (83.14)	4.5	0.04%
Twin Wells North No. 77012 78,189.17 acres	6752 (320) 6753 (120)	9.0	0.01%

Note: The analysis contained in this EA generally provides percentage contribution rounded to two decimal points. As such, percentages may not always sum to 100 due to rounding.

* Acreages contained in the table above were calculated using geographic information system (GIS) data sets for resources and parcels which may differ slightly from the acreages contained in the parcel acreage within grazing allotments. Difference in total acres between parcels can vary due to geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall impact analysis conclusions presented in this EA.

The BLM's authority under standard lease terms and conditions would allow for the application of measures, including relocating wells up to 656 feet (200 m), to mitigate livestock grazing–related impacts. The reasonably foreseeable environmental trends and planned actions described in Section 3.3 provide a quantitative overview of these actions within the PDO. These actions would result in a cumulative loss of forage across the allotments within the analysis area. Proposed vegetation treatments and reclamation projects would ultimately contribute to cumulatively long-term countervailing impacts as new forage for livestock grazing is made available through revegetation.

AIB-14 Recreation

How would future potential development of the nominated lease parcels affect dispersed public recreation?

Recreation activities within the 20 million-acre PDO include camping, hiking, hunting and shooting, fishing, nature viewing, sightseeing, horseback riding, mountain biking, and motorized recreation including off-highway travel (on existing maintained or primitive roads), and off-road travel (cross- country, off existing roads). Off-highway vehicle use has increased in popularity as more versatile vehicles have become affordable and available. Noted recreation attractions within the PDO include Carlsbad Caverns National Park (CCNP), which attract tourists from New Mexico and beyond.

Oil and gas–related and other surface disturbances have the potential to modify recreation opportunities and the recreation experience over the long term, primarily as a result of changes in the landscape (viewshed), soundscape (noise), habitat loss, and presence of oil and gas development–related activities (construction, traffic, etc.). Within the PDO, reasonably foreseeable environmental trends and planned actions would add to past and present disturbance, resulting in a total of 427,740 acres of surface disturbance over the next 20 years. This comprises 2.14% of the PDO. Some of the past impacts have been mitigated through vegetation restoration projects and surface reclamation of well pads, roads, and facility sites.

It is estimated that 85.5 acres would be disturbed as a result of future potential development of the nominated lease parcels; this comprises 0.02% of total landscape-level surface disturbance (see Table 3.2) associated with reasonably foreseeable environmental trends and planned actions. Oil and gas development–related equipment and structures would be present in the areas of development. This disturbance is unlikely to change overall dispersed recreation opportunities or the experience of dispersed recreation because of the limited scale of the proposed development and the presence of substantial existing oil and gas development (see Table 3.1). There may be some small increases in access for dispersed recreation due to new roads. There are no designated recreation sites or facilities within any of the nominated lease parcels. The closest recreation facility is one shooting range and action sports recreation center that is located 0.08 mile northeast of nominated lease parcel 6795. Lastly, there are no Extensive Recreation Management Area (ERMAs)[6] or Special Recreation Management Areas (SRMAs)[7] within any of the nominated lease parcels.

The nearest nominated lease parcel (6795) is 16.57 miles northeast of the boundary of CCNP, and 38.48 miles northeast of the boundary of Guadalupe Mountains National Park (GUMO). As such, future potential development of the nominated lease parcels is not expected to impact access, dispersed recreation, or noise for CCNP or GUMO beyond existing conditions. See AIB-16, AIB-17, and AIB-24 for more information regarding visual impacts and economic activity impacts to CCNP and recreation.

Nominated lease parcel 6795 would comprise approximately 83.14 acres of Game Management Unit (GMU) 30 (which totals 1,881,995.61 acres), parcels 6797 and 6798 would comprise approximately 400 acres of GMU 33 (which totals 1,453,066.02 acres), and the remaining 16 nominated lease parcels would comprise approximately 2,797.27 acres of GMU 31 (which totals 5,340,536.21 acres). Hunting opportunities based on the NMDGF permit system and the supporting business section contributes to the economy within Chaves, Eddy, and Lea Counties. A 2014 analysis conducted for the NMDGF on the economic benefit of fishing, hunting, and trapping in 2013 (Southwick Associates 2014) reported a total of 9,190 anglers, 11,612 hunters, and 5,793 trappers in Chaves, Eddy, and Lea Counties. Fishing, hunting, and trapping activities were reported as resulting in 155, 183, and 161 jobs and total angler, hunter and trapper spending of approximately 13.7, 18.4, and 15.6 million dollars within each county, respectively (Southwick Associates 2014).

Future potential development of the nominated lease parcels is anticipated to impact approximately 4.5 acres (0.0002%) of GMU 30; 9 acres (0.0006%) of GMU 33; and 72 acres (0.001%) of GMU 30. Given the amount of the GMU present within the nominated lease parcels and that existing GMU-hunting opportunities and hunting-related economic benefits in Chaves, Eddy, and Lea Counties occur amidst a landscape of existing oil and gas development within the PDO (41,006 existing wells and 317,000 acres of surface disturbance within the PDO; see Section 3.1), impacts to hunting opportunities and the hunting

[6] An ERMA is an area where recreation is unstructured and dispersed, and where minimal recreation-related investments are required. All BLM lands not designated as SRMAs are considered ERMAs in the 1997 Carlsbad Approved RMP, as amended (BLM 1997a) and Roswell Approved RMP (BLM 1997b). This does not apply to private or state lands.

[7] The BLM's land use plans may designate SRMAs to provide specific recreational opportunities, such as trailhead areas for hikers, mountain bikers, or off-road vehicle users (BLM 2020a).

sector of the economy are not anticipated from future potential development of the lease parcels. Information on GMUs managed by the NMDGF and populations of big games species are discussed in AIB-15.

AIB-15 General Wildlife and Game Species

How would future potential development of the nominated lease parcels affect wildlife, including game and non-game species?

The 20 million-acre BLM PDO contains populations of big-game species, including mule deer (*Odocoileus hemionus*) and pronghorn (*Antilocapra americana*), as well as a multitude of other non-game species. Carnivores include bobcat (*Lynx rufus*), coyote (*Canis latrans*), badger (*Meles meles*), swift fox (*Vulpes velox*), and striped skunk (*Mephitis mephitis*). Two upland game bird species, mourning dove (*Zenaida macroura*) and scaled quail (*Callipepla squamata*), are prevalent throughout the area as well. The BLM PDO also contains year-round habitat for big-game species including mule deer and pronghorn. Disturbance from future potential development of the nominated lease parcels can result in the long-term loss of vegetation, burrows, and nests, and could also cause habitat loss and fragmentation and mortalities. Future potential development may also have effects on pronghorn, mule deer, bobcat, coyote, badger, swift fox, striped skunk, mourning dove, and scaled quail such as in avoidance of areas within and near the nominated lease parcels.

Reasonably foreseeable environmental trends and planned actions within the PDO would add to past and present disturbance, resulting in 427,740 acres of total landscape-level surface disturbance, which would impact wildlife habitat. Past, present, and future vegetation restoration projects (outlined in Section 3.3), which include herbicide treatments and surface reclamation of well pads, roads, and caliche pits, have improved habitat availability for wildlife and big-game species. The aforementioned reclamation activities improve nesting cover for ground nesting birds, improve fawning habitat for pronghorn and mule deer, and restore proper hydrological functionality by increasing ground cover, slowing water movement across the surface and increasing percolation where applicable. Migratory birds have also benefitted from the improved herbaceous cover associated with these vegetative treatments. It is assumed that future vegetative restoration will produce similar effects where they are implemented. Additionally, since 1990 the BLM has installed many wildlife habitat improvements within in the analysis area including numerous watering developments and playa enclosures. These habitat improvements have been implemented through the Habitat Stamp Program funding, which is generated through the sale of a $5.00 stamp or authorization associated with hunting and fishing licenses. The BLM has also funded many of these projects through its annual budget.

Overall, the landscape habitat fragmentation and human presence could be considered long-term effects for wildlife, and a potential exists for the decline in species numbers and/or use of the analysis area. Where implemented, restoration projects (outlined in Section 3.3.) would help offset disturbance to wildlife habitat. Additionally, new wildlife watering developments and playa exclosures would have beneficial impacts related to water availability for wildlife species.

Surface disturbance associated with future potential development of the nominated lease parcels would result in approximately 85.5 acres of surface disturbance (0.0004% of the acreage in the approximately 20 million-acre PDO). Currently, there are no mapped migration corridors within the BLM PDO (NMDGF 2019). In accordance with SO 3362, the NMDGF has identified priority areas for further research within their New Mexico State Action Plan (NMDGF 2019), and these priority areas were based on big game units. The NMDGF is currently conducting research on movement routes and/or defined wintering areas for mule deer and pronghorn. In coordination with NMDGF, the BLM PDO is completing fence modification and grassland restoration efforts for pronghorn. The only mapped migration corridor in New Mexico is within the Farmington Field Office (reflected in the NMDGF New Mexico State

Action Plan [NMDGF 2019]), which is outside of the analysis area (NMDGF 2019). Additionally, 13 special status species (see AIB-8) and non-listed species have the potential to occur within the nominated lease parcels due to suitable habitat.

GMUs are subdivisions used to manage big game species in the state. These GMUs are designated and mapped by the NMDGF and are readily available through its annual hunting proclamation (NMDGF 2022) and website (http://www.wildlife.state.nm.us/hunting/maps/big-game-unit-maps-pdfs/). The NMDGF has provided a set of guidelines that are useful to guide oil and gas development statewide. Specifically, these guidelines can be applied in areas where potential conflicts occur between development and the various wildlife species present (NMDGF 2007). Nominated lease parcel 6795 would comprise approximately 83.14 acres of GMU 30 (which totals 1,881,995.61 acres), parcels 6797 and 6798 would comprise approximately 400 acres of GMU 33 (which totals 1,453,066.02 acres), and the remaining 16 nominated lease parcels would comprise approximately 2,797.27 acres of GMU 31 (which totals 5,340,536.21 acres). Future potential development of the nominated lease parcels is anticipated to impact approximately 4.5 (0.0002%) of GMU 30; 9 acres (0.0006%) of GMU 33; and 72 acres (0.001%) of GMU 30.

Pre-disturbance surveys would be required at the time of proposed lease development in accordance with standard terms and conditions of the lease. The surveys would analyze potential effects on game and non-game species habitat. Avoidance, minimization, and/or mitigation measures would also be determined at that time. The BLM has the authority under standard terms and conditions to attach COAs at the site-specific level to minimize significant adverse effects on resource values at the time operations are proposed. Examples of potential mitigation measures include design modifications to avoid or minimize effects to sensitive habitats; limiting the number of well pads under simultaneous construction; seasonal restrictions; limiting the number of proposed roads; reclaiming old and/or unnecessary roads; minimizing truck traffic; noise-buffering measures; pre-development surveys; or use of special construction techniques to minimize surface disturbance to sensitive areas.

AIB-16 Visual Resources

How would future potential development of the nominated lease parcels affect the visual landscape, including areas adjacent to Carlsbad Caverns and Guadalupe Mountains National Parks?

Reasonably foreseeable environmental trends and planned actions within the 20 million-acre PDO would create surface disturbances and visual contrasts with the surrounding landscape and adversely contribute to the existing scenic quality effects on the analysis area's landscapes. The degree of effect would depend on the location of proposed infrastructure relative to sensitive viewsheds and areas already highly modified in character. At the landscape level, vegetation rehabilitation efforts such as Restore New Mexico would continue to help offset negative effects on visual resources by plugging and reclaiming existing and active wells to their former visual conditions. Visual resources on BLM lands are managed using four Visual Resource Management (VRM) classes: VRM Class I, II, III, and IV (BLM 1986). Oil and gas development is not compatible with VRM Class I designated areas, is often not compatible with VRM Class II designated areas, is generally compatible with VRM Class III designated areas, and is compatible with VRM Class IV designated areas (BLM 1986).

Nominated lease parcel 6795 (83.14 acres) is located with VRM III. The objective of this VRM class is to partially retain the existing character of the landscape (BLM 1986). Within this VRM class, the level of change to the characteristic landscape should be moderate, and management activities may attract attention, but should not dominate the view of the casual observer (BLM 1986). Lastly, changes should repeat the basic elements found in the predominant natural features of the characteristic landscape (BLM 1986). Stipulation SENM-S-25 has been applied to nominated lease parcel 6795, which provides protection for visual resources (see Appendix B).

The remaining 18 nominated lease parcels (3,197.18 acres collectively) are all located within VRM IV. The objective of this VRM class is to provide for management activities which require major modification of the existing character of the landscape. Within this VRM class, the level of change to the characteristic landscape can be high, and management activities may dominate the view and be the major focus of viewer attention (BLM 1986). However, every attempt should be made to minimize the effect of these activities through careful location, minimal disturbance, and repeating the basic elements (BLM 1986).

Future potential development of the nominated lease parcels would result in approximately 85.5 acres (2.6% of total parcel acreage) of surface disturbance, and approximately 19 wells. This disturbance comprises 0.12% of new surface disturbance (110,740 acres) associated within the PDO, and 0.00004% of the total landscape-level surface disturbance (427,740 acres) associated with reasonably foreseeable environmental trends and planned actions within the PDO (see Table 3.5). The BLM PDO reviewed aerial photography and records of existing oil and gas development to evaluate the nature and extent of visual effects as a result of future potential development of the nominated lease parcels and found that the nominated lease parcels are adjacent to lands with a high degree of oil and gas development. Future potential development of an estimated 19 wells on the nominated lease parcels (1 well each) would lead to a new visual element and modification of the landscape, resulting in long-term visual impacts associated with the nominated parcels, however, this would be visually consistent with the surrounding landscape, which is already highly modified in character. The three nearest nominated lease parcels to the boundaries of CCNP and GUMO are approximately 18.74 miles northeast (parcel 6795), 26.43 miles northeast (parcel 6799), and 28.39 miles northeast (parcel 6132) of CCNP, and 48.03 miles northeast (parcel 6799), 48.76 miles northeast (parcel 6795), and 58.33 miles northeast (parcel 6132) of GUMO. Future potential development within these nominated lease parcels is not expected be visible from portions of CCNP or GUMO.

It is assumed that development of the nominated lease parcels could be visible from some or all of the residences located within proximity the nominated lease parcels and immediately adjacent areas (see AIB-25). The presence of oil and gas development–related equipment and structures on the nominated parcels is unlikely to change the visual landscape of adjacent surface because of the limited scale of the proposed development (see Table 3.2), and the presence of existing oil and gas development in adjacent and surrounding areas.

Standard terms and conditions allow the BLM to consider further mitigation for visual resources at the time of proposed lease development. Measures could include siting of well sites, roads, and associated infrastructure to follow the contour of the landform and mimicking the lines in vegetation to screen and hide locations. In addition, per Onshore Order 1 (OO1 – XII. Abandonment, B. Reclamation), interim reclamation (reclamation of surface disturbance not necessary for production) and final reclamation (reclamation following well plugging and abandonment) is required within 6 months of well completion and well plugging, respectively.

AIB-17 Night Skies at Carlsbad Caverns National Park

How would future potential development of the lease parcels affect the quality of night skies at the Carlsbad Caverns National Park?

The darkness of the night sky is a valuable aspect of CCNP. Those who visit the park often seek an experience of solitude and the wilderness experience that dark night skies provide. Sky glow is the result of scattered artificial light in the atmosphere; it raises night sky luminance and creates the most visible negative effect of light pollution. The Sky Quality Index (SQI) is an index of light pollution from sky glow with a range of 0 to 100, where 100 is a sky free from artificial sky glow. Using the best available data, the National Park Service's (NPS's) Night Sky Monitoring Reports from 2008 indicate the SQI for

the CCNP monitoring station within CCNP is between 89 and 91 (NPS 2016a). These values show that skies in the analysis area retain their natural characteristics throughout most of the sky. The SQI data have limitations that "bright unshielded lights in the land portion of the mosaic will not be accurately measured for two reasons: they commonly are so bright their recorded luminescence exceeds the dynamic range of the detector so they become clipped or saturated at the maximum ADU value, and the median filter will remove most of the light from these sources since they resemble stars or point sources" (NPS 2016a). The limitations of the SQI data indicate that point source lights from oil and gas development may not be completely accounted for.

The main sources of sky glow in the analysis area are the following: the communities of Artesia, Carlsbad, Roswell, Dexter, Hagerman, and Hobbs; artificial lighting associated with areas of consolidated oil and gas development (particularly at Loco Hills); and infrastructure lighting, flaring, and traffic. At present, there are approximately 41,006 active well bores of all well types in the PDO (BLM 2022a). Surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the PDO (110,740 acres of new surface disturbance, for a total of 427,740 acres of total landscape-level surface disturbance) would likely contribute to sky glow over the long term with an incremental increase as wells are developed. Past and reasonably foreseeable environmental trends and planned actions would result in a total of 57,006 wells. While NPS monitoring data indicate that dark sky conditions in the area currently retain their natural characteristics, SQI ratings could be affected by sky glow associated with community and urban growth, as well as oil and gas well development (associated with reasonably foreseeable environmental trends and planned actions.

Future potential development of the nominated lease parcels would result in 85.5 acres of surface disturbance and 19 wells, which would represent 0.03% of the 57,006 wells associated with past and reasonably foreseeable environmental trends and planned actions (see Table 3.2). Future potential development of the nominated lease parcels could introduce additional artificial lighting that would contribute to sky glow over the short and long term. The degree to which artificial lighting contributes to sky glow would be generally temporary and transient in nature and would vary based on conditions such as cloud cover, weather, and wind speed or direction. For example, most artificial lighting would be short term and would occur during the drilling, completion, and potential flaring of a well, which could last for approximately 30 to 60 days. Long-term lighting sources from oil and gas development and production include those associated with vehicle traffic as well as safety lighting required at night. There is wide variability in both type of lighting and potential impacts of that lighting on night skies that are dependent on environmental factors best understood at the site-specific development stage. Because site-specific information such as the average number of lumens per well or proposed lighting plans for each proposed development is not known at the leasing stage, the number of proposed wells and anticipated new surface disturbance is used as the proxy for determining the change in oil and gas-related lighting from existing conditions (currently estimated at 41,006 active wells and 317,000 acres of related surface disturbance; see Section 3.1). Given that the NPS reports that the primary sources that contribute to an increase in night sky effects (sky glow) are cities (NPS 2016b), contributions to sky glow from future potential development of the nominated lease parcels would be a small contribution to the existing sources (a 0.05% increase over current number of wells and a 0.03% increase in oil and gas–related surface disturbance). Parcel 6795 is 18.74 miles northeast of, and most proximal to, the CCNP monitoring site and is 16.57 miles northeast of the CCNP park boundary (NPS 2016a).

Under standard terms and conditions, the BLM has the authority to require mitigation measures to reasonably reduce resource effects at the lease development level. The BLM may require mitigation measures that specify flare shields, the type of lighting (limited to downcast lighting with covers for safety purposes only), and project alignment.

AIB-18 Air Quality Related Values at Carlsbad Caverns National Park

How would future potential development of the nominated lease parcels affect air quality related values (visibility and deposition) at CCNP?

The analysis for this issue examines the Class I areas within the BLM PDO planning area. This area was chosen because these areas are afforded a higher level of protection under the Clean Air Act (CAA). The analysis considers oil and gas development within the PDO planning area as well as other sources outside of the planning area that might affect these Class I Air Quality Related Values (AQRVs).

AQRVs are resources sensitive to air quality and can include a wide variety of atmospheric chemistry–related indicators. Monitoring and modeling of AQRVs help to provide a level of protection to sensitive areas such as Class I park and wilderness areas. For purposes of this analysis, the following AQRVs have been considered: visibility, nitrogen deposition, and sulfur deposition.

Congress established certain national parks and wilderness areas as mandatory Class I areas where only a small amount of air quality degradation is allowed. Defined by the CAA, Class I areas include national parks greater than 6,000 acres, wilderness areas and national memorial parks greater than 5,000 acres, and international parks. These areas must have been in existence at the time the CAA was passed by Congress in August 1977. There are three Class I areas in or near the analysis area: CCNP, GUMO, and Salt Creek Wilderness. The most closely watched Class I areas near the analysis area are CCNP and GUMO. GUMO has monitoring data representative of the CCNP. The NPS is responsible for managing the CCNP and the GUMO. The three nearest nominated lease parcels to the boundaries of CCNP and GUMO are approximately 18.74 miles northeast (parcel 6795), 26.43 miles northeast (parcel 6799), and 28.39 miles northeast (parcel 6132) of CCNP, and 48.03 miles northeast (parcel 6799), 48.76 miles northeast (parcel 6795), and 58.33 miles northeast (parcel 6132) of GUMO. Visibility[8] modeling was performed using the BLM PDO RFD potential oil and gas well development scenario and with mitigation using EPA's on-the-books emission controls and additional management controls. This analysis tiers to the modeling that was performed in the Air Resources Technical Support Document (ARTSD) (URS Group Inc. [URS] 2013) for the BLM PDO for results of visibility impairment, indicating that, for the Carlsbad region, visibility effects on CCNP at the project level are minimal and not expected to be of concern (Engler and Cather 2014; Engler et al. 2012; URS 2013). The visibility screening analysis followed the recommendations in the Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report – Revised Guidelines (FLAG 2010). The analysis relies on a 0.5 and 1.0 delta-deciview (change in visibility) threshold, calculated for base year 2008, base case 2017, and future RFD years. Non-project, aggregate emissions are driving the overall visibility effects. A refinement of the aggregate emissions would reduce the number of days of total visibility effects and would likely be closer to baseline and future visibility effects. Any refinement down to a smaller scope of development or project-specific level would likely reduce the number of days of total visibility effects that would be likely, closer to matching actual base and future visibility effects/baseline conditions (URS 2013). Further refinement of the URS 2013 visibility modeled results was performed to show relative effects. The results indicate that there are no days in which the threshold is exceeded at the project level for the CCNP.

[8] Visibility impairment is a result of regional haze that is caused by the accumulation of pollutants from multiple sources in a region. Emissions from industrial and natural sources may undergo chemical changes in the atmosphere to form particles of a size that scatter or absorb light and result in reductions in visibility.

Deposition[9] modeling was performed using the BLM PDO RFD potential oil and gas well development scenario and with mitigation using EPA's on-the-books emission controls and additional management controls. Regional modeling was performed to determine the potential effects of emissions increases within the PDO RFD to nitrogen and sulfur deposition impairment at nearby federal Class I areas (Engler et al. 2012; URS 2013). To assess potential nitrogen and sulfur deposition effects in the planning area, deposition effects were compared with the NPS screening deposition analysis thresholds (DATs), which are defined as 0.005 kilogram per hectare per year (kg/ha/yr) in the western United States for both nitrogen and sulfur. A DAT is the additional amount of nitrogen or sulfur deposition within a Class I area below which estimated effects from a proposed new or modified source are considered to be insignificant. The DAT is a screening threshold that was developed primarily to assess effects from a single stationary source (FLAG 2008, 2010). Modeling results showing deposition greater than a DAT do not strictly indicate the need for mitigation. If a DAT is exceeded, modeling may be required to demonstrate that deposition is below the level of concern (LOC). The LOC is the rate of deposition below which there are believed to be no significant adverse effects. The LOC for the nitrogen and sulfur deposition values, defined by the NPS and U.S. Forest Service, are 3 kg/ha/yr for nitrogen and 5 kg/ha/yr for sulfur (Fox et al. 1989). Results of analysis showed that the maximum annual nitrogen DAT at the RFD level was exceeded for CCNP but may be below the LOC at specific receptors. The contribution of CFO RFD development was found to be below the LOC for nitrogen of 3 kg/ha/yr for CCNP (URS 2013). Based on modeled contributions from the CFO RFD development, the maximum modeled effects to sulfur deposition were below the DAT and LOC thresholds for CCNP. It is important to note that the nitrogen and sulfur deposition benchmarks that have recently been established by the NPS for CCNP are lower than the LOC values noted in the ARTSD. To maintain the highest level of protection, the maximum of the 5-year average range (2013–2017) is used to set the benchmark. Normally, the most recently available 2017 values of 1.9 kg/ha/yr for nitrogen and 1.1 kg/ha/yr for sulfur would indicate fair condition. However, the condition has been reduced to poor because the ecosystems at CCNP may be more sensitive to acidification effects relative to other ecosystems (NPS 2019).

Modeling to determine effects to deposition at Class I areas is included in the ARTSD (URS 2013). To assess potential effects to AQRVs, the air quality assessment considers emissions and impacts from anticipated increase development within nearby oil and gas basins (URS 2013). Appendix R and Appendix S of the ARTSD provide detailed nitrogen and sulfur deposition results (URS 2013), which model results above for the LOC for CCNP. It should be noted that for a large aggregate project that includes thousands of sources (such as oil and gas development in the BLM PDO), deposition greater than the DAT as well as LOC is typical based on the uncertainty in the model parameters, and more refined modeling studies are often required to better understand potential effects. Future potential development of the lease parcels could result in degradation of air quality related to nitrogen deposition, depending on the number of sources present during development and any mitigation applied. Appropriate mitigation would be determined following further analysis at the site-specific APD stage that allows for refined modeling analysis (as appropriate), which incorporates project-specific information that is not available at the leasing stage.

For instance, as part of a master development plan for development of 436 oil and gas wells on more than 106 well pads, Chevron conducted additional analysis extending the URS (2013) modeling that was performed in support of the CFO RMP effort. The refined emission inventory for the modeling study

[9] Deposition of pollutants through direct or dry atmospheric transport and precipitation can result in acidification of water and soil resources in areas far removed from the source of the pollution, as well as in harm to terrestrial and aquatic species. The EPA's Acid Rain Program, a national cap and trade program for sulfur dioxide (SO_2) and nitrogen oxides (NO_X), has resulted in greatly reduced levels of the most damaging pollutants. There are currently four wet deposition monitors in New Mexico: Gila Cliff Dwellings, Mayhill, Bandelier National Monument, and Capulin Volcano National Monument. Deposition data for nitrogen and sulfur deposition can be accessed through the National Atmospheric Deposition Program (NADP) website (NADP 2019).

reflected emission control measures implemented by the applicant to reduce nitrogen oxide(s) (NO_X) emissions in the project area. The results of acid deposition monitoring showed incremental exceedances of the nitrogen DAT of 0.005 kg/ha/yr in the CCNP would occur during drilling operations but would be well below the DAT once drilling is completed (BLM 2016). Similar results of AQRVs can be expected for other large well development projects in the PDO. With consideration of these project-specific modeling results, future potential development of the proposed lease (26 wells) would not be expected to show exceedances of the nitrogen DAT and, therefore, would not be likely to contribute significantly to degradation of deposition benchmark values at CCNP.

In addition, the EPA has promulgated various regulations to protect Class I AQRVs from degradation. A further summary of the regulations meant to protect AQRVs at Class I areas is discussed in Section 3.6.1.1.

AIB-19 Cultural Resources

How would future potential development of the nominated lease parcels affect cultural resources?

There are 427,740 acres of surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the PDO. Surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the PDO would likely impact cultural resources. Such impacts may include, but are not limited to, loss of or damage to cultural resources or contextual information (such as redistribution of cultural resources) due to the development of oil and gas facilities and related industrial development, increased vehicular traffic, unauthorized ground disturbances, inadvertent oil and produced water spills, erosion, unauthorized collection, and new audible and visual impacts. The magnitude of impacts associated with reasonably foreseeable environmental trends and planned actions would generally depend upon the location of reasonably foreseeable development relative to the location of cultural resources and the degree to which the setting has already been affected. Effects from reasonably foreseeable development on federal lands or with a federal nexus would require separate National Historic Preservation Act (NHPA) processes to avoid, minimize, and/or mitigate effects on cultural resources.

The BLM CFO and RFO conducted a records review of the New Mexico Cultural Resource Information System (NMCRIS), internal BLM data sources, and General Land Office record for the lease parcels to identify historic properties, traditional cultural properties (TCPs), sacred sites, and traditional use areas within the area of potential effects (APE) for the lease sale. The APE for physical effects is the physical footprint of the proposed lease parcel boundaries (3,279.49 acres collectively). This is to account for any potential development that may occur within the parcels at the APD stage. The proposed undertaking will not authorize any ground-disturbing activities; therefore, the APE for audible and visual effects is the same as the physical effects APE. A 1-mile buffer of the nominated lease parcels was used to conduct a literature search.

Approximately 726.84 acres (22.04%) of 3,297.50 total acres of the nominated lease parcels (all located within the PDO) have been previously surveyed for cultural resources. The records search found a total of 198 archaeological sites. A total of 17 were within the lease parcels and 181 were located within a one-mile buffer of the lease parcels. Of the 17 archaeological sites located within the lease parcels, a total of six sites have been determined eligible for listing to the National Register of Historic Places (NRHP); seven have been determined not eligible, and five are undetermined. Of the 181 sites located within the 1-mile buffer, 66 sites have been determined eligible; 67 have been determined not eligible, and 48 are undetermined. The probability of discovering previously unrecorded historic properties in this area is high. There are no known TCPs within or near the proposed parcels.

Eight parcels are located within the Permian Basin Programmatic Agreement (PBPA) and the other 11 are located outside of the PBPA. Due to low archaeological survey coverage and minimal overall ground disturbance from development within those lease parcels, there is potential for identifying previously unrecorded sites. However, the nominated lease parcels would be subject to additional cultural resource analysis through NEPA and Section 106 of the NHPA.

The nominated lease parcels assessed within this EA have been assigned the National HQ-CR-1 Lease Stipulation, which requires additional cultural resources analyses pursuant to Section 106 of the NHPA, to include identification, effects assessment, consultation, and if necessary, resolution of significant adverse effects, prior to the authorization of any ground-disturbing activities associated with the oil and gas lease. Additionally, the nominated lease parcels assessed within this EA have also been assigned Lease Notice NM-11-LN, which requires compliance with Section 106 of the NHPA and Executive Order 13007 (see Appendix B). In effect, this lease notice notifies lessees that the BLM could require intensive cultural resource inventories, Native American consultation, and mitigation measures to avoid significant adverse effects—the costs for which would be borne by the lessee—and that the BLM may require modifications to authorize activities that are likely to adversely affect TCPs or sacred sites for which no mitigation measures are possible. Such measures could include the development of COAs to protect cultural resources. The BLM would work with consulting parties, including any tribes or pueblos that might attach religious and cultural significance to properties within the APE, to identify additional historic properties when an APD is received and may develop COAs to mitigate physical, audible, or visual impacts to sensitive cultural resources. The processing constitutes a separate undertaking that would be analyzed through the NHPA Section 106 process at that time.

Because the proposed oil and gas lease sale does not directly authorize ground disturbance and future oil and gas development would constitute a new undertaking that would require a separate analysis under Section 106 of the NHPA, the CFO and RFO cultural heritage resources specialists determined that there would be *no adverse effect* to historic properties as defined in 36 CFR 800.5(b) as a result of the proposed lease sale. Additionally, the CFO and RFO sent letters notifying the New Mexico State Historic Preservation Office (SHPO) of their intent to use the State Protocol Appendix C.I.a. on November 9, 2022, as part of the BLM PDO Quarter 2 2023 Competitive Oil and Gas Lease Sale planning process. Please refer to Section 4.3 for additional details.

AIB-20 Native American Concerns

How would future potential development on the nominated lease parcels impact Native American concerns?

There are 427,740 acres of surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the PDO. Surface disturbance associated with reasonably foreseeable environmental trends and planned oil and gas operations within the PDO have the potential to adversely impact TCP and religious properties located within the vicinity. Such impacts may include, but are not limited to, temporary or long-term loss of or damage to Native American religious use or gathering areas, or loss of access to these areas due to the development of oil and gas facilities and related industrial development, increased vehicular traffic, unauthorized ground disturbances, inadvertent oil and produced water spills, or erosion. The magnitude of impacts associated with reasonably foreseeable environmental trends and planned actions would generally depend upon the location of reasonably foreseeable development relative to areas of concern to Native American tribes. Reasonably foreseeable development on federal lands or with a federal nexus would undergo the same type of consultation process discussed above (see AIB-19). In addition, the BLM could apply COAs to protect such properties, which may affect or limit oil and gas development. Through tribal consultation, such measures may include COAs to mitigate audible and visual impacts to sensitive TCPs. The processing of lease development applications

is a separate undertaking that would be analyzed through the Section 106 process at that time, as directed in law, regulation and policy, including the use of the PBPA (as applicable).

As described in Section 1.1 of this EA, one parcel (413) was originally nominated for the BLM CFO Quarter 2 2022 Competitive Oil and Gas Lease Sale. The BLM PDO re-initiated government-to-government consultation for nominated lease parcel 413, and initiated government-to-government consultation under NEPA and NHPA for the remaining 18 nominated lease parcels for auction in the BLM PDO May 2023 Competitive Oil and Gas Lease Sale. This government-to-government consultation took place on November 7, 2022, with the Apache Tribe of Oklahoma, Comanche Nation, Hopi Tribe, Kiowa Tribe of Oklahoma, Mescalero Apache Tribe, Pueblo of Isleta, and Ysleta del Sur Pueblo. No specific Native American concerns have been identified on the subject lease parcels; however, this consultation is considered ongoing. If the nominated parcels are leased, future potential development would go through separate NEPA and NHPA processes as directed by regulation and current policy.

AIB-21 Cave and Karst

How would the future potential development of the nominated lease parcels affect cave and karst resources?

Karst is a landscape produced by the dissolution of soluble rock types such as limestone, dolomite, marble, gypsum, or salt. Features associated with karst terrains include sinkholes or closed depressions, caves, dry valleys, sinking streams, and resurgences or springs. Sinkholes leading to underground voids and drainages are common. These features, as well as fissures and discontinuities in the bedrock, may serve as direct conduits leading to groundwater. Thus, surface and subsurface contaminants have the potential to be quickly transported into subterranean water systems and freshwater aquifers without filtration as a result of the development of oil and gas lease parcels. In addition, contaminants spilled or leaked into or onto karst zone surfaces and subsurfaces may disrupt and displace cave species and critical biological processes. Changes in geologic formation integrity, runoff quantity/quality, drainage course, rainfall percolation factors, vegetation, surface contour, and other surface factors can negatively impact cave ecosystems and aquifer recharge processes. Heavy vibrations and focusing of surface drainages can lead to slow subsidence, collapse of subsurface voids, and/or cave ecosystem damage. The BLM categorizes all areas within the PDO as having either low, medium, or high karst potential occurrence based on geology, occurrence of known caves, and density of known karst features (BLM 1997a, 2018b). Effects on cave and karst resources would depend on the locations of proposed disturbance relative to existing subsurface cave and/or karst features as described above.

Effects from reasonably foreseeable environmental trends and planned actions are anticipated to be the same as the effects documented above. Reasonably foreseeable environmental trends and planned actions would result in a total of 427,740 acres of total landscape-level surface disturbance, of which future potential development of the nominated lease parcels would comprise approximately 85.5 acres (0.02% of total landscape-level surface disturbance; see Table 3.2).

Of the PDO's mapped cave potential zones, nine nominated lease parcels intersect approximately 957.3 acres of low cave potential areas, two nominated lease parcels intersect approximately 400 acres of medium cave potential areas, and eight nominated lease parcels intersect approximately 1,923.14 acres of high cave potential areas. Nine parcels intersect approximately 957.3 acres of low karst potential areas, four nominated lease parcels impact approximately 720 acres of medium karst occurrence areas, six nominated lease parcels impact 1,686.3 acres of high kart potential areas, and one nominated lease parcel impacts 83.14 acres of critical karst potential areas. Table 3.12 lists the nominated lease parcels, associated cave and karst intersect, and applicable stipulations and lease notices. Lease notice SENM-LN-1 and stipulation SENM-S-21-CSU (each of which provide protections for caves and karst resources

[see Appendix B]) have been applied to nominated lease parcels with medium, high, or critical cave or karst occurrence areas (see Table 3.12).

Table 3.12. Cave and Karst Impact Summary

Nominated Lease Parcel (total parcel acres)	Cave Designation (percent of parcel within cave designation)	Karst Designation (percent of parcel within karst designation)	Applicable Stipulations and Lease Notices
413 (40)	Low (100%)	Low (100%)	-
419 (120)	Low (100%)	Low (100%)	-
420 (80)	Low (100%)	Low (100%)	-
6132 (280)	High (100%)	Medium (100%)	SENM-LN-1 and SENM-S-21-CSU
6751 (40.01)	Low (100%)	Low (100%)	-
6752 (320)	High (100%)	High (100%)	SENM-LN-1 and SENM-S-21-CSU
6753 (120)	High (100%)	High (100%)	SENM-LN-1 and SENM-S-21-CSU
6789 (160)	High (100%)	High (100%)	SENM-LN-1 and SENM-S-21-CSU
6790 (240)	Low (100%)	Low (100%)	-
6795 (83.14)	High (100%)	Critical (100%) and High (100%)	SENM-LN-1 and SENM-S-21-CSU
6797 (80)	Medium (100%)	Medium (100%)	SENM-LN-1 and SENM-S-21-CSU
6798 (320)	Medium (100%)	Medium (100%)	SENM-LN-1 and SENM-S-21-CSU
6799 (40)	High (100%)	Medium (100%)	SENM-LN-1 and SENM-S-21-CSU
6800 (280)	High (100%)	High (100%)	SENM-LN-1 and SENM-S-21-CSU
6801 (640)	High (100%)	High (100%)	SENM-LN-1 and SENM-S-21-CSU
6803 (40)	Low (100%)	Low (100%)	-
6804 (40)	Low (100%)	Low (100%)	-
6805 (321.92)	Low (100%)	Low (100%)	-
6806 (35.83)	Low (100%)	Low (100%)	-

While there is a low likelihood of encountering karst features within the low karst occurrence zone, past oil and gas development in high and medium karst occurrence zones has resulted in the intersection of subterranean voids during construction, resulting in damage to equipment, loss of infrastructure, bit drops, and losses of drilling medium and cement during drilling and casing, respectively. Losses of circulation during drilling and cementing introduces foreign materials into the subterranean environment, while the opening of subterranean voids could change airflow patterns within a cave system to negatively impact the cave ecosystem and compromise the structural integrity of the cave passage. In the past year, the BLM PDO has received nine reports of subsurface voids opening during construction (power line, pipeline, and facility pad) and exploration activities (two seismic surveys) in areas where there were no previously known sinkholes or caves. None of these events resulted in reported contamination events of groundwater, and the features impacted did not meet the criteria of a "significant cave;" thus, development remained in conformance with the Cave Resource Protection Act of 1988 and attendant regulations.

All future potential development within medium, high, and critical karst occurrence zones on the nominated lease parcels would be further reviewed and mitigated at the time of proposed lease development, or during other proposed ground-disturbing activities, per standard terms and conditions of the lease. While several measures can be implemented to mitigate impacts, it is still possible for impacts

to occur from containment failures, well blowouts, accidents, spills, and structural collapses. It is therefore necessary to implement long-term monitoring studies to determine if current mitigation measures are sufficient to prevent long-term or short-term impacts to cave/karst resources. Mitigation measures could include changes in drilling operations, special casing and cementing programs, installation of leak detection and automatic shut-off systems, and modifications in surface activities. A complete list of mitigation measures can be found in Appendix 3, Practices for Oil and Gas Drilling and Production in Cave and Karst Areas, within the Carlsbad and Roswell RMPs (BLM 1997a, 1997b). Therefore, although cave/karst resources may experience impacts, the degree and extent of impacts are not expected to exceed a threshold of significance and the Proposed Action is expected to remain in conformance with the Cave Resource Protection Act of 1988 and attendant regulations.

AIB-22 Playas

How would future potential development of the parcels affect function of playa features in these locations?

Playas are relatively small, round, shallow depressions. Their basins are lined with clay soil, which collects and holds water from rainfall and runoff, creating temporary lakes. Properly functioning playas have intact clay basins, are encompassed by grassy buffer strips or prairie, and collect water runoff from the surrounding area after large rain events. Despite their small size and relatively simple structure, playas are relevant to the landscape because they provide important ecological and hydrological functions. In the 20 million-acre PDO, playas are the main source of water and are the center of biodiversity on the plains—supporting 185 bird species, 450 plant species, 13 amphibian species, and 37 mammal species at some point in their life cycle (Smith 2003); playas are also a water source for migratory and wintering shorebirds, waterfowl, and other game and nongame wildlife, and contribute to groundwater recharge. Past development in southeastern New Mexico has resulted in disturbance to one-third of wetlands, including, but not limited to, playa wetlands (Fretwell et al. 1996).

Culturally accelerated dust and sediment accumulation, which is the result of increased transport of dust and sediments from the upland through airborne particles and water erosion, could degrade function of the playa features. Land disturbances near a playa exacerbate the accelerated sedimentation problem: 1) through movement of sediments into the playa basin, and 2) through mixing of sediments with the underlying clay layer. The additional sediments may interfere with the shrinking and swelling of the clay layer, which is vital to aquifer recharge, and reduce playa volume, which in turn decreases the hydroperiod. (i.e., the length of time and portion of the year the playa holds ponded water). Hydroperiod reduction greatly alters the plant and wildlife community supported by the playa (LaGrange et al. 2011). Oil and gas operations could result in land disturbance within the drainage basin that would introduce sediments through erosion from heavy rains or wind. Additional sediments can fill the playa, preventing water from pooling and reducing the capacity of the playa to recharge an aquifer (Gurdak and Roe 2009). Spills can occur as a result of development (see Water Support Document [BLM 2022b] for discussion of spills) resulting in degraded playa function. There are no methods for remediation that would not disrupt the hydrologic connectivity, natural hydrology, and benefits that playas provide to wildlife within the planning area. Surface disturbance associated with reasonably foreseeable environmental trends and planned actions within the PDO (427,740 acres of surface disturbance) would likely occur in leases that include or are in close proximity to playas.

Based on desktop aerial photography, the USGS NHD, FEMA floodplain data, USFWS NWI data, and internal communication with the BLM PDO interdisciplinary team, nominated lease parcel 6798 (320 acres) contains 8.9 acres (2.85 of total parcel acreage) of playa wetlands, and nominated lease parcel 6799 (40 acres) contains 1.4 acres (3.4% of total parcel acreage) of playa wetlands. Playas have also been identified within 656 feet (200 m) of the boundaries of nominated lease parcels 6798 and 6799.

Stipulation SENM-S-19, which provides protections to playas and does not allow surface disturbance within 200 m of these areas, has been applied to nominated lease parcels 6798 and 6799 (see Table 2.1 and Appendix B). The BLM also has the authority under standard terms and conditions to attach COAs at the site-specific level to minimize significant adverse effects on resource values at the time operations are proposed. Standard terms and conditions would allow for measures to avoid and mitigate accelerated soil erosion and sedimentation to water bodies. With consideration of standard terms and conditions, stipulation SENM-S-19, and COAs as determined by the BLM Authorized Officer, all permanent effects from surface occupancy to any playa features identified at the site-specific level would be avoided.

AIB-23 Human Health and Safety

How would future potential development of the nominated lease parcels contribute risks to human health and safety concerns?

Within the 20 million-acre PDO, there are 41,006 existing active well bores of all well types across all land jurisdictions (BLM 2022a). This level of development has resulted in the following public health and safety–related risks: occasional fire starts; spills of hazardous materials, hydrocarbons, produced water, or hydraulic fracturing fluid (see Appendix D) and corresponding potential contamination of air, soil, or water; exposure to naturally occurring radioactive material (NORM) in drill cuttings or produced water (see Appendix D); traffic congestion and collisions from commercial vehicles and heavy use, especially south and east of Carlsbad along New Mexico State Road 128 and U.S. Route 285; infrequent industrial accidents; presence of hydrogen sulfide (H_2S); or increased levels of fugitive dust (PM_{10} and $PM_{2.5}$), other criteria pollutants, VOCs, and hazardous air pollutants (HAPs). See the air quality analysis in Section 3.6.1 for projected levels of criteria pollutants, HAPs, GHG emissions, and VOC and NO_X emissions that contribute to O_3 formation, as well as NAAQS.

As further described in Section 3.6.1 and the *Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas, and Kansas* (BLM 2022a), future potential development of the nominated lease parcels would result in emissions of air pollutants that can lead to human health effects depending on the level and duration of exposure.

HAPs are known or suspected to cause cancer or other serious health effects, such as compromises to immune and reproductive systems, birth defects, developmental disorders, or adverse environmental effects resulting from either chronic (long-term) and/or acute (short-term) exposure, and/or adverse environmental effects. Breathing O_3 can trigger a variety of health problems, including coughing and sore or scratchy throat; difficulty breathing deeply and vigorously and pain when taking deep breaths; inflammation and damage to the airways; increased susceptibility to lung infections; aggravation of lung diseases such as asthma, emphysema, and chronic bronchitis; and an increase in the frequency of asthma attacks. Some of these effects have been found even in healthy people, but effects are more serious in people with lung diseases such as asthma. Breathing air with a high concentration of CO reduces the amount of oxygen that can be transported in the blood stream to critical organs like the heart and brain. At very high levels, which are possible indoors or in other enclosed environments, CO can cause dizziness, confusion, unconsciousness, and death. Very high levels of CO are not likely to occur outdoors. However, when CO levels are elevated outdoors, they can be of particular concern for people with some types of heart disease. Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. PM is measured and regulated according to particle size. PM_{10} refers to all particles with a diameter of 10 microns or less. $PM_{2.5}$ is made up of particles with diameters of 2.5 microns or less. Smaller particles are associated with more negative health effects, including respiratory and cardiovascular problems, because they can become more deeply embedded in the lungs and may even get into the bloodstream (BLM 2022a).

The following links provide additional information on air pollution health effects:

Criteria Pollutants:

- Ozone (https://www.epa.gov/ground-level-ozone-pollution) (EPA 2022a)
- Particulates (https://www.epa.gov/pm-pollution/particulate-matter-pm-basics) (EPA 2022b)
- Nitrogen dioxide (https://www.epa.gov/no2-pollution/basic-information-about-no2) (EPA 2022c)
- Carbon monoxide (https://www.epa.gov/co-pollution/basic-information-about-carbon-monoxide-co-outdoor-air-pollution#Effects) (EPA 2022d)
- Lead (https://www.epa.gov/lead-air-pollution/basic-information-about-lead-air-pollution#health) (EPA 2022e)
- Sulfur dioxide (https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects) (EPA 2022f)
- Hazardous air pollutants (https://www.epa.gov/haps/health-effects-notebook-hazardous-air-pollutants) (EPA 2021a)

While no formal human health risk assessments have been conducted specific to past and present development in the PDO, the results of EPA's 2017 Air Toxics Screening Assessment (AirToxScreen) indicate that cancer, neurological risks, and respiratory risks in the analysis area are all lower than national levels, and are generally the same as state of New Mexico levels (BLM 2022a) (see Section 3.6.1.1).

While the 2017 AirToxScreen estimates the risk of cancer and/or other health impacts solely based on exposure to HAPs, other economic or social indicators can also influence the general health risks of a population, such as poverty status, educational attainment, or language proficiency. Headwaters Economics data for populations at risk (i.e., more likely to experience adverse health outcomes due to demographic or socioeconomic factors) show that most of the indicators for populations at risk are higher for state of New Mexico compared with the nation as a whole. Most notably, the Hispanic population and population living in mobile homes for the state exceed national percentages by 30% and 10%, respectively (Headwaters Economics 2022a). Compared with the state of New Mexico, most of the indicators for populations at risk in Eddy, Lea, and Chaves Counties are similar to or lower than state levels. However, certain indicators are noticeably higher than those of the state of New Mexico; these include people without a high school diploma, people with limited English proficiency (Lea County only), households receiving public assistance (Chaves County only), and the Hispanic population. The percentages of these populations at risk in Eddy, Lea, and Chaves Counties exceed those within the state of New Mexico by 3% to 7% (Headwaters Economics 2022b). See AIB-26 for additional discussion of existing health risks for low-income and minority populations.

Human health risk assessments cannot be performed until project-specific details are known so that frequency, timing, and levels of contact with potential stressors may be identified (EPA 2022g). However, each of the reasonably foreseeable environmental trends and planned actions have been, or will be, subject to relevant rules and regulations regarding public health and safety. Ongoing and future potential development would continue to present aggregate risks to human health as detailed above. When wells reach the end of their useful life and are properly plugged and reclaimed, they would no longer contribute to air quality effects; however, depending on the level and duration of individual's exposure during well operation, some of the public health effects from air pollution may endure beyond the life of the wells (e.g., chronic respiratory problems such as asthma).

Future potential development on the nominated lease parcels is estimated to be 19 new wells for this lease sale. This is a 0.05% increase in addition to the 41,006 existing active wells. When authorizing development, federal and state laws, regulations, and policy are applied to reduce effects or respond to incidents. These include the following:

- Federal, state, county, and municipal fire managers shall coordinate on fire response and mitigation.
- Developers who install and operate oil and gas wells, facilities, and pipelines are responsible for complying with the applicable laws and regulations governing hazardous materials and for following all hazardous spill response plans and stipulations. The NMOCD requires similar spill response measures after release of hydrocarbons, produced water, or hydraulic fracturing fluids (see the Water Support Document [BLM 2022b] for further information on spills).
- All well pads, vehicles, and other workplaces must comply with worker safety laws as stipulated by the Occupational Safety and Health Administration (OSHA).
- Vehicular traffic and pipelines are regulated according to safety laws as stipulated by the Department of Transportation.
- Measures to lower risks related to H_2S exposure include flaring or venting gas and the use of stock tank vapor recovery systems.

Fugitive dust is concentrated in the short term during construction but may occur to a lesser degree in the long term due to increased vehicle use and ground disturbance. In addition to fugitive dust, see the air quality analysis in Section 3.6.1 for potential health effects of other air pollutants, including criteria pollutants, VOCs, and HAPs. See AIB-1 and AIB-2 for further information regarding potential surface and groundwater effects and relevant regulations, stipulations, and lease notices offering protections to groundwater and surface water quality.

The U.S. Department of Energy's Waste Isolation Pilot Plant (WIPP) fenced property boundary, the nation's only deep geologic long-lived radioactive waste repository that permanently isolates defense-generated transuranic waste 2,150 feet underground in an ancient salt formation (U.S. Department of Energy 2022), is located approximately 8.82 miles southwest of the nearest nominated lease parcel (6132). Given this distance, no impacts to the WIPP are expected from future potential development of the nominated lease parcels. The WIPP is insulated by a 16-section minerals withdrawal. The waste storage area is in the center of the withdrawal, and waste is encapsulated prior to transport and storage. In most areas around the WIPP, oil and gas wells would not directionally drill beneath the WIPP, as minerals are withdrawn in this area. On the southwest corner of the WIPP, existing oil and gas leases are located in areas where minerals have not been withdrawn and hydraulic fracturing has taken place within the WIPP boundary. The WIPP has multiple seismicity, waterflow, and air monitors on-site to detect adverse impacts related to oil and gas development near the WIPP, and no impacts have been detected. Additionally, the salt beds in which the WIPP is located are tied to existing potash mining, and lease parcels are buffered to ensure future potential development of the nominated lease parcels does not interfere with existing potash mining, which indirectly protects the WIPP. Finally, the BLM is required to notify the WIPP if an oil and gas well is to be located within 1 mile of the WIPP boundary and coordinate application of COAs. As a result of these protective measures, no impacts to the WIPP are expected from the Proposed Action.

AIB-24 Economic Activity

What are the potential effects from oil and gas leasing and future potential development on economic activity?

The oil and gas industry has been a substantial contributor to the social setting and economic basis of the BLM PDO for decades. The oil and gas sector of the economy relies on both ongoing operational activities (development of existing leases) and new development opportunities (acquisition and development of new leases) to continue to provide local and regional jobs and revenue on a sustained basis. In the 20 million-acre PDO, there are approximately 7.6 million acres of federal mineral estate. Overall development of federal fluid minerals comprises approximately 38% of total oil and gas development activities in the PDO.

While the act of leasing federal minerals itself would not result in social effects, subsequent development of a lease may generate impacts on communities and individuals in the vicinity of the lease. At the lease sale stage, it is unknown where, or if, development would occur in any given nominated lease parcels; however, in general, acquisition and development of new leases provide short-term local and regional jobs and long-term revenue on a sustained basis. These may include employment opportunities related to the oil and gas and service support industries in the region, as well as federal, state, and county government revenue related to taxes, royalty payments, and other revenue streams. For example, the revenue collected from the lease sale auction is split between the U.S. Treasury and the state in which the auction is held and can be used for improvements to transportation networks and education systems. As specific types and locations of development are proposed, their effects would be analyzed and addressed at the time of proposed lease development.

Oil and gas lease sales may contribute to employment for area residents, continued demand for oil and gas industry–related goods and services, and continued demand for support goods and services. This continued demand may contribute to stability in employment in sectors outside of the oil and gas industry. To the extent that additional oil and gas development affect recreational and tourism opportunities in the area of the nominated lease parcels, there may be related effects in these economic sectors. Continued expansion of the oil and gas industry may be perceived as having a negative effect on quality-of-life considerations for people who value undeveloped landscapes, opportunities for isolation, and activities such as wildlife viewing and cattle ranching. The BLM uses a number of stipulations and lease notices applied to the nominated lease parcels in the current sale that may mitigate potential effects on wildlife (see AIBs-7, 8, 9, and 15) and other resources that in turn may mitigate effects on related recreation (see AIB-14) and quality-of-life (see AIB-25) concerns (see Table 2.1 and Appendix B for specific stipulations and lease notices applied to the nominated lease parcels, and individual stipulation and lease notice summaries).

AIB-25 Quality of Life

How would future potential development of the nominated lease parcels affect quality of life and residences within and adjacent to the nominated lease parcels?

The 20 million-acre PDO contains 427,740 acres of total landscape-level surface disturbance associated with reasonably foreseeable environmental trends and planned actions (see Table 3.2), which includes activities that generate increased human activity, traffic, noise, dust, odor, light pollution, and visual effects (see summary of the phases of oil and gas development in Appendix D). Collective effects from noise, dust, odor, and light disturbance associated with reasonably foreseeable environmental trends and planned actions could affect the quality of life for residences, depending on the intensity of development activities and proximity to residences.

Future potential development of the nominated lease parcels would comprise approximately 85.5 acres of surface disturbance (0.02% of the total landscape-level surface disturbance associated with reasonably foreseeable environmental trends and planned actions) and 19 wells. Table 3.13 identifies residences within 5 miles of eight nominated lease parcels (parcels 6132, 6751, 6795, 6799, 6800, 6801, 6805, and 6806); the remaining 11 nominated lease parcels (parcels 413, 419, 420, 6752, 6753, 6789, 6790, 6797, 6798, 6803, and 6804) do not have residences within 5 miles of the parcel boundaries. While the majority of the effects to the nearest residences would be short term and would cease during operations (e.g., increased human activity, traffic, noise, dust, and odor during construction, drilling, completion, and interim reclamation phases), the residences would continue to experience long-term visual or other effects that have potential to affect quality of life; however, as discussed in AIB-16 (visual resources) the presence of oil and gas development–related equipment and structures on the nominated parcels is unlikely to change the visual landscape of adjacent surface because of the limited scale of the proposed development and the presence of existing oil and gas development in adjacent and surrounding areas.

Table 3.13. Residential Areas in and near the Nominated Lease Parcels

Parcel Number (total parcel acres)	Parcel Distance and Direction to Nearest Residence*	Parcel Closest to Nearest Municipality	Discussion*
6132 (280)	4.06 miles, west	7.40 miles east of the town of Loving, NM.	Lands north, east, west, and south of nominated lease parcel 6132 are rural, sparsely populated, and primarily consist of sporadically to moderately concentrated oil and gas development. Lands north and west of the parcel also include salt and potash mines. Parcel 6132 is 5.4 miles south of New Mexico State Road 128.
6751(40)	3.40 miles, east-southeast	22.40 miles southeast of the town of Lovington, NM.	Lands north, east, south, and west of nominated lease parcel 6751 are rural, sparsely populated, and primarily consist of moderately to heavily concentrated oil and gas development. Parcel 6751 is 0.37 mile south of New Mexico State Road 529.
6795 (83)	0.16 mile, west	1.75 miles west of the city of Carlsbad, NM.	Lands north, south, and west of nominated lease parcel 6795 are rural, sparsely populated, and primarily consist of sporadically concentrated oil and gas development. Lands east of the parcel are densely populated, mostly developed, and include agricultural development. Parcel 6795 is 0.75 mile southeast of New Mexico State Road 524.
6799 (40)	1.95 miles, west	6.35 miles north of the city of Carlsbad, NM.	Lands north, east, south, and west of nominated lease parcel 6799 are rural, sparsely populated, and primarily consist of sporadically concentrated oil and gas development. Parcel 6799 is 0.75 mile west of New Mexico State Road 206.
6800 (280)	0.06 mile, southeast	6.30 miles north of the city of Carlsbad, NM.	Lands north, east, south, and west of nominated lease parcel 6799 are rural, sparsely populated, and primarily consist of sporadically concentrated oil and gas development. Parcel 6799 is 4.0 miles west of New Mexico State Road 206.
6801 (640)	3.45 miles, west	9.45 miles southeast of the town of Artesia, NM.	Lands north, east, south, and west of nominated lease parcel 6801 are rural, sparsely populated, and contain sporadically to heavily concentrated oil and gas development. Parcel 6801 is 3.62 miles west of New Mexico State Road 206 and 0.37 mile east of the Pecos River.

Parcel Number (total parcel acres)	Parcel Distance and Direction to Nearest Residence*	Parcel Closest to Nearest Municipality	Discussion*
6132 (280)	4.06 miles, west	7.40 miles east of the town of Loving, NM.	Lands north, east, west, and south of nominated lease parcel 6132 are rural, sparsely populated, and primarily consist of sporadically to moderately concentrated oil and gas development. Lands north and west of the parcel also include salt and potash mines. Parcel 6132 is 5.4 miles south of New Mexico State Road 128.
6805 (322)	3.68 miles, east-northeast	9.0 miles northeast of the town of Jal, NM.	Lands east, south, and west of nominated lease parcel 6805 are rural, sparsely populated, and primarily consist of sporadically to moderately concentrated oil and gas development. Lands north of the parcel are mostly undeveloped. Parcel 6805 is 6.0 miles west of New Mexico State Road 18.
6806 (35)	4.65 miles, northeast	7.75 miles west of the town of Eunice, NM.	Lands north, east, south, and west of nominated least parcel 6806 are rural, sparsely populated, and contain sporadically to heavily concentrated oil and gas development. Parcel 6806 is 2.75 miles south of New Mexico State Road 176.

* Source: Google Earth (2022). For surface ownership of the parcels listed above, see Table 2.1 or Appendix A.

With consideration of total lease acreage, topography, and other resources issues present within the nominated lease parcels, there are opportunities for future potential development to reasonably be placed in portions of the nominated lease parcels that are less proximal to the residences to minimize quality of life issues. Under the authority granted in standard terms and conditions attached to each lease, measures to reduce effects on or avoid resource values, land uses, or users would be attached as COAs to the APD. Site-specific avoidance, minimization, and/or mitigation measures would be determined at the time of proposed lease development. This could include measures to reduce noise, dust, odor, and light effects during construction and operations. As with reasonably foreseeable environmental trends and planned actions, effects to quality of life from these trends and actions would be examined at the APD level with consideration of site-specific locational information and development of COAs to reduce effect as needed.

AIB-26 Environmental Justice

What are the potential effects from oil and gas leasing and future potential development on environmental justice (EJ) populations?

Environmental justice (EJ) refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies (CEQ 1997). Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 16, 1994), requires federal agencies to determine whether proposed actions would have disproportionately high and adverse environmental impacts to minority, low-income, and American Indian populations of concern. BLM policy, as contained in BLM Land Use Planning Handbook H-1601-1 (BLM 2005:Appendix C), provides direction on how to fulfill agency responsibilities for Executive Order 12898.

The CEQ has developed guidance to assist federal agencies with their NEPA procedures so that EJ concerns are effectively identified and addressed. The guidance focuses on identifying minority and low-income EJ populations using census data. The BLM's IM 2022-059 builds upon CEQ's guidance and provides further direction for considering EJ concerns in BLM-prepared NEPA documents, including a

detailed framework for identifying EJ populations using census data as well as several other recommended data sources (BLM 2022d).

The analysis area for EJ comprises Lea, Eddy, and Chaves Counties, which represents the maximum anticipated extent of potential effects (e.g., air quality, water quality) associated with future potential development of the nominated lease sale parcels. This analysis area is intended to represent all communities that could be affected by future potential development of the lease parcels, either directly or indirectly.

Eddy County has a population of 57,865, with 7.4% of the population under the age of 5 and 14.4% of the population over the age of 65 (Headwaters Economics 2022c). Median household income is $65,000, with 76.2% of the population between the ages of 16 and 64 participating in the labor force and an unemployment rate of 6.4% (Headwaters Economics 2022d, 2022e). Lea County has a population of 70,359, with 7.9% of the population under the age of 5 and 11.1% of the population over the age of 65 (Headwaters Economics 2022c). Median household income is $61,867, with 70.9% of the population between the ages of 16 and 64 participating in the labor force and an unemployment rate of 9.6% (Headwaters Economics 2022d, 2022f). Chaves County has a population of 64,711, with 6.7% of the population under the age of 5 and 15.8% of the population over the age of 65 (Headwaters Economics 2022c). Median household income is $46,254, with 71.8% of the population between the ages of 16 and 64 participating in the labor force and an unemployment rate of 7.1% (Headwaters Economics 2022d, 2022g).

Within the tri-county analysis area, individual counties, census tracts, and census-mapped places (i.e., individual cities and towns) are the geographic units of analysis used for gathering information about low-income and minority populations. There are a total of 48 census tracts (17 census tracts in Chaves County, 13 in Eddy County, and 18 in Lea County) and 30 census-mapped places (five in Chaves County, 17 in Eddy County, and eight in Lea County) within the tri-county analysis area (see Figures E.1–E.3 in Appendix E). The state of New Mexico is used as the reference area for determining whether minority or low-income EJ populations exist within the counties, census tracts, or census-mapped places.

The BLM defines low-income populations as individuals or groups of people whose income is less than or equal to twice (200% of) the federal poverty threshold, as identified by the U.S. Census Bureau (BLM 2022d). Minority populations include the following population groups: American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, Black or African-American, some other race (other than White), a combination of two or more races, or Hispanic (BLM 2022d; CEQ 1997). Except for White non-Hispanics, all other racial and ethnic groups are considered minorities; therefore, the total minority population of an area is calculated by subtracting the White non-Hispanic population from the total population (BLM 2022d).

Members of tribal populations include all persons having origins in any of the original peoples of North America and South America (including Central America), and who maintain tribal affiliation or community attachment. Any American Indian or Alaska Native population qualifies as a tribal population, and membership in a federally recognized tribe is not required (BLM 2022d). All tribal populations qualify as EJ populations, regardless of the percentage of the analysis area population they constitute. In addition, dispersed tribal populations can also constitute EJ populations if they do not reside within the analysis area but depend on cultural resources or places located on BLM-managed land within the analysis area.

Based on the percentage of the analysis area population that constitutes a low-income, minority, or tribal population, the BLM uses the following five criteria to identify EJ populations (BLM 2022d):

1. low-income population of analysis area is the same or greater than that of the reference area

2. low-income population of analysis area is 50% or greater of the total analysis area population
3. minority population of analysis area is meaningfully greater than that of the reference area (i.e., 110% or more of reference area population)
4. minority population of analysis area is 50% or greater of the total analysis area population
5. tribal populations are present within the analysis area

After examining the most recently available data on minority and low-income populations for the analysis area and reference areas (U.S. Census Bureau 2022a, 2022b, 2022c), the BLM has determined that there are both low-income and minority EJ communities of concern present in the analysis area. Data concerning low-income and minority communities of concern identified within the analysis area are presented in Table E.1 of Appendix E. Tribal populations that reside, or rely on resources, within the analysis area also constitute communities of concern within the analysis area and are identified in AIB-20 (Native American Concerns) and Section 4.2 (Tribal Consultation). The BLM will consult with these tribal populations as part of government-to-government consultation under NEPA and NHPA.

Of the three counties in the analysis area (Chaves, Eddy, and Lea), all three counties meet the criteria for minority communities of concern, and Chaves County meets the criteria for a low-income community of concern. Of the 48 census tracts in the analysis area, the majority (42) meet the criteria for minority communities of concern and about half (21) meet the criteria for low-income communities of concern. When combined, all but six census tracts in the analysis area meet the criteria for either a low-income or minority community of concern (see Table E.1 in Appendix E). Of the 30 census-mapped places in the analysis area, the majority meet the criteria for minority (25 places) and low-income (19 places) communities of concern. When combined, all but three census-mapped places in the analysis area meet the criteria for either a low-income or minority community of concern (see Table E.1 in Appendix E).

Specific minority groups that meet the criteria for EJ communities of concern vary by county, census tract, and census-mapped place, but the most common minority communities of concern are the total minority population, which is present in all three counties, 79% of all census tracts, and 80% of all census-mapped places, and the Hispanic or Latino population, which is present in all three counties, 65% of all census tracts, and 77% of all census-mapped places. Other minority communities of concern present within the analysis area include Black or African-American, Asian, Native Hawaiian or other Pacific Islander, some other race (other than White), and a combination of two or more races (see Table E.1 of Appendix E).

The total minority populations and Hispanic or Latino populations in Eddy, Lea, and Chaves Counties have increased over recent years (2015–2020) by approximately 3% to 5% compared with the state of New Mexico (2%–3% increases in those same populations for the same period). The low-income population (including both individuals and families) of Chaves County has stayed relatively constant from 2015 to 2020 with only minor fluctuations (+/- 0.5%), whereas the low-income population for the state of New Mexico has decreased by approximately 3% to 4% over the same period (U.S. Census Bureau 2022a–f).

The EJ communities of concern within the analysis area include several types of populations at risk, or populations who are more likely to experience adverse health outcomes due to demographic or socioeconomic factors (Headwaters Economics 2022b). As described in AIB-23 (Human Health and Safety), most of the indicators for populations at risk in Eddy, Lea, and Chaves Counties are similar to or lower than the state of New Mexico levels. However, certain indicators are noticeably higher than those of the state of New Mexico; these include people without a high school diploma, people with limited English proficiency (Lea County only), households receiving public assistance (Chaves County only),

and the Hispanic population. The percentages of these populations at risk in Eddy, Lea, and Chaves Counties exceed those within the state of New Mexico by 3% to 7% (Headwaters Economics 2022b).

While the determination of potential adverse and disproportionate effects from specific actions may initially be the assessment of the BLM, this assessment should not be assumed to be the position of specific, potentially affected EJ populations. The BLM realizes that additional adverse impacts may be identified by local communities as specific development locations and types are proposed. Therefore, the BLM would provide EJ communities of concern with opportunities to identify any perceived adverse environmental impacts at the time of site-specific analysis during the APD stage. As a result, the following discussion assesses only the effects for the issues identified by the BLM during scoping associated with this leasing process. The BLM issued a press release for the proposed Quarter 2 2022 lease sale in Spanish in an effort to target public involvement from Hispanic or Latino communities of concern within the analysis area (which is present in all three counties and 65% of all census tracts). The BLM would continue to work with potentially affected communities of concern to identify and address additional EJ issues as they arise.

The federal government cannot dictate where oil and gas reserves may exist. Consequently, there may be instances where oil and gas exploration activities disproportionately and adversely affect EJ communities of concern due to proximity and other factors, and for variable amounts of time. For example, a typical horizontal well averages from 30 to 60 days from start of drilling to completion (see Appendix D) and may have a greater effect (increased dust, traffic, etc.) on resident populations in close proximity while the drilling operations are ongoing. These types of exploration activities may result in adverse impacts to EJ communities of concern located near the drilling operations; however, the BLM does not know exactly where drilling operations may take place until lease development is proposed, if a nominated lease parcel is developed at all. Thus, the BLM PDO uses stipulations and COAs to minimize impacts to nearby populations, including EJ communities of concern, during construction and operations, to the extent practicable.

For purposes of the proposed leasing action, Table 3.14 provides a summary of the analysis associated with the issues analyzed in detail as well as any issues analyzed in brief that would have potential to affect EJ communities of concern. Those conclusions were then assessed by the BLM relative to whether the projected impacts to EJ communities of concern may be adverse and disproportionate. As described in AIB-25 (Quality of Life), none of the nominated lease parcels contain residences, and lands surrounding the nominated lease parcels are characterized as rural and sparsely populated. The closest residences to the nominated lease parcels range from 0.06 mile to greater than 5 miles from the parcel boundaries. Note that any residence, community facility, or gathering space in an area with a community of concern has the chance of being significant to that community; however, no such places have been identified within the nominated lease parcels. In addition, there were no other resources of significance identified during public scoping, and no specific Native American resource concerns have been identified on the subject lease parcels; however, this consultation is considered ongoing. Therefore, given the lack of any residences or other resources of concern identified within the nominated lease sale parcels, any impacts to EJ communities of concern associated with future potential development of the lease parcels are more likely to be indirect and may incrementally contribute to impacts associated with reasonably foreseeable environmental trends and planned actions.

Additional analysis would be conducted at the time of proposed lease development. Standard terms and conditions attached as COAs to the APD could include measures to reduce effects on nearby EJ communities of concern. Under the Oil and Gas Leasing Regulation for Surface Use Rights (43 CFR 3101-1-2), such reasonable measures may include modification to siting or design of facilities, including relocation of proposed operations up to 656 feet (200 m). These measures may minimize potential significant adverse effects (e.g., from dust or visual/audio effects) on members of EJ communities of concern.

Table 3.14. Summary Comparison of Conclusions from Analysis of Other Issues to Environmental Justice

Issues Analyzed	Summary of Potential Significant Adverse Effects	Are potential effects disproportionate to environmental justice communities of concern?
Air Quality (Issue 1, Section 3.6.1)	Criteria pollutants, VOC, and HAP emissions would increase as shown in Section 3.6.1.2 (Table 3.23). Future potential development of the lease parcels would result in short-term local area increases of pollutant emissions, particularly fugitive dust ($PM_{2.5}$ or PM_{10}), lasting an average of 30 to 60 days.	Potential for disproportionate impacts to EJ communities of concern. Fugitive dust and diesel exhaust emissions from construction would result in criteria pollutant, VOC, and HAP emissions. These emissions would be short term (30–60 days) and would have the greatest impact at locations near the construction activities. Therefore, residents near the construction activities would experience greater levels of impacts due to project construction. Air pollution and associated health effects (as described in Section 3.6.1) can disproportionately affect individuals within EJ communities of concern in the analysis area who are already socially vulnerable and have greater difficulty accessing healthcare facilities and paying for medical treatment or have a higher likelihood of having pre-existing health conditions (EPA 2021b). Additional analysis would be conducted at the time of proposed lease development if development occurs; standard design features and project-specific COAs would help to minimize potential effects that could be adverse and disproportionate to EJ populations.
Greenhouse Gases and Climate Change (Issue 2, Section 3.6.2)	Based on a 100-year global warming potential, future potential development of the nominated lease parcels is estimated to result in 81,893 metric tons of carbon dioxide equivalent (CO_2e) from construction and operation and 2,398,703 metric tons of CO_2e from downstream GHG emissions. All GHG emissions would contribute to global GHG emissions. GHG emissions are associated with documented ongoing and reasonably foreseeable climate-related effects. For the Upper Rio Grande Basin (southern Colorado to central-southern New Mexico), these may include increased temperatures, decreases in overall water availability, and increases in frequency, intensity, and duration of both droughts and floods (BLM 2022c).	Potential for disproportionate impacts to EJ communities of concern. While any climate change–related effect from the future potential development of the parcels themselves would be minimal, climate change is the result of collective and global actions. Any climate change–related impact would be regional in nature but may disproportionately affect individuals within communities of concern in the analysis area who are already socially vulnerable and have a lower capacity to prepare for, cope with, and recover from climate change impacts, including higher temperatures, decreased overall water availability, or increased flooding (EPA 2021b).
Water Use and Quantity (AIB-1, AIB-2, and Issue 3, Section 3.6.3)	Drilling and completion of 19 horizontal wells on the nominated lease parcels is estimated to use approximately 592.8 AF of water. Assuming that all wells are developed in the same year, this would increase the annual demand for groundwater and surface water in the tri-county analysis area by 0.01% at current usage rates. With consideration of design features and regulatory requirements, no effects on groundwater or surface water quality are expected from well drilling and completion. Spills affecting groundwater or surface waters could occur.	Potential for disproportionate impacts to EJ communities of concern. While groundwater resources are regional in nature and water withdrawals are not anticipated to affect domestic water sources, any impacts to local water wells (for example, a spill that affects groundwater) could force residents to find other means of supplying water for domestic use. BMPs and COAs would help to minimize this risk. Should a spill occur, the BLM would work with the NMOCD to immediately remediate spills in accordance with federal and state standards, including 19.15.29.11 NMAC.

Issues Analyzed	Summary of Potential Significant Adverse Effects	Are potential effects disproportionate to environmental justice communities of concern?
Quality of Life (AIB-25)	Future potential development of the nominated lease parcels could result in localized air, noise, visual resources, and traffic and safety effects that could affect quality of life for local residences and EJ populations, particularly during construction. Continued expansion of the oil and gas industry can have a negative effect on quality of life for people who value undeveloped landscapes.	Potential for disproportionate impacts to EJ communities of concern. In general, quality of life impacts would be greater for the residents in close proximity to future potential development. None of the nominated lease parcels contain residences, and most of the nominated lease parcels do not have any residences within 5 miles of the parcel boundary. However, two parcels have residences less than 0.2 mile away (parcels 6795 and 6800). When evaluating placement of wells at the lease development stage, standard design features and project-specific COAs would be applied to reduce effects that could be adverse and disproportionate to communities of concern.
Human Health and Safety (AIB-23)	Future potential development of the nominated lease parcels would result in emissions of air pollutants that can lead to human health effects depending on the level and duration of exposure. Other health and safety risks may include occasional fire starts; spills of hazardous materials and corresponding potential contamination of air, soil, or water; exposure to naturally occurring radioactive material; traffic collisions; and presence of hydrogen sulfide. The magnitude of effects on human populations would depend on the frequency, timing, and levels of contact with potential stressors. After wells are properly plugged and reclaimed, they would no longer contribute to human health and safety risks; however, some public health effects from air pollution may endure beyond the life of the wells (e.g., chronic respiratory problems such as asthma).	Potential for disproportionate impacts to EJ communities of concern. Communities of concern within the analysis area include several types of populations at risk who are more likely to experience adverse health outcomes due to demographic or socioeconomic factors including ethnicity, education, language proficiency, and receiving public assistance (Headwaters Economics 2022c). Therefore, the communities of concern within the analysis area may be more sensitive to the effects of air pollution and other health and safety risks associated with future potential development of the lease parcels, relative to non-EJ communities. Additional analysis of potential human health and safety risks would be conducted at the time of proposed lease development. Standard terms and conditions attached as COAs to the APD could include measures to reduce health and safety effects on nearby communities of concern. Future potential development would be subject to relevant rules and regulations regarding public health and safety.

AIB-27 Areas of Critical Environmental Concern

How would future potential development of the nominated lease parcels affect areas of critical environmental concern (ACECs) and proposed ACECs?

An ACEC is defined in FLPMA 103(a) as an "areas within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historical, cultural, or and scenic values; fish and wildlife resources or other natural systems or processes; or to protect and life and safety from natural hazards." Regulations for implementing the ACEC provisions of FLPMA are found at 43 CFR 1610.7-2(b). Although federal, state, and private lands may be located within the boundaries of an ACEC, only BLM-administered lands are managed under the ACEC prescriptions. While ACEC designation by itself does not automatically prohibit or restrict uses, each ACEC may include management prescriptions, including oil and gas stipulations, to protect the relevant and important values for which the ACEC was designated.

Oil and gas–related and other surface disturbances have the potential to modify the experience of ACECs over the long term, primarily as a result of changes in the landscape (viewshed), soundscape (noise), habitat loss, and presence of oil and gas development–related activities (construction, traffic, etc.). Within the PDO, reasonably foreseeable environmental trends and planned actions would add to past and present disturbance, resulting in a total of 427,740 acres of surface disturbance over the next 20 years. This comprises 2.14% of the PDO. Some of the past impacts have been mitigated through vegetation restoration projects and surface reclamation of well pads, roads, and facility sites.

None of the nominated lease parcels are within an ACEC or proposed ACEC (in accordance with the CFO Draft RMP (BLM 2018b). The Salt Playas proposed ACEC is approximately 0.5 mile south of nominated lease parcel 6790, 1 mile north of nominated lease parcel 6132, 2 miles south of nominated lease parcel 6804, and 2.75 miles south of nominated lease parcel 6803. The proposed Salt Playas ACEC is approximately 49,772 acres of BLM surface ownership within the CFO planning area and encompasses portions of the Laguna Plata Special Management Area (SMA) from the 1988 RMP (BLM 2018b). This proposed ACEC is managed to protect cultural and wildlife resources (BLM 2018b). The proposed Cave Resources ACEC are between 0.5 and 1 mile north and south of nominated lease parcels 6752 and 6753. The proposed Cave Resources ACEC is approximately 19,625 acres of BLM-administered land broken into nine individual cave areas, or "units" (BLM 2018b). The Cave Resources ACEC encompasses portions of the Chosa Draw ACEC, Dark Canyon ACEC, Dark Canyon SMA, Guadalupe Escarpment SMA, Cave Resources SMA, and Dry Cave RNA from the 1988 RMP (BLM 2018b). These nine cave units each contain some of the most significant cave resources within the CFO planning area and are the most susceptible to resource impacts (BLM 2018b).

It is estimated that 85.5 acres would be disturbed as a result of future potential development of the nominated lease parcels (which comprises 0.02% of total landscape-level surface disturbance; see Table 3.2) associated with reasonably foreseeable environmental trends and planned actions. Oil and gas development–related equipment and structures would be present in the areas of development. This disturbance is unlikely to change overall experience of ACECs because of the limited scale of the proposed development and the presence of substantial existing oil and gas development (see Table 3.1). There may be some small increases in access for ACECs due to new roads. Depending on the specific location of future potential development, noise from well development and completion within nominated lease parcels 6790, 6132, 6804, and 6803 could impact the soundscape for those recreating the proposed Salt Playas ACEC and for wildlife (for which its designation is proposed), or could contribute to existing noise within the ACEC, but would not result in direct disturbance if and when the ACEC is designated. Depending on the specific location of future development, noise from well development and completion within nominated lease parcels 6752 and 6753 could impact the soundscape for those recreating within the proposed Cave Resources ACEC and for caves (for which its designation is proposed) or contribute to existing noise within the ACEC, but would not result in direct disturbance if and when the ACEC is designated.

With consideration of total lease acreage, topography, and other resources issues present within the nominated lease parcels, there are opportunities for future potential development to be reasonably placed in portions of the nominated lease parcels that are less proximal to the ACECs. Under the authority granted in standard terms and conditions attached to each lease, measures to reduce effects on or avoid resource values, land uses, or users would be attached as COAs to the APD. Site-specific avoidance, minimization, and/or mitigation measures would be determined at the time of proposed lease development. This could include measures to reduce noise, dust, odor, and light effects during construction and operations. As with reasonably foreseeable environmental trends and planned actions, effects to ACECs from these trends and actions would be examined at the APD level with consideration of site-specific locational information and development of COAs to reduce effect as needed.

3.6 ISSUES ANALYZED IN DETAIL

The issues identified for detailed analysis in this EA were developed in accordance with CEQ regulations and the guidelines set forth in the BLM NEPA Handbook H-1790-1 (BLM 2008c) using input from internal and external scoping. Issues were retained for detailed analysis if that analysis is necessary to make a reasoned choice between alternatives, to determine significance, if there is disagreement about the best way to use a resource, or if there is conflict between resource impacts or uses.

3.6.1 Issue 1: Air Quality

How would future potential development of the nominated lease parcels affect air quality (particularly National Ambient Air Quality Standards and volatile organic compounds) in the analysis area?

Air quality is determined by the quantity and chemistry of atmospheric pollutants in consideration of meteorological factors (i.e., weather patterns) and topography, both of which influence the dispersion and concentration of those pollutants. The presence of air pollutants is due to a number of different and widespread sources of emissions. The analysis area for this issue is the BLM New Mexico portion of the Permian Basin. This spatial scope of analysis was identified based on the regional nature of air pollution and to facilitate analysis using the best available air quality data, which are generally provided at the county level. For the purposes of this analysis, short-term effects to air quality are considered those that cease after well construction and completion (30–60 days); long-term effects are considered those associated with operation. Long-term effects would cease after well operation.

Much of the information in this section is incorporated from the *BLM Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas and Kansas* (herein referred to as Air Resources Technical Report and incorporated into this EA by reference) (BLM 2022a).

3.6.1.1 *Affected Environment*

The CAA, 42 USC 7401-7671q, requires the EPA to set NAAQS for pollutants considered harmful to public health and the environment. *Primary standards* provide public health protection, and *secondary standards* provide for public welfare, including protection against degraded visibility and damage to animals, crops, vegetation, and buildings (EPA 2022h) The primary NAAQS are set at a level to protect public health, including the health of at-risk populations, with an adequate margin of safety (EPA 2022h).

The EPA has set NAAQS for six principal pollutants ("criteria" air pollutants): carbon monoxide (CO); nitrogen dioxide (NO_2); ozone (O_3); particulate matter equal to or less than 10 microns in diameter (PM_{10}) and particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$); sulfur dioxide (SO_2); and lead (Pb) (EPA 2022h). The EPA has delegated the responsibility of regulation and enforcement of the NAAQS to the state level and has approved the New Mexico State Implementation Plan (SIP), which allows the State to enforce both the New Mexico Ambient Air Quality Standards (NMAAQS) and the NAAQS on all public and private lands with the exception of tribal lands and lands within Bernalillo County.[10] The NMED Air Quality Bureau is responsible for implementation of the SIP and enforcement of air quality standards (BLM 2022a).

Various federal and state-level permitting programs ensure protectiveness of the NAAQS and reduce effects to AQRVs at Class I areas. New major emitting facilities or significant modifications to major emitting facilities are required to undergo prevention of significant degradation (PSD) pre-construction review. PSD review requires an air quality analysis to assess the project's potential contribution to the NAAQS and PSD increments (maximum allowable increases in air quality over baseline concentrations), a Best Available Control Technology Analysis, and an additional effects analysis (to assess potential effects to soils, vegetation, and visibility) (EPA 2022i). Complete PSD applications are generally forwarded to the NPS Air Quality Division for review to ensure protectiveness of AQRVs at Class I areas. Additional state-level permitting requirements have been adopted by NMED such as New Source Review permitting requirements or de-minimis emission thresholds (10 pounds per hour or 25 tons per year of any criteria pollutant) that must be met in lieu of completing the construction permitting process

[10] Under the CAA and the Tribal Authority Rule, tribes have express authority to manage air quality on tribal lands. Air quality in Bernalillo County is regulated by the City of Albuquerque/Bernalillo Air Quality Division.

are also enforced within the analysis area in order to ensure protectiveness of the NAAQS (NMED 2001). Construction permitting requirements are listed in NMAC 20.2.72 (NMED 2001).

CRITERIA POLLUTANT CONCENTRATIONS

Concentrations of air pollutants are measured at air monitoring sites and expressed in ppm, parts per billion (ppb), or micrograms per cubic meter ($\mu g/m^3$) depending on the unit of measure for a specific standard. The EPA and State of New Mexico periodically analyze and review air monitor locations and will discontinue monitoring where pollutant concentrations have been well below standards or may add monitors in areas where concentrations may be suspected of approaching the NAAQS or the NMAAQS (BLM 2022a).

Design values are the concentrations of air pollution at a specific monitoring site that can be compared with the NAAQS. The most recent design values for criteria pollutants within Lea and Eddy Counties are listed in Table 3.15 (EPA 2022j). These counties do not have monitoring data for CO, Pb, and PM_{10} concentrations, nor is there any criteria pollutant monitoring data for Chaves and Roosevelt Counties, but because the counties are relatively rural, it is likely that these pollutants are not elevated.

Table 3.15. 2021 Design Values in Eddy and Lea Counties

Pollutant	2021 Design Values	Averaging Time	NAAQS	NMAAQS
O_3	0.077 ppm (Eddy County), 0.066 ppm (Lea County)	8-hour	0.070 ppm*	–
NO_2	5 ppb (Eddy County), 4 ppb (Lea County)	Annual	53 ppb†	50 ppb
NO_2	29 ppb (Eddy County), 32 ppb (Lea County)	1-hour	100 ppb‡	–
$PM_{2.5}$§	6.5 $\mu g/m^3$ (Lea County)	Annual	12 $\mu g/m^3$ §	–
$PM_{2.5}$§	17 $\mu g/m^3$ (Lea County)	24-hour	35 $\mu g/m^3$ ‡	–

Source: EPA (2022j).

Notes: NMAAQS = New Mexico Ambient Air Quality Standards; ppm = parts per million; ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter. While there are no NAAQS for H_2S, New Mexico has set half-hour standards for H_2S at 0.100 ppm within Pecos-Permian Air Quality Control Region and 0.030 ppm, for municipal boundaries and within 5 miles of municipalities with populations greater than 20,000 in the Pecos-Permian Air Quality Control Region (BLM 2022a). The NMAAQS standard for total suspended particulates, which was used as a comparison for PM_{10} and $PM_{2.5}$, was repealed as of November 30, 2018. Where no standards are presented, the NAAQS still apply.

* Annual fourth-highest daily maximum 8-hour concentration averaged over 3 years.

† Not to be exceeded during the year.

‡ 98th percentile, averaged over 3 years.

§ Annual mean, averaged over 3 years.

O_3 is the criteria pollutant that is of most concern for the New Mexico portion of the Permian Basin. As a secondary pollutant, O_3 is not a direct emission pollutant (that is, it is not emitted directly into the air), but it is the result of chemical reactions between a group of highly reactive gases called NO_X and VOCs (which are organic compounds that vaporize [i.e., become a gas] at room temperature) when exposed to sunlight (EPA 2022a). O_3 and NO_2 are criteria air pollutants and are regulated under the NAAQS and NMAAQS. VOCs are not criteria pollutants, however, because O_3 is not a direct emission; emissions of NO_X (particularly NO_2, which is used as an indicator for the larger group of gases) and VOCs are used as a proxy for determining potential levels of secondary formation of O_3.

O_3 is most likely to reach unhealthy levels on hot, sunny days in urban environments and can be transported long distances by wind into rural areas (EPA 2022a). People most at risk from breathing air containing O3 include people with asthma, children, older adults, and people who are active outdoors, especially outdoor workers. In addition, people with certain genetic characteristics, and people with reduced intake of certain nutrients, such as vitamins C and E, are at greater risk from O3 exposure (EPA 2022a). Major sources of both NO_X and VOCs emissions include industrial facilities like oil and

gas production and motor vehicle exhaust (including off-road equipment). Biogenic sources, such as vegetation and soil, can also represent a substantial portion of NO_X and VOC emissions in an area, including New Mexico (BLM 2022a).

In May 2021, the EPA published new design values for NAAQS for various counties throughout the United States. The 2811 Holland Street and 727 Carlsbad Caverns Highway monitoring stations in Eddy County reported 8-hour O_3 exceedances of the NAAQS from 2017 through 2021 (EPA 2022j). Table 3.16 and Table 3.17 provide the 1-hour and 8-hour O_3 values from the two Eddy County monitoring stations, including the number of days per year any exceedances of the NAAQS occurred. NMED is required by New Mexico state statute (NMSA 1978, § 74-2-5(C)) to plan for O_3 mitigation in areas where monitors indicate O_3 levels within 95% of the O_3 standard. The area discussed above in Carlsbad, New Mexico has not been formally declared nonattainment by the EPA.

The Ozone Attainment Initiative is a project authorized by state statute, NMSA 1978, § 74-2-5(C). This statute directs the NMED to develop plans that may include regulations more stringent than federal rules for areas of the state in which ambient monitoring shows O_3 levels at or above 95% of the NAAQS (BLM 2022a). In addition, this statute requires the NMED to take action to reduce O_3 pollution in counties where O_3 levels reach certain thresholds. Therefore, an Ozone Attainment Initiative has been established with three main goals:

- To ensure the health and welfare of current residents and future generations in New Mexico.
- To protect the attainment/unclassifiable status of all areas in the state.
- To develop plans that detail how nonattainment areas will attain and maintain the standards by reducing O_3.

The Ozone Attainment Initiative is necessary to keep counties in New Mexico in attainment for O_3. Currently, only the Sunland Park area in southern New Mexico is classified as a nonattainment area. However, other counties are monitoring increased O_3 concentrations, with Eddy County (see Table 3.16 and Table 3.17) and several other counties currently exceeding 95% of the O_3 standard. If these counties are designated as being in nonattainment by the EPA, it would trigger planning requirements including a more stringent, costly, and lengthy air permitting process.

NMED is relying on a combination of mandatory state and federal regulations as well as voluntary public participation measures to reduce O_3 concentrations in the state. NMED is mandated to develop a draft rule according to the directives in the New Mexico Air Quality Control Act. The draft rule establishes emissions standards for VOCs and NO_X, which are O_3 precursor pollutants, for oil and gas production and processing sources located in areas of the state within the Environmental Improvement Board's jurisdiction where O_3 concentrations are exceeding 95% of the NAAQS. In addition to state rules, NMED relies on existing federal regulations targeted at reducing O_3 precursor pollutant emissions. Standards of Performance for New Stationary Sources (40 CFR 60) are federal regulations already in place that control NO_X and VOCs emitted from oil and gas facility equipment, and National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR 63) are federal regulations already in place that control hazardous pollutants emitted from oil and gas facility equipment.

NMED also participates in the voluntary Ozone Advance Program, which is a collaborative effort to encourage O_3 emission reductions in attainment areas. Through this program, states, tribes, and local governments work with EPA to take near-term steps to improve local air quality and ensure continued health protection over the long term. The goal is to avoid violations of a NAAQS and maintain an attainment designation. Since the acceptance into the Ozone Advance Program in April 2019, O_3 levels in Rio Arriba, Sandoval, Santa Fe, and Valencia Counties either currently or recently have exceeded 95% of the 2015 8-hour O_3 NAAQS (67 ppb) and could soon violate this standard. In total, the Ozone Advance

Program and outreach efforts include the following nine counties: Chaves, Doña Ana, Eddy, Lea, Rio Arriba, San Juan, Santa Fe, Sandoval, and Valencia. Although Chaves County does not have O3 monitors, the NMED includes it in the Ozone Advance Program planning effort as it is part of the Permian Basin with oil and gas emissions that contribute to high O_3 levels in Lea and Eddy Counties.

Table 3.16. O_3 Exceedances at the Eddy County Holland Site

Year	O_3 1-hour ppm*			O_3 8-hour ppm*				
	Days with Exceedances	Highest	2nd Highest	Days with Exceedances	Highest	2nd Highest	3rd Highest	4th Highest
2016	0	0.075	0.07	0	0.065	0.064	0.064	0.063
2017	0	0.094	0.091	10	0.082	0.078	0.077	0.076
2018	1	0.128	0.104	18	0.096	0.095	0.091	0.083
2019	0	0.114	0.103	19	0.095	0.092	0.084	0.08
2020	0	0.088	0.087	5	0.075	0.075	0.075	0.073
2021	0	0.098	0.097	23	0.092	0.082	0.08	0.08

Note: Values are from the Eddy County Holland Site: 2811 Holland Street, Carlsbad, New Mexico (ID 350151005).

Source: EPA (2022k).

* Annual fourth-highest daily maximum 8-hour concentration averaged over 3 years.

Table 3.17. O_3 Exceedances at the Eddy County Carlsbad Site

Year	O_3 1-hour ppm*			O_3 8-hour ppm*				
	Days with Exceedances	Highest	2nd Highest	Days with Exceedances	Highest	2nd Highest	3rd Highest	4th Highest
2016	0	0.081	0.078	0	0.07	0.069	0.069	0.069
2017	0	0.073	0.073	0	0.069	0.065	0.065	0.065
2018	0	0.111	0.101	10	0.099	0.081	0.08	0.08
2019	0	0.087	0.084	6	0.082	0.08	0.078	0.074
2020	0	0.083	0.083	9	0.074	0.074	0.073	0.072
2021	0	0.092	0.089	15	0.085	0.08	0.079	0.077

Note: Values are from the Eddy County Carlsbad Site: 727 Carlsbad Caverns Highway, Carlsbad, New Mexico (ID 35010010).

Source: EPA (2022k).

* Annual fourth-highest daily maximum 8-hour concentration averaged over 3 years.

Specific to oil and gas, NMED released the General Construction Permit for Oil and Gas Facilities (GCP-O&G) at the end of April 2018 (NMED 2018). This GCP-O&G registers new and existing minor source oil and gas facilities, replacing GCP-1 and GCP-4 applications. It provides a new permitting path, allowing for increased capacity for certain types of equipment in comparison with GCP-1 and GCP-4; new recordkeeping, monitoring, setback requirements, and reporting requirements may be more stringent than previous GCPs. These standard conditions and setback requirements developed by the GCP-O&G have been established such that the qualifying source would not be anticipated to result in air quality violations or exceedances, including contributing to the current O_3 exceedances.

The primary sources of NO_X nationally are from the burning of fuel. The excess air required for complete combustion of fuels introduces atmospheric nitrogen into the combustion reactions at high temperatures and produces nitrogen oxides. VOCs are components of natural gas and may be emitted from well drilling, operations, and equipment leaks, valves, pipes, and pneumatic devices. Additionally, VOCs are

emitted from a variety of sources, such as refineries, oil and gas production equipment, consumer products, and natural (biogenic) sources, such as trees and plants.

Particulate matter (also known as particle pollution) is a mixture of solid particles and liquid droplets in the air. Particulate matter varies in size: PM_{10} refers to particulate matter 10 micrometers or less in diameter (commonly considered "dust"). $PM_{2.5}$ refers to particulate matter that measures 2.5 micrometers or less (i.e., fine particles), which are the main cause of reduced visibility (haze) in the United States (EPA 2022b). The EPA regulates particulate matter 10 micrometers in diameter or smaller (PM_{10} and $PM_{2.5}$) because these smaller particles are associated with negative health effects, including respiratory and cardiovascular problems, and because they can become more deeply imbedded into the lungs and may even get into the bloodstream (EPA 2022b) but does not regulate particles larger than 10 micrometers in diameter (such as sand and larger dust particles). PM_{10} and $PM_{2.5}$ are not currently monitored in the analysis area, and there are no areas of high concentrations that would warrant monitoring by the NMED. Like O_3, most particulate matter is formed by reactions between other chemicals, specifically between SO_2 and NO_X, which are emitted from vehicles, power plants, and other industrial processes (EPA 2022b). Particulate matter emissions often result directly from activities like construction, traffic on unpaved roads, fields, and fires (EPA 2022b). Particulate matter is of heightened concern when emissions are near sensitive receptors, such as residences, because particulate matter can be present in higher concentrations in a localized area prior to settling or dispersion.

CRITERIA POLLUTANT EMISSIONS

Along with criteria pollutant concentrations as measured by air monitors, the EPA provides data on criteria pollutant emissions, expressed in tons per year or total volume of pollutant released into the atmosphere. Emissions data point to which industries and/or practices are contributing the most to the general level of pollution (BLM 2022a). Total emissions within the analysis area are reported in Table 3.18, based on 2017 National Emissions Inventory (NEI) in tons per year (EPA 2021c).

Table 3.18. Emissions in the New Mexico Portion of the Permian Basin, in Tons per Year

County (Chaves, Eddy, Lea, and Roosevelt)	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2
2017 NEI—all sources	33,217	78,938	172,241	39,761	7,086	7,577
2017 NEI Chaves County all sources	4,791	18,024	33,767	8,966	1,452	80
2017 NEI Eddy County all sources	10,083	31,592	64,734	13,957	2,803	1,288
2017 NEI Lea County all sources	15,514	23,582	65,207	12,309	2,048	6,185
2017 NEI Roosevelt County all sources	2,830	5,741	8,533	4,528	783	23
2017 NEI—petroleum and related industries	13,001	–	82,793	–	–	–
WESTAR-WRAP 2014 oil and gas sources[§†]	30,351	–	121,644	–	–	–

Note: BLM reports both biogenic and human-caused emissions in the table above. The table above shows emissions by county including biogenic sources. Biogenic emissions include natural emissions from vegetation and soil and contributed 4,790 tons of NO_x, 19,679 tons of CO, and 79,137 tons of VOCs in 2017. Emissions of PM_{10}, $PM_{2.5}$, and SO_2 result solely from human-caused sources. The portion of Human-caused emissions contributing to the 2017 NEI totals are 28,426 tons, 59,260 tons, and 93,104 tons for NO_x, CO, and VOCs, respectively.

[§]Only precursor pollutants to ozone formation are compared in this analysis (NO_x and VOC).

Source: EPA (2021c); Data pulled from NEI as of September 2021. Values may not always sum correctly if queried on demand as the NEI database updates its emissions periodically with newer emission information. Values include Tier 1 summaries for each county, including combustion, industrial, on-road/nonroad, and miscellaneous sectors.

[†] Source: Ramboll Environ (2017). WESTAR-WRAP data includes Roosevelt County emissions; 133 tons per year of NO_x emissions and 374 tons per year VOCs.

The primary sources of air pollution in the PDO are dust from blowing wind on disturbed or exposed soil, exhaust emissions from motorized equipment, oil and gas development, agriculture, and industrial sources. Table 3.18 shows annual emissions, including fire and biogenic substances, for each of the

counties in the PDO based on EPA's 2017 emissions inventory in tons/year (EPA 2021c). The Western States Air Resources Council-Western Regional Air Partnership (WESTAR-WRAP) conducted an oil and gas emissions inventory report for base year 2014 to further clarify the contributions of oil and gas activities to human-caused emissions within the Permian and San Juan Basins (BLM 2022a). The results indicate there are non-point sources, including fugitive components, pneumatic devices, pumps, and well blowdown events, that may not be reported through the state and federal inventories. These nonpoint sources could represent greater criteria, HAPs, and GHG emissions within these basins, in particular VOC and NO_X emissions that contribute to O_3 formation. It is therefore believed that the NEI data related to Petroleum and Related Industries is underreported in terms of VOC and NO_X emissions. Table 3.18 provides the 2017 NEI and WESTAR-WRAP datasets. Because the inventories are not presenting the same base-year emissions, it is not possible to make a meaningful comparison as to the magnitude of potential underestimates of emissions; however, both datasets are provided below for reference.

AIR QUALITY INDEX

Air quality in a given region can also be measured by its Air Quality Index (AQI) value. The AQI is used to report daily air quality information in an easy-to-understand way by explaining how local air quality relates to human health. Calculated by the EPA, the AQI considers the following: O_3, particulate matter ($PM_{2.5}$ and PM_{10}), NO_2, and CO (all except Pb). As of Dec 8, 2021, SO_2 is no longer included in the air quality index report because SO_2 concentrations tend to be very localized and not necessarily representative of broad geographical areas (EPA 2021d).

The AQI translates daily air quality data into a tiered, color-coded system that helps people understand how clean outdoor air is, who may be affected if pollutant levels are higher than desired, and when individuals may want to take measures to protect their own health. The higher the AQI value, the greater the level of air pollution and the greater the concern for public health. An AQI value of 100 typically corresponds to the NAAQS set for that pollutant, and values below 100 are considered satisfactory for public health. Table 3.19 presents the AQI values (with associated color category) and levels of health concern.

Table 3.19. Air Quality Index

AQI Values	Levels of Health Concern	Meaning
0 to 50 (green)	Good	Air quality is considered satisfactory, and air pollution poses little or no risk.
51 to 100 (yellow)	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
101 to 150 (orange)	Unhealthy for sensitive groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
151 to 200 (red)	Unhealthy	Everyone may begin to experience health effects, and members of sensitive groups may experience more than serious health effects.
201 to 300 (purple)	Very unhealthy	Health alert: everyone may experience more serious health effects.
301 to 500 (maroon)	Hazardous	Health warnings of emergency conditions. The entire population is more likely to be affected.

Source: EPA (2022l).

Note: AQI values above 500 are considered beyond the AQI and represent extreme levels of particle pollution.

The AQI summary report provides annual summary information, including maximum AQI values and count of days in each AQI category (EPA 2022m). Table 3.20 lists the number of days in which the AQI was "unhealthy for sensitive groups" or worse for the past 10 years. Over the past 10 years, Eddy County

shows an upward trend in maximum AQI while Lea County shows no significant trends in maximum AQI.

Table 3.20. AQI Summary Data for Number of Days Classified above 100 for the Analysis Area (2011–2021)

Location	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Eddy County	7	10	2	4	0	0	10	20	19	11	26
Lea County	7	1	2	3	1	0	4	6	4	0	3

Source: EPA (2022m).

Note: Data from Chaves County are available for less than one-third of the year, and therefore, the data from this site are not included to avoid providing misleading information due to incomplete data. However, based on the Chaves County data that are available, the number of days with AQI over 100 is one or fewer for each of the years represented. No data is available for Roosevelt County.

HAZARDOUS AIR POLLUTANTS

The CAA requires control measures for HAPs. A pollutant is classified as a HAP if it has been identified by the EPA as a compound that is known or suspected to cause cancer or other serious health effects, such as compromises to immune and reproductive systems, birth defects, developmental disorders, and/or adverse environmental effects (BLM 2022a). There are currently 188 compounds listed as HAPs by the EPA. NESHAPs, established by the EPA, limit the release of specified HAPs from specific industries (BLM 2022a). NESHAPs for oil and gas development include control of benzene, toluene, ethyl benzene, mixed xylenes, and n-hexane from major sources, and benzene emissions from triethylene glycol dehydration units as area sources (BLM 2022a). The CAA defines a major source for HAPs as being one that emits 10 tons per year of any single HAP or 25 tons per year of any combination of HAPs. Under state regulations, a construction or operating permit may be required for a major source, and for New Mexico, determining a major source requires consideration of each oil and gas exploration and production well individually (BLM 2022a). In New Mexico, regulations for major sources are found under NMAC 20.2.70 and 20.2.71.

The Air Resources Technical Report discusses the relevance of HAPs to oil and gas development and the particular HAPs that are regulated in relation to these activities (BLM 2022a). The Air Toxics Screening Assessment (AirToxScreen), published by the EPA, provides a screening tool for state, local, and tribal air agencies. AirToxScreen's results help the EPA and other agencies identify which pollutants, emission sources, and places they may wish to study further to better understand any possible risks to public health from air toxics. AirToxScreen is the successor to the previous National Air Toxics Assessment, or NATA. In March 2022, EPA released the results of its 2017 AirToxScreen. AirToxScreen calculates concentration and risk estimates from a single year's emissions data using meteorological data for that same year. The risk estimates assume a person breathes these emissions each year over a lifetime (or approximately 70 years). AirToxScreen then provides quantitative estimates of potential cancer risk and five classes of non-cancer hazards (grouped by organ/system: immunological, kidney, liver, neurological, and respiratory) associated with chronic inhalation exposure to real-world toxics for each county and census tract (BLM 2022a). The 2017 AirToxScreen assessment includes emissions, ambient concentrations, and exposure estimates for about 180 of the 188 CAA air toxics plus diesel particulate matter (diesel PM). AirToxScreen cannot give precise exposures and risks for a specific individual; therefore, AirToxScreen data are best applied to larger areas. AirToxScreen derives concentration and risk estimates from emissions data from a single year and assumes a person breathes these emissions each year over a lifetime (approximately 70 years). Lastly, AirToxScreen only considers health impacts from breathing air toxics and does not take into account indoor hazards, contacting or ingesting these air toxics, or other ways in which people may be exposed (BLM 2022a). A review of the results of the 2017

AirToxScreen shows that cancer, neurological risks, and respiratory risks in the analysis area are all lower than national levels and are generally the same as the state of New Mexico.

The 2017 AirToxScreen map application reveals that the total cancer risk (defined as the probability of contracting cancer over the course of a 70-year lifetime, assuming continuous exposure) from human-caused emissions of HAPs in most of the analysis area is approximately 19 to 22 cases per 1 million people, which is lower than the nationwide level (28.7 cases per 1 million people) and in the same range as the state of New Mexico (20.3 cases per 1 million people). The total cancer risk is 20.3, 19.5, and 21.4 for Lea, Chaves, and Eddy Counties, respectively (BLM 2022a).

AirToxScreen non-cancer hazards (i.e., respiratory and neurological) are expressed as a ratio of an exposure concentration to a reference concentration (RfC) associated with observable adverse health effects (i.e., a hazard quotient). For a given air toxic, exposures at or below the RfC (i.e., hazard quotients are 1 or less) are not likely to be associated with adverse health effects. As exposures increase above the RfC (i.e., hazard quotients are greater than 1), the potential for significant adverse effects also increases (EPA 2018). The total respiratory hazard quotient in the analysis area ranges from 0.22 to 0.24, which is lower than that of the nation (0.36) and within a similar range as that of the state (0.24). The total neurological hazard quotient in the analysis area ranges from 0.015 to 0.017, which is lower than that of the nation (0.035) and within a similar range of that of the state (0.019).

REASONABLY FORESEEABLE ENVIRONMENTAL TRENDS AND PLANNED ACTIONS

Current estimated emissions across the analysis area (Chaves, Eddy, Roosevelt and Lea Counties) and air quality across the analysis area is generally good based on AQI ratings over the last decade (see Table 3.19). Current estimated emissions and AQI ratings are reflective of the effects of past and present actions. While there are other sources of emissions in the 20 million-acre PDO, oil and gas development is one of the most prominent sources of emissions. There are 41,006 active oil and gas wells in the New Mexico Permian Basin. Of this total, 18,690 wells are federal, with the remainder falling in other jurisdictions (BLM 2022a). Over the last 6 years, there have been 2,641 federal well completions in the Pecos District (Table 3.21).

Table 3.21. Past and Present Federal Well Completions

Number of Federal Well Completions*	2016	2017	2018	2019	2020	2021
Pecos District	150	199	261	284	1,160	587

Sources: BLM (2021a, 2021b)

Note: Methodology updated to use SNT.50 Reports from AFMSS. Wells completed from 2016 through 2019 are reported from BLM AFMSS 1 with run date April 2021 (BLM 2021a). Wells completed from 2020 through 2021 are reported from BLM AFMSS II with run date August 2022 (BLM 2021b). Counts for AFMSS I and AFMSS II used different methods, hence a marked increase in 2020. AFMSS II counts each single well completion separately. The number of wells developed after the start of the RFD for each respective field office (2018 for FFO and 2016 for PDO) are presented to disclose the current levels of development toward the total reasonably foreseeable development projections.

* PDO number of BLM federal and non-federal wells in PDO RFD (2016–2037) is 16,000. PDO BLM wells includes completions from Carlsbad, Hobbs, and Roswell Field Offices.

As with past and present actions, continued oil and gas development is the most prominent reasonably foreseeable future action (RFFA) affecting air quality in the PDO. The 2012 and 2014 RFD scenario estimates that there could be an additional 16,000 wells drilled by 2035, of which 6,400 would be federal (Engler and Cather 2014; Engler et al. 2012). However, the CFO is currently undertaking an RMP plan revision, and as part of that, is revising its RFD well projections and air modeling. As such, the BLM Air Resources Technical Report (BLM 2022a) provides information related to the reasonably foreseeable development for the PDO planning area. Reasonably foreseeable development projected for a 20-year

time period shows well development with an average of 800 wells per year (of which 320 would be federal). Annual well averages are multiplied by the one oil-well pollutant emission factor (Table 3.22) to calculate RFFA annual emissions for both federal well development and federal and non-federal well development associated with the RFD scenario (see Table 3.22).

Emissions are anticipated to be at the most acute level during the construction and completion phases of implementation (estimated to be 30–60 days). Localized and short-term effects on air quality for nearby residences from emissions of particulate matter, NO_X, VOCs, and HAPs are expected; however, because well development varies (i.e., permit approval, well pad construction, spudding, and completion), the phases of development may not occur in succession but may be spread out in development over time as a result of the varying development plans and approaches of lessees in the context of overall oil and gas development throughout the analysis area. The parcels may not be developed at all. As such, the incremental addition of criteria pollutants and VOCs over a period of 20 years would not be expected to result in any direct exceedances of the NAAQS or NMAAQS for any criteria pollutants in the analysis area. These areas have not been formally declared non-attainment by the EPA through the State's recommendation. The BLM will continue to monitor these areas and participate in any ozone initiative meetings and strategies recommended by the State.

Table 3.22. Air Emissions from Annual Oil and Gas Well Development Associated with the RFD Scenario

Air Emissions	Lease Sale Emissions (tons per year)					
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOC
Current emissions (Chaves, Eddy, Lea, and Roosevelt Counties)	39,761	7,086	33,217	7,577	78,938	172,241
One oil-well emission factors*	0.58	0.27	4.53	0.12	2.06	4.46†
One gas-well emission factors	0.67	0.33	5.53	0.11	1.87	0.77
Total annual emissions for annual reasonably foreseeable federal well development (320 wells)	**185.60**	**86.40**	**1,449.60**	**38.40**	**659.20**	**1,427.20**
Percent increase	0.47%	1.22%	4.36%	0.51%	0.84%	0.83%
Total annual emissions for annual reasonably foreseeable federal and non-federal well development (800 wells)	464	216	3,624	96	1,648	3,568
Percent increase	1.17%	3.05%	10.91%	1.27%	2.09%	2.07%

Note: The analysis contained in this table provides percentage contribution rounded to two decimal points.

* The representative well used to calculate emissions is a horizontal oil well. Emissions for vertical wells were not used from this analysis due to current predominance in horizontal technological drilling methods and because presenting horizontal well emissions estimates represents a more conservative summary of emissions, compared with emissions from a vertical well, with the exception of SO_2, which could be four to five times greater in a vertical well scenario. However, sulfur dioxide emissions are still estimated to be within the same magnitude and less than 1 ton per year of SO_2 emissions per well. Oil wells are used for this analysis because they are the more prevalent well type in the PDO area. However, note that emissions of some compounds (NO_x, SO_2, PM_{10}, and $PM_{2.5}$) tend to be higher for gas well development in the area, but gas wells emit lower amounts of VOCs, CO, and HAPs.

† VOC emissions at the operational phase represent uncontrolled emissions and estimate potential emissions representing the contribution for "one oil well" from the emissions at storage tanks, gathering facilities, etc. However, federally enforceable regulations such as New Source Performance Standards (NSPS) OOOO and OOOOa both require emission reduction of VOC from well completions following hydraulic fracturing or refracturing and storage tanks with emissions greater than 6 tons per year after federally enforceable controls. Therefore, actual emissions from the one well scenario are likely be lower than represented.

An ARTSD (URS 2013) was prepared to analyze potential air quality effects resulting from the RFD scenario. This effort included atmospheric dispersion and photochemical grid modeling to predict concentrations of specific pollutants in and around the BLM CFO (in which most of the Pecos District oil and gas activity occurs). The results of ARTSD analysis indicate that air quality effects from the RFD scenario, while noticeable, are generally acceptable. Most predicted criteria pollutant concentrations are

well below the NAAQS throughout the extensive modeling domains included in this analysis. While no exceedances of NAAQS were predicted from the modeling of federal wells associated with the RFD scenario, consideration of the entire RFD scenario, and other reasonably foreseeable trends and planned actions RFFAs (in the ARTSD) included predictions of pollutant concentrations approaching or exceeding the NAAQS (for O_3, $PM_{2.5}$, and potentially SO_2) and indicate the need for additional ambient monitoring data, refined modeling, and consideration of additional mitigation measures. Most of the areas where NAAQS were projected to be exceeded are out of the BLM CFO region (URS 2013), including potential exceedances at CCNP. The CFO is currently undertaking a plan revision, and as part of that, is revising its RFD and air modeling.

3.6.1.2 *Environmental Effects*

METHODOLOGY AND ASSUMPTIONS

Methodology and assumptions for calculating air pollutant emissions and developing inputs for the calculators are described in the Air Resources Technical Report (BLM 2022a). Emissions calculators were developed by air quality specialists at the BLM National Operations Center in Denver, Colorado, and account for a number of variables, including access and construction requirements, equipment, and other infrastructure needs, as well as expected production volumes. Because these calculators quantify emissions based on averages and several assumptions (e.g., construction methods, all wells would be hydraulically fractured), these estimates provide approximations of emissions of criteria pollutants, VOCs, and HAPs relative to regional and national levels. Additionally, the BLM in New Mexico has modified the calculators and assumptions for use in analyzing a single well to more closely represent oil and gas wells in the state, specifically the San Juan and Permian Basins. However, it must be understood that the calculators were originally designed to make estimations of emissions at the resource management plan (RMP) level, which would result in some averaging and smoothing of assumptions. At the single well level, the uncertainty in emissions projections increases substantially (BLM 2022a). Emissions estimates per well are included in Table 3.23.

EFFECTS ANALYSIS

Future potential development of the nominated lease parcels would include increased criteria pollutant emissions, including increased particulate matter released from new well pads or roads, exhaust emissions from drilling equipment, compressor engines, vehicles, flares, dehydration and separation facilities, and VOCs during drilling and production activities. As stated above, the most substantial criteria pollutants and O_3 precursors emitted by oil and gas development and production are VOCs, particulate matter, and NO_2.

Future potential development on the nominated lease parcels is estimated at 19 horizontal wells (1 well per parcel) (see Table 3.1). The future potential development of the nominated lease parcels associated with the Proposed Action comprises 0.12% of the RFD scenario and would be 2.38% of annual reasonably foreseeable development (800 wells). Reasonably foreseeable trends and planned actions would incrementally contribute to increases in in criteria pollutants between 1.17% to 10.91% of existing annual emissions of all well development, federal and non-federal (see Table 3.22).

VOCs and NO_2 contribute to the formation of O_3, which is the pollutant of most concern in the Permian Basin, and because O_3 is not a direct emission, emissions of NO_X and VOCs are used as proxies for estimating O_3 levels. Under the Proposed Action, the additional NO_X and VOC emissions (quantified in Table 3.23) from the well would incrementally add to O_3 levels within the analysis area, which recently exceeded NAAQS in Eddy County. Given that only 19 wells are expected to be developed as part of the Proposed Action and are dispersed across the analysis area, it is not expected that the Proposed Action would lead directly to additional NAAQS exceedances of O_3 in Eddy County. As previously discussed in

Section 3.6.1.1, no exceedances of NAAQS were predicted from the modeling of federal wells associated with the RFD scenario (6,400 wells), which is inclusive of the estimated nineteen wells under the Proposed Action. Although O_3 exceedances may continue to be an issue in Eddy County, any future potential well development for the Proposed Action would be subject to the state and federal regulations previously discussed (Section 3.6.1.1), as well as NMED GCP requirements, all of which include measures to reduce O_3 concentrations in the state. HAP emissions could include 0.31 and 0.06 ton per well per year for an oil well and a gas well, respectively. The CAA defines a major source for HAPs to be one emitting 10 tons per year of any single HAP or 25 tons per year of any combination of HAPs (BLM 2022a). Emissions presented in this analysis conservatively represent uncontrolled emission rates prior to implementation of applicable federally enforceable controls. Therefore, it is not expected that the Proposed Action would be a major source of HAP emissions.

Table 3.23. Percent Increase from Future Potential Development of the Lease Parcels

Future Potential Development	Lease Sale Emissions (tons per year)					
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOC
Current emissions (Chaves, Eddy, Lea, and Roosevelt Counties)	39,761	7,086	33,217	7,577	78,938	172,241
One oil-well emission factors*	0.58	0.27	4.53	0.12	2.06	4.46†
One gas-well emission factors*	0.67	0.33	5.53	0.11	1.87	0.77
Total emissions from lease sale (19 wells)	11.02	5.13	86.07	2.28	39.14	84.74
Percent increase	0.03%	0.07%	0.26%	0.03%	0.05%	0.05%

Note: The analysis contained in this table provides percentage contribution rounded to two decimal points.

Note: HAPs from the 2017 NEI Inventory are not included for comparison at the county level as a large portion of the inventory includes only facility level emissions emitted after controls are accounted for and only includes facility level or sources as required to be reported by the NMED. HAP emissions could include 0.31 and 0.06 tons per well/year for an oil well and a gas well respectively.

* The emission estimates for a one-well (oil well) scenario include construction, operations, maintenance, and reclamation activities. Construction emissions include well pad construction (fugitive dust), heavy equipment combustive emissions, commuting vehicles, and wind erosion. Emissions from operations include well workover operations (exhaust and fugitive dust), well site visits for inspection and repair, recompletion traffic, water and oil tank traffic, venting, compression and well pumps, dehydrators, and compression station fugitives. Maintenance emissions for both oil and gas wells are for road travel, and reclamation emission activities are for interim and final activities and include truck traffic, a dozer, a blade, and track hoe equipment. The representative well used to calculate emissions is a horizontal oil well. Emissions for vertical wells were not used from this analysis due to current predominance in horizontal technological drilling methods and because presenting horizontal oil well emissions estimates represent a more conservative summary of emissions, compared with emissions from a vertical well, with the exception of SO_2, which could be four to five times greater in a vertical well scenario. However, sulfur dioxide emissions are still estimated to be within the same magnitude and less than 1 ton per year of SO_2 emissions per well. Oil wells are used for this analysis because they are the more prevalent well type in the PDO area. However, note that emissions of some compounds (NO_x, SO_2, PM_{10}, and $PM_{2.5}$) tend to be higher for gas well development in the area, but gas wells emit lower amounts of VOCs, CO, and HAPs.

† VOC emissions at the operational phase represent uncontrolled emissions and estimate potential emissions representing the contribution for "one oil well" from the emissions at storage tanks, gathering facilities, etc. However, federally enforceable regulations such as New Source Performance Standards (NSPS) OOOO and OOOOa both require emission reduction of VOC from well completions following hydraulic fracturing or refracturing and storage tanks with emissions greater than 6 tons per year after federally enforceable controls. Therefore, actual emissions from the one well scenario are likely be lower than represented.

Under the Proposed Action, particulate matter emissions (PM_{10} and $PM_{2.5}$) would increase by 0.03% and 0.07%, respectively. Construction activities would be one of the primary sources of particulate matter emissions as a result of dust and fine particles generated from on-site equipment use and related groundwork, as well as on- and off-site vehicles (Araújo et al. 2014; Reid et al. 2010). How particulate matter interacts with the environment is dependent on a variety of factors, with the size and chemical composition of the airborne particles being the most important in terms of dispersion (distance from the source) and deposition from the atmosphere. Effects of particulate matter emissions would not be confined to the construction site because $PM_{2.5}$ (fine particles) can travel farther in terms of distance than PM_{10} (dust) and other total suspended particulates (particles of sizes up to 50 micrometers) and therefore can affect local residents in the surrounding area (Araújo et al. 2014). According to Araújo et al. (2014), construction site activities may influence the environment in the immediate area or neighborhood through

emissions of total suspended particulate. Total suspended particulates are particles that have lower permanence in the atmosphere, thereby depositing near the emission sources (Araújo et al. 2014). The dispersion and concentration of particulate matter emissions depend on the technology and management control methods used by each project and the weather condition variables (i.e., wind speed, wind direction, and humidity/moisture) (Araújo et al. 2014). The nominated lease parcels do not contain any residences. The nearest residence to any of the nominated lease parcels is approximately 0.06 mile southeast (6800) and 0.16 mile west (6795). However, the use of best management practices (BMPs) as described in Section 3.6.1.3 can reduce off-site effects from fugitive dust.

The Proposed Action may also result in localized effects to air quality at nearby residences due to O_3 precursors and HAP emissions. A significant portion of the criteria pollutants, VOCs, and HAP emissions would be from construction and completion from future potential development of the nominated lease parcels; therefore, the Proposed Action would result in short-term increases in these emissions, lasting an average of 30 to 60 days. As stated above, air quality is dependent not only on the quantity of air pollutants, but also environmental conditions (humidity, wind direction and speed, temperature) that influence concentration and/or dispersion of pollutants. Ongoing operations of the well site would be subject to state and federal permitting (unless emissions are so minimal the site qualifies as de minimis), recordkeeping, monitoring, and reporting requirements, which ensure compliance with air quality emission standards.

Levels of HAPs would also temporarily increase during construction and completion activities under the Proposed Action, particularly in the form of diesel particulate matter from the on- and off-road construction equipment. However, concentrations of mobile source emissions of diesel particulate matter are typically reduced by 60% at a distance of approximately 300 feet (Zhu et al. 2002). According to Zhu et al. (2002), the ultrafine particle (diameter <100 nanometers) concentration measured at 300 m downwind from source of emissions was indistinguishable from the upwind background concentration. The relatively steep drop-off with distance of diesel particulate matter concentrations as well as the short duration of the activity make the effects from exposure to HAP emissions minimal during construction. HAP emissions could include 0.31 and 0.06 ton per well per year for an oil well and a gas well, respectively.

Ongoing operations of the well site would be subject to state and federal permitting (unless emissions are so minimal the site qualifies as *de minimis*), recordkeeping, monitoring, and reporting requirements, which ensure compliance with air quality emission standards. Compliance with state and federal permitting requirements are designed to ensure that a proposed source will not cause or contribute to a violation of NAAQS standards.

3.6.1.3 *Mitigation Measures and Residual Effects*

Although there will be emissions associated with the RFD, including future potential development of leases, there would also be substantial decreases in emissions from fossil-fired electric generating units in the area (BLM 2022a). New Mexico will have to comply with the Federal Regional Haze Rule requirements as it develops its SIP for the second planning period. New Mexico is currently in the 2021 Regional Haze Planning Process and is in the process of updating its Regional Haze SIP, however, as of August 25, 2022, the EPA reported that New Mexico and several other states have failed to submit complete Regional Haze SIPs for the second planning period. (EPA 2022n). The EPA has promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of VOCs during gas well completions. Based on its authority under the standard terms and conditions, the BLM requires industry to incorporate and implement BMPs, which are designed to reduce effects on air quality by reducing emissions, surface disturbances, and dust from field production and operations. Typical measures include requirements for

watering dirt roads or applying magnesium chloride dust suppressants on dirt roads during periods of high use to reduce fugitive dust emissions of PM_{10} (Intermountain Oil and Gas BMP Project 2013); colocation of wells and production facilities to reduce new surface disturbance; implementation of directional and horizontal drilling and completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores; suggestions that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored; and interim reclamation to revegetate areas not required for production facilities and reduce the amount of fugitive dust.

In addition, the BLM encourages industry to participate in the Natural Gas STAR program, administered by the EPA (EPA 2022o). The Natural Gas STAR program is a flexible, voluntary partnership that encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions (EPA 2022o).

Further, the EPA provides control measures for emission mitigation of various pollutants in the Menu of Control Measures (MCM). The MCM provides state, local, and tribal air agencies with information on existing emissions reduction measures, as well as relevant information concerning the efficiency and cost effectiveness of the measures. The MCM includes information on measures for large point sources of emissions, as well as some information on measures for nonpoint sources of emissions. State, local, and tribal agencies will be able to use this information in developing emissions reduction strategies, plans, and programs to assure they attain and maintain the NAAQS (EPA 2022p).

NO_X reductions can include several control measures from oil and gas–related point sources. One such measure is selective catalytic reduction (SCR) for natural gas compressors. This control is the reduction of NO_X through add-on controls. SCR controls are post-combustion control technologies based on the chemical reduction of NO_X into molecular nitrogen (N_2) and water vapor (H_2O). The SCR utilizes a catalyst to increase the NO_X removal efficiency, which allows the process to occur at lower temperatures. This control applies to compressors used in natural gas production operations, natural gas–fired and process gas–fired heaters with NO_X emissions greater than 10 tons per year. This method generally offers an 80% control efficiency for NO_X (EPA 2022p).

Another NO_X control measure for non-point sources is for process heaters using natural gas or process gas. This control is the use of low-NO_X burner (LNB) technology to reduce NO_X emissions. LNBs reduce the amount of NO_X created from reaction between fuel nitrogen and oxygen by lowering the temperature of one combustion zone and reducing the amount of oxygen available in another. This control is applicable to natural gas–fired and process gas–fired process heaters with uncontrolled NO_X emissions greater than 10 tons per year (EPA 2022p).

VOC control measures from oil and gas–related non-point sources include reducing emissions at storage tanks, use of flares, and a leak detection and repair program to capture fugitive emissions (leaks). The EPA has New Source Performance Standards (NSPS) in place at 40 CFR 60, Subparts OOOO and OOOOa, to reduce VOCs from well completion operations and storage tanks constructed after August 23, 2011. NSPS OOOOa requires reduction of VOCs from well completion operations and storage tanks and imposes semiannual monitoring requirements for the collection of fugitive emission components at well sites constructed after September 18, 2015. Following the 2020 amendment to OOOO and OOOOa, fugitive emissions monitoring is only required for those wells producing greater than 15 bbl per day. Other emission controls of VOCs include vapor recovery units, enclosed combustors (vapor combustion unit), and open-tipped (candlestick flares). The most desirable control method is a vapor recovery unit since this recovers the natural gas production and sends the gas to the sales line or back to the process for facility use. In lieu of vapor recovery, flaring of waste gas generally reduces 98% of VOC emissions at oil and gas sites (EPA 2022p).

On May 25, 2021, in accordance with Governor Michelle Lujan Grisham's Executive Order 2019-003 (January 29, 2019), the Energy, Minerals and Natural Resources Department (EMNRD) announced the release of the NMOCD proposed Statewide Natural Gas Capture Requirements, NMAC 19.15.27.9, as part of New Mexico's statewide, enforceable regulatory framework to secure reductions in oil and gas sector emissions and to prevent natural gas waste from new and existing sources. Key provisions include prohibition of unnecessary venting and flaring of waste natural gas where it is technically feasible to route the gas to pipeline or to use this gas for some other beneficial purpose (such as on-site fuel consumption). In all cases, operators must flare rather than vent natural gas except where this is technically infeasible or would pose a safety risk. These provisions will reduce VOC emissions due to stringent limitations on natural gas venting which results in un-combusted VOC emissions. Additionally, it proposes that natural gas be recovered and reused rather than flared, which would result in reductions of VOC, NO_X, CO, SO_2, and particulate matter emissions.

The Statewide Natural Gas Capture Requirements focus on natural gas loss reporting, collection of baseline gas capture data and natural gas waste targets and requires monthly reporting, monitoring, and recordkeeping and requires operators to reduce their natural gas waste by a fixed amount each year to achieve a gas capture rate of 98% by December 31, 2026.

The specified emission control techniques have varying degrees of effectiveness as discussed above. Therefore, the mitigation measures applied to future potential development of the nominated lease parcels would reduce emissions of particulate matter and VOCs but would not completely eliminate these emissions. Emission control techniques would be further evaluated when specific lease development projects are proposed.

3.6.2 Issue 2: Greenhouse Gases and Climate Change

How would future potential development of nominated lease parcels contribute to greenhouse gas (GHG) emissions and climate change?

Future development of the nominated lease parcels could lead to emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), the three most common GHGs associated with oil and gas development. These GHG emissions would be emitted from leased parcels if developed, and from the consumption of any fluid minerals that may be produced. However, the BLM cannot reasonably determine at the leasing stage whether, when, or in what manner a lease would be explored or developed. The uncertainty that exists at the time the BLM offers a lease for sale includes crucial factors that would affect actual GHG emissions and associated impacts, including but not limited to the future feasibility of developing the lease, well density, geological conditions, development type (vertical, directional, or horizontal), hydrocarbon characteristics, specific equipment used during construction, drilling, production, abandonment operations, production and transportation, and potential regulatory changes over the 10-year primary lease term. Actual development on a lease may vary from that analyzed in this EA and may be evaluated through site-specific environmental review documentation when an operator submits an APD or plan of development to the BLM.

For the purposes of this analysis, the BLM has evaluated the potential effects of the proposed leasing action on climate change by estimating and analyzing potential GHG emissions from projected oil and gas development on the nominated lease parcels using estimates based on past oil and gas development and available information from existing development within the state.

Further discussion of climate change science and predicted impacts, as well as the reasonably foreseeable and cumulative GHG emissions associated with BLM's oil and gas leasing actions, are included in the 2021 Annual GHG Report (BLM 2022c). This report presents the estimated emissions of GHGs

attributable to development and consumption of fossil fuels produced on lands and mineral estates managed by the BLM. The Annual GHG Report is incorporated by reference as an integral part of this analysis and is available at https://www.blm.gov/content/ghg/2022.

3.6.2.1 *Affected Environment*

CLIMATE CHANGE AND GREENHOUSE GASES

Climate change is a global process that is affected by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from a single proposed land management action cannot be accurately translated into its potential effect on global climate change or any localized effects in the area specific to the action. Currently, global climate models are unable to forecast local or regional effects on resources as a result of specific emissions. However, there are general projections regarding potential impacts to natural resources and plant and animal species that may be attributed to climate change resulting from the accumulation of GHG emissions over time. GHGs influence the global climate by increasing the amount of solar energy retained by land, water bodies, and the atmosphere. GHGs can have long atmospheric lifetimes, which allow them to become well mixed and uniformly distributed over the entirety of the Earth's surface no matter their point of origin. Therefore, potential emissions resulting from the Proposed Action can be compared with state, national, and global GHG emission totals to provide context of their significance and potential contribution to climate change impacts.

Table 3.24 shows the total estimated GHG emissions from fossil fuels at the global, national, and state scales over the previous 5 years. Emissions are shown in megatonnes (Mt) per year of carbon dioxide equivalent (CO_2e). Chapter 3 of the Annual GHG Report contains additional information on GHGs and an explanation of CO_2e. State and national energy-related CO_2 emissions include emissions from fossil fuel use across all sectors (residential, commercial, industrial, transportation, and electricity generation) and are released at the location where the fossil fuels are consumed.

Additional information on current state, national, and global GHG emissions as well as the methodology and parameters for estimating emissions from BLM fossil fuel authorizations and cumulative GHG emissions is included in the Annual GHG Report (see Chapters 4, 5, and 6).

Table 3.24. Global and U.S. GHG Emissions, 2015–2020 (Mt CO_2/year)

Scale	Emissions (Mt CO_2/year)				
	2016	2017	2018	2019	2020
Global	36,465.6	36,935.6	37,716.2	37,911.4	35,962.9
U.S.	5,077.0	5,005.5	5,159.3	5,036.0	4,535.3
State (New Mexico)	48.7	49.3	45.1	48.3	NA

Sources: Annual GHG Report (BLM 2022c), Chapter 6, Table 6-1 (Global and U.S.) and Table 6-3 (State).
Mt (megatonne) = 1 million metric tons
NA = not available

The continued increase of anthropogenic GHG emissions over the past 60 years has contributed to global climate change impacts. A discussion of past, current, and projected future climate change impacts is described in Chapters 8 and 9 of the Annual GHG Report (BLM 2022c). These chapters describe currently observed climate impacts globally, nationally, and in each state, and present a range of projected impact scenarios depending on future GHG emission levels. These chapters are incorporated by reference in this analysis.

3.6.2.2 *Environmental Consequences*

PROPOSED ACTION ALTERNATIVE

While the leasing action does not directly result in development that would generate GHG emissions, emissions from potential future development of the leased parcels are reasonably foreseeable and can be estimated for the purposes of this lease sale. There are four general phases of post-lease development that would generate GHG emissions: 1) well development (well site construction, well drilling, and well completion), 2) well production operations (extraction, separation, gathering), 3) midstream (refining, processing, storage, and transport/distribution), and 4) end use (combustion or other uses) of the fuels produced. While well development and production operation emissions occur on-lease and the BLM has program authority over these activities, midstream and end-use emissions typically occur off-lease, where the BLM has no program authority.

Emission inventories at the leasing stage are imprecise due to uncertainties with regard to the type (oil, gas, or both), scale, and duration of potential mineral development; types of equipment (drill rig engine tier rating, horsepower, fuel type); and the mitigation measures that future operators may propose in their development plans. In order to estimate reasonably foreseeable on-lease emissions at the leasing stage, the BLM uses estimated well numbers based on state data for past lease development combined with per-well drilling, development, and operating emissions data from representative wells in the area. The amount of oil or gas that may be produced if the offered parcels are developed is unknown. For the purposes of estimating production and end-use emissions, potential wells are assumed to produce oil and gas in amounts similar to those of existing nearby wells. While the BLM has no authority to direct or regulate the end use of the products, for this analysis, the BLM assumes all produced oil or gas would be combusted (such as for domestic heating or energy production). The BLM acknowledges that there may be additional sources of GHG emissions along the distribution, storage, and processing chains (commonly referred to as midstream operations) associated with production from the lease parcels. These sources may include emissions of CH_4 (a more potent GHG than CO_2 in the short term) from pipeline and equipment leaks, storage, and maintenance activities. These sources of emissions are highly speculative at the leasing stage; therefore, the BLM has chosen to assume that midstream emissions associated with lease parcels for this analysis would be similar to the national level of emissions identified by the U.S. Department of Energy's National Energy Technology Laboratory (NETL) (2009, 2019).

The emission estimates calculated for this analysis were generated using the assumptions previously described using the BLM Lease Sale Emissions Tool. Emissions are presented for each of the four phases of post-lease development described above.

- Well development emissions occur over a short period and may include emissions from heavy equipment and vehicle exhaust, drill rig engines, completion equipment, pipe venting, and well treatments such as hydraulic fracturing.
- Well production operation, midstream, and end-use emissions occur over the entire production life of a well, which is assumed to be 20 years for this analysis based on the productive life of a typical oil/gas field.
- Production emissions may result from storage tank breathing and flashing, truck loading, pump engines, heaters and dehydrators, pneumatic instruments or controls, flaring, fugitives, and vehicle exhaust.
- Midstream emissions occur from the transport, refining, processing, storage, transmission, and distribution of produced oil and gas. Midstream emissions are estimated by multiplying the EUR of produced oil and gas with emissions factors from NETL life cycle analysis of U.S. oil and

natural gas. Additional information on emission factors can be found in the Annual GHG Report (Chapter 4, Tables 4-7 and 4-9).

- For the purposes of this analysis, end-use emissions are calculated assuming all produced oil and gas is combusted for energy use. End-use emissions are estimated by multiplying the EUR of produced oil and gas with emissions factors for combustion established by the EPA (Tables C-1 and C-2 to Subpart C of 40 CFR 98). Additional information on emission factors and EUR factors can be found in the Annual GHG Report (Chapter 4) (BLM 2022c).

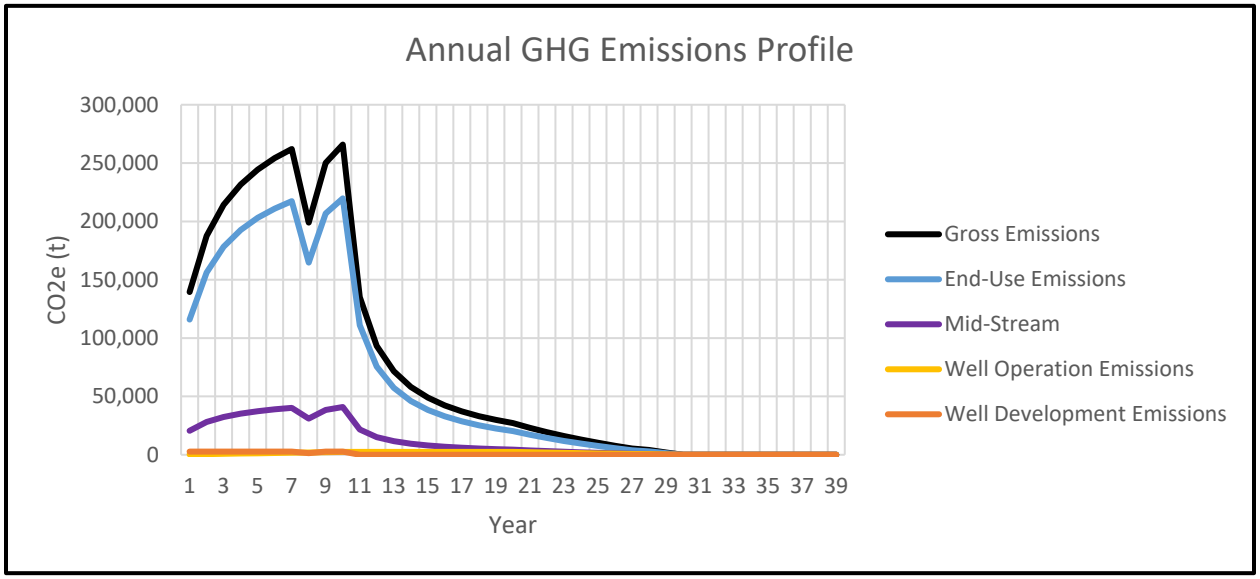
Table 3.25 lists the estimated direct (well development and production operations) and indirect (midstream and end-use) GHG emissions in metric tons for the subject leases over the average 20-year production life of the lease.

Table 3.25. Estimated Life-of-Lease Emissions from Well Development, Well Production Operations, Midstream, and End-Use (tonnes)

Activity	CO_2	CH_4	N_2O	CO_2e (100-year)	CO_2e (20-year)
Well development	10,834	500.84	0.114	25,790	52,184
Well production operations	15,337	1,136.38	0.077	49,222	109,109
Mid-stream	362,333	2,996.71	5.547	453,149	611,076
End-use	2,392,303	74.60	13.010	2,398,078	2,402,009
Total	**2,780,807**	**4,708.53**	**18.749**	**2,926,240**	**3,174,379**

Source: BLM Lease Sale Emissions Tool

GHG emissions vary annually over the production life of a well due to declining production over time. Figure 3.1 shows the estimated annual GHG emissions profile over the production life of a typical lease including well development, well production operations, midstream, end-use, and gross (total of well development, well production, midstream, and end-use) emissions.



Source: BLM Lease Sale Emissions Tool

Figure 3.1. Estimated annual GHG emissions profile over the life of a lease.

To put the estimated GHG emissions for this lease sale in a relatable context, potential emissions that could result from development of the nominated lease parcels can be compared with other common activities that generate GHG emissions and with emissions at the state and national level. The EPA GHG equivalency calculator can be used (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) to express the potential average-year GHG emissions on a scale relatable to everyday life (EPA 2022r). For instance, the projected average annual GHG emissions from expected development following the proposed lease sale are equivalent to 26,963 gasoline-fueled passenger vehicles driven for 1 year, or the emissions that could be avoided by operating 26 wind turbines as an alternative energy source or offset by the carbon sequestration of 151,256 acres of forest land.

Table 3.26 compares the estimated average annual lease-sale emissions with existing federal fossil fuel (oil, gas, and coal) emissions, state, and U.S. total GHG emissions from all sectors as reported in the EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020 (EPA 2022s).

Table 3.26. Comparison of Lease Sale Annual Emissions to Other Sources (megatonnes)

Reference	Mt CO_2e* (per year)	Average Year Percentage of Reference
Lease sale emissions (average year)	0.101	–
New Mexico onshore federal (oil and gas)†	245.71	0.041
U.S. onshore federal (oil and gas)†	465.63	0.022
U.S. federal-all (oil and gas)†	844.27	0.012
U.S. federal (oil, gas, and coal)†	1,292.57	0.008
New Mexico Total (all sectors)‡	74.80	0.166
U.S. Total (all sectors)‡	5,981.40	0.002

* Estimates are based on 100-year global warming potential values.

† Federal values are from the BLM Annual GHG Report (BLM 2022c:Tables ES-1 and ES-2). U.S federal-all includes offshore oil and gas production.

‡ Values are from the EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020 (EPA 2022s) and use IPCC Fourth Assessment Report Global Warming Potentials.

Table 3.27 compares emission estimates over the 20-year life of the lease with the 20-year projected federal emissions in the state and nation from existing wells, the development of approved APDs, and emissions related to reasonably foreseeable lease actions.

Table 3.27. Comparison of the Life-of-Lease Emissions to other Federal Oil and Gas Emissions

Reference	Mt CO_2e (100-year)	Life of Lease Percentage of Reference
Lease sale emissions (life of lease)	2.926	100.000
New Mexico reasonably foreseeable short-term federal (oil and gas)*	1,939.52	0.151
New Mexico U.S. Energy Information Administration (EIA)-projected long-term federal (oil and gas)†	5,767.27	0.051
U.S. short-term federal (oil and gas)	4,614.81	0.063
U.S. long-term federal (oil and gas)	13,560.24	0.022

Source: U.S. and federal emissions from BLM Lease Sale Emissions Tool and Annual GHG Report (BLM 2022c:Tables 5-17 and 5-18).

* Short-term foreseeable is estimated federal emissions from existing producing wells, approved APDs, and 1 year of leasing.

† Long-term foreseeable is estimated federal emissions to meet EIA-projected energy demand.

Compared with emissions from other existing and foreseeable short-term federal oil and gas development, the life-of-lease emissions for the Proposed Action is between 0.051% and 0.151% of federal fossil fuel authorization emissions in the state and between 0.022% and 0.063% of federal fossil fuel authorization emissions in the nation. If foreseeable "long-term" federal oil and gas development and production remains a constant percentage of U.S. Energy Information Administration (EIA)-projected energy demand, the estimated emissions from the life of leases in the Proposed Action is between 0.022% and 0.063% of federal emissions in the United States over the next 20 years (BLM 2022c). In summary, potential GHG emissions from the Proposed Action could result in GHG emissions of 2.926 Mt CO_2e over the life of the lease.

As detailed in the Annual GHG Report (BLM 2022c), which the BLM has incorporated by reference, the BLM also looked at other tools to inform its analysis, including the MAGICC model (see Section 7.0 of the Annual GHG Report). This model suggests that "30-plus years of projected federal emissions would raise average global surface temperatures by approximately 0.0158 °C, or 1% of the lower carbon budget temperature target" (BLM 2022c:71). As this is an assessment of what BLM has projected could result from the entire federal fossil fuel program, including the projected emissions from the Proposed Action, over the next 20 years, the reasonably foreseeable lease sale emissions contemplated in this EA are not expected to substantially affect the rate of change in climate effects, bring forth impacts that are not already identified in existing literature, or cause a change in the magnitude of impacts from climate change at the state, national, or global scales.

NO ACTION ALTERNATIVE

Under the No Action Alternative, the parcels would not be leased, and no new oil and gas development would occur on the subject parcels. Although no new GHG emissions from the development of the lease parcels would occur under the No Action Alternative, recent projections indicate that U.S. production levels are expected to remain static or even increase in the short term to accommodate U.S. and global demand. The most recent short-term energy outlook (STEO) published by the EIA (2022a) predicts that the world's oil and gas supply and consumption will increase over the next 18 to 24 months. The latest STEO projections are adequate to use for the No Action discussion as the global forecast models used for the STEO are not dependent on whether the BLM issues onshore leases but are based on foreseeable short-term global supply and demand and include oil and gas development/operations on existing U.S. onshore leases. The most recent STEO includes the following projections for the next 2 years:

- Global liquid fuels consumption is projected to be 99.82 million bpd in 2022 and increase to 100.98 million bpd in 2023.
- U.S. crude oil production averaged 11.2 million bpd in 2021. Production is expected to average 11.9 million bpd in 2022 and 12.3 million bpd in 2023.
- Natural gas production is expected to average 99.7 billion cubic feet per day (Bcf/d) in 2023, 2% more than in 2022.
- U.S. liquid natural gas export capacity increases will contribute to liquid natural gas exports of 10.85 Bcf/d in 2022, up from 9.76 Bcf/d in 2021. Liquid natural gas exports are predicted to average 12.33 Bcf/d in 2023.
- Coal production is expected to total 595 million short tons in 2022, up 3% from 2021. The increase reflects strong international demand for U.S. coal and a need among power plant operators to replenish coal stocks. Monthly U.S. coal inventories through August 2022 were 19% lower compared with the same period in 2021, as production was not sufficient to both replenish stocks and satisfy summer power demand. Coal production in 2023 is projected to decrease to 573 million short tons.

- Generation from renewable sources will make up an increasing share of total U.S. electricity generation, increasing from 22% in 2022 to 24% in 2023.

Based on recent events, both domestic and international, that have resulted in abrupt changes to the global oil and gas supply, other EIA studies and recent U.S. analyses (associated with weather impacts, etc.) regarding short-term domestic supply disruptions and shortages or sudden increases in demand demonstrate that reducing domestic supply (in the near term under the current supply and demand scenario) will likely lead to the import of more oil and natural gas from other countries, including countries with lower environmental and emission control standards than those of the United States (EIA 2022b). Current global supply disruptions have also led to multiple releases from the U.S. Strategic Petroleum Reserve in order to meet consumer demand and curb price surges.

The EIA 2022 Annual Energy Outlook (EIA 2022b) projects energy consumption increases through 2050 as population and economic growth outweighs efficiency gains. As a result, U.S. production of natural gas and petroleum and liquids will rise amid growing demand for exports and industrial uses. In the 2022 Annual Energy Outlook, crude oil production is forecast to rise in 2022 and 2023 to record high levels, with production then remaining relatively flat through 2050. However, renewable energy will be the fastest-growing U.S. energy source through 2050. Energy-related CO_2 emissions are expected to decrease from 2022 to 2037 due to a transition away from more carbon-intensive coal to less carbon-intensive natural gas and renewable energy for electricity generation. After 2037, CO_2 emissions are expected to trend upward as increasing energy consumption, resulting from population and economic growth, outpaces continuing reductions in energy intensity and CO_2 intensity. Further discussion of past, present, and projected global and state GHG emissions can be found in Chapter 6 of the Annual GHG Report (BLM 2022c).

MONETIZED IMPACTS FROM GREENHOUSE GASE EMISSIONS

The “social cost of carbon,” “social cost of nitrous oxide,” and “social cost of methane”—together, the “social cost of greenhouse gases” (SC-GHG)—are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year.

On January 20, 2021, President Biden issued Executive Order 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (Federal Register 86:7037). Section 1 of Executive Order 13990 establishes an administration policy to, among other things, listen to the science, improve public health and protect the environment, ensure access to clean air and water, reduce GHG emissions, and bolster resilience to the impacts of climate change. Section 2 of the Executive Order calls for federal agencies to review existing regulations and policies issued between January 20, 2017, and January 20, 2021, for consistency with the policy articulated in the Executive Order and to take appropriate action.

Consistent with Executive Order 13990, the CEQ rescinded its *2019 Draft National Environmental Policy Act Guidance on Considering Greenhouse Gas Emissions* and has begun to review for update its *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* issued on August 5, 2016 (2016 GHG Guidance). While the CEQ works on its updated guidance, it has instructed agencies to consider and use all tools and resources available to them in assessing GHG emissions and climate change effects, including the 2016 GHG Guidance.

Regarding the use of the social cost of carbon or other monetized costs and benefits of GHGs, the 2016 GHG Guidance noted that NEPA does not require monetizing costs and benefits (CEQ 2016). It also noted that “the weighing of the merits and drawbacks of the various alternatives need not be displayed

using a monetary cost-benefit analysis and should not be when there are important qualitative considerations" (CEQ 2016).

Section 5 of Executive Order 13990 emphasizes the importance for federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account" and established the Interagency Working Group on Social Cost of Greenhouse Gases, United States Government (IWG). In February 2021, the IWG published *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide: Interim Estimates under Executive Order 13990* (IWG 2021). This is an interim report that updated previous guidance from 2016. The final report is still pending.

In accordance with this direction, this subsection provides estimates of the monetary value of changes in GHG emissions that could result from selecting each alternative. Such analysis should not be construed to indicate a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. These numbers were monetized; however, they do not constitute a complete cost-benefit analysis, nor do the SC-GHG numbers present a direct comparison with other impacts analyzed in this document. For instance, the BLM's overall economic analysis for this lease sale does not monetize most of the major costs or benefits and does not include all revenue streams from the Proposed Action, but instead seeks to quantify certain impacts related to employment numbers and labor income. SC-GHG is provided only as a useful measure of the benefits of GHG emission reductions to inform agency decision-making.

For federal agencies, the best currently available estimates of the SC-GHG are the interim estimates of the social cost of carbon dioxide (SC-CO_2), methane (SC-CH_4), and nitrous oxide (SC-N_2O) developed by the IWG. Select estimates are published in the Technical Support Document (IWG 2021), and the complete set of annual estimates are available on the Office of Management and Budget's website (Office of Management and Budget 2021).

The IWG's SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are a less significant factor in present-day decisions). The current set of interim estimates of SC-GHG have been developed using three different annual discount rates: 2.5%, 3%, and 5% (IWG 2021).

As expected with such a complex model, multiple sources of uncertainty are inherent in the SC-GHG estimates. Some sources of uncertainty relate to the physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021). To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, the IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of estimated damages, applying a 3% annual discount rate for future economic effects. This is a low-probability, high-damage scenario, representing an

upper bound of damages within the 3% discount rate model. The estimates below follow the IWG recommendations.

The SC-GHGs associated with estimated emissions from future potential development of the lease parcels are reported in Table 3.28. These estimates represent the present value (from the perspective of 2021) of future market and nonmarket costs associated with CO_2, CH_4, and N_2O emissions from potential well development and operations, and potential end use, as described in Section 3.6.2.2. Estimates are calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and BLM's estimates of emissions in each year. They are rounded to the nearest $1,000. The estimates assume development would start in 2022 and end-use emissions would be complete in 2041, based on experience with previous lease sales.

Table 3.28. SC-GHGs Associated with Future Potential Development

Activity	Social Cost of GHGs (2020 $)			
	Average Value, 5% Discount Rate	Average Value, 3% Discount Rate	Average Value, 2.5% Discount Rate	95th Percentile Value, 3% Discount Rate
Development and operations	$1,264,000	$3,629,000	$5,103,000	$10,100,000
Midstream and end use	$37,343,000	$136,936,000	$205,965,000	$411,210,000
Total	**$38,607,000**	**$140,565,000**	**$211,068,000**	**$421,310,000**

ESTIMATED GREENHOUSE GAS EMISSIONS FOR REASONABLY FORESEEABLE ENVIRONMENTAL TRENDS AND PLANNED ACTIONS

The analysis of GHGs presented in this EA includes estimated emissions for the lease parcels from the development, production, and end use of the federal fossil fuels. An assessment of GHG emissions from the BLM's fossil fuel authorizations, including coal leasing and oil and gas leasing and development, is included in the BLM Annual GHG Report (see Chapter 5) (BLM 2022c). The Annual GHG Report includes estimates of reasonably foreseeable GHG emissions related to BLM lease sales anticipated during the calendar year, as well as the best estimate of emissions from ongoing production and development of parcels sold in previous lease sales. It provides an estimate of cumulative GHG emissions from the BLM fossil fuel leasing program based on actual production and statistical trends.

The Annual GHG Report provides an estimate of short-term and long-term GHG emissions from activities across the BLM's oil and gas program. The short-term methodology presented in the Annual GHG Report includes a trends analysis of 1) leased federal lands that are held-by-production, 2) approved APDs, and 3) leased lands from competitive lease sales occurring over the next annual reporting cycle (12 months) to provide a 30-year projection of potential emissions from federal lease actions over the next 12 months. The long-term methodology uses oil and gas production forecasts from the EIA to estimate GHG emissions out to 2050 that could occur from past, present, and future federal oil and gas development. For both methodologies, the emissions are calculated using life-cycle-assessment emissions and data factors. These analyses are the basis for projecting GHG emissions from lease parcels that are likely to go into production during the analysis period of the Annual GHG Report and represent both a hard look at GHG emissions from fossil fuel leasing and the best available estimate of reasonably foreseeable cumulative emissions related to any one lease sale or set of quarterly lease sales.

Table 3.29 shows the cumulative estimated GHG emissions from the development of the projected lease sale acres in 2022 using the methodology described above. The 5-year lease averages include all types of oil and gas development–related leases, including leases granted under the MLA, as well as other

authorities, that have been issued over the last 5 years. As such, the projections made from the 5-year averages represent the potential for all types of future oil and gas development activity and, although acreages are not exact, would account for the Proposed Action. However, the projections likely overestimate the potential emissions from the 12-month cycle of competitive oil and gas leasing because not all lease acreage may be developed, and lease sale acreage is often reduced based on the environmental review documentation.

Table 3.29. Reasonably Foreseeable Projected Emissions from Federal Lease Development

State (BLM Administrative Unit)	GHG Emissions from Past, Present, and Foreseeable Federal Lease Development (Mt CO_2e per year)
Alabama (Eastern States [ES])	9.34
Alaska	136.9
Arkansas (ES)	9.34
California	51.49
Colorado	243.1
Idaho	0.17
Illinois	0.31
Kansas (ES)	3.32
Kentucky (ES)	0.19
Louisiana (ES)	43.29
Michigan (ES)	1.95
Mississippi (ES)	2.89
Montana	58.82
Nebraska (Wyoming State Office)	0.21
Nevada	2.74
New Mexico	1,939.52
New York	0.01
North Dakota (Montana State Office)	379.63
Ohio (ES)	0.37
Oklahoma (New Mexico State Office [NMSO])	20.43
Pennsylvania	0.46
South Dakota (Montana State Office)	2.31
Texas (NMSO)	49.55
Utah	187.84
Virginia	0.15
West Virginia (ES)	0.45
Wyoming	1.487.65
Total	**4,614.81**

* Emissions obtained from 2021 Annual GHG Report, Figure 5-1 (BLM 2022c).

3.6.2.3 *Mitigation Strategies*

GHG emissions contribute to changes in atmospheric radiative forcing resulting in climate change impacts. GHGs act to contain solar energy loss by trapping longer-wave radiation emitted from the

Earth's surface and act as a positive radiative forcing component. The buildup of these gases has contributed to the current changing state of the climate equilibrium toward warming. Chapters 8 and 9 of the Annual GHG Report provide a detailed discussion of climate change science, trends, and impacts. The relationship between GHG emissions and climate impacts is complex, but a project's potential to contribute to climate change is reduced as its net emissions are reduced. When net emissions approach zero, the project has little or no contribution to climate change. Net-zero emissions can be achieved through a combination of controlling and offsetting emissions. Emission controls (e.g., vapor recovery devices, no-bleed pneumatics, leak detection and repair, etc.) can substantially limit the amount of GHGs emitted to the atmosphere, while offsets (e.g., sequestration, low carbon energy substitution, plugging abandoned or uneconomical wells, etc.) can remove GHGs from the atmosphere or reduce emissions in other areas. Chapter 10 of the Annual GHG Report provides a more detailed discussion of GHG mitigation strategies (BLM 2022c).

Several federal agencies work in concert to implement climate change strategies and meet U.S. emissions reduction goals while supporting U.S. oil and gas development and operations. The EPA is the federal agency charged with regulating air pollutants and establishing standards for protection of human health and the environment. The EPA has issued regulations that will reduce GHG emissions from any development related to the proposed leasing action. These regulations include the New Source Performance Standard for Crude Oil and Natural Gas Facilities (49 CFR 60, subpart OOOOa) which imposes emission limits, equipment design standards, and monitoring requirements on oil and gas facilities. A detailed discussion of existing regulations and Executive Orders that apply to BLM management of federal lands, as well as current federal and state regulations that apply to oil and gas development and production, can be found in Chapter 2 of the Annual GHG Report (BLM 2022c).

The NMED has developed the "Oil and Natural Gas Regulation for Ozone Precursors" (20.2.50.1 NMAC), which went into effect August 2022. Approximately 50,000 wells and associated equipment are subject to this regulation. It is anticipated that the regulation will reduce CH_4 emissions by 200,000 to 425,000 tons annually.

The majority of GHG emissions resulting from federal fossil fuel authorizations occur outside of the BLM's authority and control. These emissions are referred to as indirect emissions and generally occur off-lease during the transport, distribution, refining, and end use of the produced federal minerals. The BLM's regulatory authority is limited to those activities authorized under the terms of the lease, which primarily occur in the "upstream" portions of natural gas and petroleum systems. This decision authority is applicable when development is proposed on public lands and the BLM assesses the specific location, design, and plan of development. In carrying out its responsibilities under NEPA, the BLM has developed BMPs designed to reduce emissions from field production and operations. BMPs may include limiting emissions from stationary combustion sources, mobile combustion sources, fugitive sources, and process emissions that may occur during development of the lease parcel. Analysis and approval of future development may include the application of BMPs within BLM's authority, included as COAs, to reduce or mitigate GHG emissions. Additional measures proposed at the project development stage may be incorporated as applicant-committed measures by the project proponent or added to necessary air quality permits. Additional information on mitigation strategies, including emissions controls and offset options, are provided in Chapter 10 of the Annual GHG Report (BLM 2022c).

3.6.3 Issue 3: Water Use and Quantity

How would future potential development of the nominated lease parcels affect surface and groundwater quantity?

The analysis area for this issue is the total area of Chaves, Eddy, and Lea Counties, which collectively make up the New Mexico portion of the Permian Basin. This analysis area is used because water sources

used to support future potential development of the nominated lease parcels would likely be sourced from these three counties.

Water uses associated with development of the nominated lease parcels would occur during the 30- to 60-day well construction and completion period (such as hydraulic fracturing), the 20-year operation period (e.g., water use associated with dust control), and interim and final reclamation. While most of the water use associated with oil and gas development is expected to occur within a 30- to 60-day well construction and completion period, the effect of this use on groundwater aquifers is expected to last until recharge occurs. Due to uncertainty about water sources and recharge rates, it is assumed that all water use associated with oil and gas development is likely to be a long-term effect. Additionally, the ability for aquifer recharge may be affected by drought conditions associated with climate change.

The following analysis summarizes information contained in the Water Support Document (BLM 2022b) and incorporated by reference. Water use for development of the nominated lease parcels is assumed to primarily come from groundwater sources based on previous oil and gas development in the area.

3.6.3.1 *Affected Environment*

CURRENT TOTAL WATER USE IN THE ANALYSIS AREA

The USGS report, *Estimated Use of Water in the United States in 2015* (Dieter et al. 2018), lists total water withdrawals across eight water use categories: aquaculture, domestic, industrial, irrigation, livestock, mining, public water supply, and thermoelectric power. Water use for 2015 is summarized in for the eight water use categories in each of the three counties within the analysis area. Irrigation is the largest category of water use in all counties, accounting for an average of 75% (466,784 acre-feet [AF]) of the total water withdrawal for the analysis area (619,375 AF). Approximately 88% (545,154 AF) of the total water use is from groundwater. Mining (which includes oil and gas development) comprises approximately 15% of water withdrawals. All mining-related water use (94,758 AF) is from groundwater. Of that total, 99% of withdrawals are from non-potable saline sources (i.e., water containing dissolved solids of 1,000 milligrams per liter or more) (Table 3.30).

Table 3.30. Tri-County Analysis Area 2015 Water Use by Category

Category	Surface Water			Groundwater			Total Withdrawals			
	Fresh (AF)	Saline (AF)	Total (AF)	Fresh (AF)	Saline (AF)	Total (AF)	Fresh (AF)	Saline (AF)	Total (AF)	Percent Total Use
Aquaculture	0	0	0	1,782	0	1,782	1,782	0	1,782	<1%
Domestic	0	-	0	2,780	-	2,780	2,780	-	2,780	<1%
Industrial	0	0	0	1,121	0	1,121	1,121	0	1,121	<1%
Irrigation	73,908	-	73,908	392,877	-	392,877	466,784	-	466,784	75%
Livestock	314	-	313.88	10,537	-	10,537	10,851	-	10,851	2%
Mining	0	0	0	1,379	93,379	94,758	1,379	93,379	94,758	15%
Public Water Supply	0	0	0	39,470	0	39,470	39,470	0	39,470	6%
Thermoelectric Power	0	0	0	1,827	0	1,827	1,827	0	1,827	<1%
Total	**74,221**	**0**	**74,221**	**451,774**	**93,379**	**545,154**	**525,996**	**93,379**	**619,375**	**100%**

Source: BLM 2022b The Mining category (highlighted in dark gray) represents the category into which the Proposed Action falls.

Note: See the Water Support Document (BLM 2022b) for graphical representation of these data, as well as comparisons with water use across the state of New Mexico.

CURRENT WATER USE ASSOCIATED WITH OIL AND GAS DEVELOPMENT

As part of oil and gas development, water is used for drilling fluid preparation and makeup water for completion fluids, in well stimulation (of which the most common method is hydraulic fracturing), as rig wash water, as coolant for internal combustion engines, for dust suppression on roads or well pads, and for equipment testing. Water uses for oil and gas development in the Pecos District tri-county area are typically sourced from groundwater. Of these uses, hydraulic fracturing activities comprise the vast majority of water use. The amount of water used for hydraulic fracturing is dependent on many factors, including the geologic formation. In the PDO, all wells use water for completion, and some include nitrogen gel or slickwater additives to the completion technologies (Herrell 2020).

Oil and gas operators are required by the State of New Mexico to disclose water use to FracFocus (per NMAC 19.15.16), a national hydraulic fracturing chemical registry managed by the Ground Water Protection Council and Interstate Oil and Gas Compact Commission to provide objective information on hydraulic fracturing. The BLM examined FracFocus data reported for the calendar years of 2014 to 2021 to ascertain actual water use in the analysis area (Table 3.31).

Table 3.31. Actual Water Use in the Tri-County Analysis Area for Calendar Years 2014 to 2021

Year	Federal Water Use (AF)	Non-Federal Water Use (AF)	Total Water Use (AF)	Federal Water Use (%)	Average Water Use per Well (AF)	Total Number of Wells Reported to Frac Focus
2014	1,268	2,355	3,623	35%	6.0	515
2015	3,958	4,101	8,060	49%	14.6	482
2016	790	5,949	6,739	12%	20.4	297
2017	3,112	10,980	14,092	22%	24.7	520
2018	8,792	22,055	30,847	29%	28.9	953
2019	10,328	31,375	41,703	25%	38.5	994
2020	13,054	24,306	37,359	35%	50.7	729
2021	24,163	24,515	48,678	50%	51.0	923
Total	**65,465**	**125,635**	**191,101**	**32%**	**35.3**	**5,413**

Source: BLM (2022b). The analysis contained in this table provides percentage contribution rounded to two decimal points.
Note: Tri-county analysis area is Lea, Chaves, and Eddy Counties.

Water use has increased from 3,623 AF in 2014 to 48,678 AF in 2021, with a corresponding basin-wide average water use per well increase from 6.0 AF per well to 51.0 AF per well (BLM 2022b). Although the average water use per well for hydraulic fracturing increased to 51.0 AF in 2021, the 6-year average is 35.3 AF per well. This increase in water use per well is likely due to the higher volume of wells, the likelihood that horizontal wells are being drilled to longer lengths, and the continued use of hydraulic fracturing technologies in well drilling and completion (BLM 2022b).

While much of the water use associated with oil and gas development is expected to occur within a 30- to 60-day well construction and completion period (such as hydraulic fracturing), the effect of this use on groundwater aquifers is expected to last until recharge occurs. Long-term water requirements during operation would depend on the project but could include coolant for internal combustion engines and dust suppression on roads or well pads. The Water Support Document (BLM 2022b) indicates there are four potential sources of groundwater in the Tri-County Analysis Area: the Pecos valley alluvium aquifer; the Dockum Formation aquifer; the Rustler Formation aquifer; and the Captain Reef aquifer (BLM 2022b). A recent study within the analysis area to identify source waters indicated that most water wells contained

a mix of source waters; however, in general, the main water source for water wells was the Dockum Formation and Rustler Formation aquifers. Some wells near the community of Carlsbad access the Capitan Reef aquifer (BLM 2022b). Recharge for the Dockum Formation aquifer and the Rustler Formation aquifer is driven by precipitation (BLM 2022b). No additional information is available about recharge rates. In addition, estimating overall aquifer volumes and water availability is difficult due to the size and complexity of water sources within the analysis area. Although some water budgets exist for individual watersheds and recent studies have measured and modeled water resource use within parts of the Permian Basin (Lowry et al. 2018; Reardon et al. 2021; USGS 2021b), data regarding overall aquifer volumes for the tri-county analysis area are not available. In light of this uncertainty about water sources and recharge rates, the BLM therefore assumes that water use associated with oil and gas development is likely to have a long term effect on aquifer water levels, and the ability for aquifer recharge may be affected by drought conditions associated with climate change.

As stated in the Water Support Document (BLM 2022b), a model has been developed as part of the Sandia National Laboratories study (Lowry et al. 2018, Reardon et al. 2021) to simulate water availability over a range of different future scenarios, including drilling activity and water demand relative to areas that are most vulnerable, and to estimate the risk to water sustainability. The recently completed model may potentially allow the BLM to examine the balances between water demand and water availability to predict and track risks to each aquifer and to calculate well drawdown. While the model has been recently completed, it is still undergoing review by the BLM for accuracy, reliability, and useability in evaluating water supply and demand related to oil and gas development in the Pecos District. This model is not yet being used in the Water Support Document for water use simulations.

REASONABLY FORESEEABLE ENVIRONMENTAL TRENDS AND PLANNED ACTIONS

The CFO is currently undertaking a plan revision, and as part of that, is revising its RFD and water modeling. This RFD scenario will include federal and non-federal wells; well development projected as a result of ongoing BLM and state lease sales; and well development associated with recent or reasonably foreseeable APDs or master development plans. With consideration of the revised water use estimates discussed in the Water Support Document (31.2 AF per well), development of the RFD scenario would require 499,200 AF water, or 24,960 AF of water in any given year if all wells were drilled horizontally (BLM 2022b). If more water-intensive stimulation methods (e.g., slick water fracturing) are implemented or if laterals become longer, or if the number of wells continue to increase, aggregate water use could increase from estimates provided in the Water Support Document (BLM 2022b). Alternatively, water use estimates could be lower if produced water is reused or recycled for use in hydraulic fracturing or if methods such as nitrogen completions (less common than slickwater completions in PDO) are implemented.

The projected annual use associated with the RFD scenario comprises about 4% of tri-county analysis area 2015 total water withdrawals (619,375 AF, which already includes past and present water use) (BLM 2022b). Irrigation would remain by far the largest water use within the analysis area (currently 75% of all water use within the tri-county analysis area and 82% of all water use within the state).

There are no reasonably foreseeable mining projects that would contribute to water withdrawals within the tri-county analysis area. Some water use would be required during construction and operation of reasonably foreseeable transmission lines and pipelines; these uses are addressed in the Water Support Document (BLM 2022b).

Predicted effects from climate change for the analysis area include intensified droughts (Mankin et al. 2021). A Bureau of Reclamation report (Bureau of Reclamation 2013) predicts decreases in overall water availability by one-quarter to one-third through the end of the twenty-first century for the Upper Rio Grande Basin (southern Colorado to central southern New Mexico).

3.6.3.1.1 Environmental Effects

Drilling and completion of 19 horizontal wells on the nominated lease parcels is estimated to use 592.8 AF of groundwater. This calculation is based on a factor of 31.2 AF per horizontal well, which the BLM continues to consider a reasonable current estimate of water use associated with drilling and completion of a single horizontal well within the analysis area (BLM 2022b). This value falls below the aforementioned average per-well estimate in 2021 (51.0 AF) and the 8-year average (35.3 AF). If more water-intensive stimulation methods (e.g., slick water fracturing) are implemented or if laterals become longer, water use could increase from estimates provided in the Water Support Document (BLM 2022b). Alternatively, water use estimates could be lower if produced water is reused or recycled, or if less water-intensive stimulation methods are used (e.g., nitrogen) in hydraulic fracturing. Water sourced from outside of the geological formation that is used in hydraulic fracturing, which remains in the geological formation after hydraulic fracturing is complete, is unlikely to be recovered for other uses (Kondash et al. 2018).

Assuming that all wells are developed in the same year, groundwater water use associated with future potential development of the leases would result in a 0.10% increase of the tri-county analysis area 2015 total water use (619,375 AF), 0.11% of the tri-county area 2015 total groundwater use (545,154 AF) and would result in an 0.63% increase over 2015 water use in the mining category for the tri-county analysis area (94,758 AF).

Assuming a 20-year development scenario for the Proposed Action (consistent with the RFD time frame), the water use associated with development of the lease parcels would be approximately 29.64 AF for any given year. Annual water use associated with future potential development of the lease parcels would result in a 0.005% increase of the tri-county analysis area total water use (619,375 AF), 0.005% of the tri-county analysis area total groundwater use (545,154 AF), and a 0.03% increase over 2015 water use in the mining category for the tri-county analysis area (94,758 AF). The total estimated water use for drilling and completion of the 19 horizontal wells in the nominated lease parcels in a single year (29.64 AF) represents approximately 0.06% of the 2021 oil and gas water use reported to FracFocus (48,678 AF) (BLM 2022b).

Water use associated with future potential development of the proposed lease parcels (592.8 AF) would comprise 2.4% of annual RFD water use and 0.12% of total water use associated with the RFD.

The demand from future potential development of the nominated lease parcels (592.8 AF) is negligible when contrasted with the estimated water demand of the RFD (499,200 AF over 20 years, or 24,960 AF in any given year), the tri-county analysis area 2015 water use (619,375 AF) and the demands of other sectors in the Tri-County analysis area such as irrigation (466,784 AF in 2015) and mining (94,758 AF in 2015).

Water used for the purpose of oil and gas drilling, completion, and operations would be purchased legally from those who hold water rights in or around the Permian Basin. The transaction would be handled by the NMOCD, as well as the NMOSE. All water uses would be evaluated at the time of proposed lease development in site-specific environmental review documentation and subject to standard lease terms and conditions and site-specific mitigation. Table 3-7 of the Water Support Document (BLM 2022b) identifies the potential sources of groundwater in the analysis area.

Produced water associated with development of the lease parcels is estimated at approximately 11,046,600 bbl of water (1,423.82 AF or 74.9 AF per well). Produced water would be either recycled, reused, or disposed of in accordance with all applicable federal and state laws and regulations. Disposal of produced water would occur at regulated and permitted commercial facilities (such as SWD wells).

3.6.3.2 *Mitigation Measures and Residual Effects*

Public concern about water use from hydraulic fracturing is especially high in semiarid regions such as the tri-county analysis area, where water withdrawals associated with hydraulic fracturing comprise the majority of oil and gas–related water use. Overall, there has been a concerted effort to increase the use of alternative water sources such as brackish water or recycling produced water, minimizing the extent to which oil and gas–related consumptive water uses contribute to the strain on local freshwater resources (Kondash et al. 2018). The BLM encourages the use of recycled water in hydraulic fracturing techniques, and in 2019, the State of New Mexico passed the Produced Water Act, which encourages oil and gas producers to reuse produced water, when possible, rather than relying on freshwater sources for oil and gas extraction. Additionally, New Mexico has promulgated new rules on produced water stemming from passage of the 2019 Produced Water Act (NMED 2021)[11]. The rules were developed to encourage the recycling, re-use or disposition of produced water while also affording reasonable protection against contamination of fresh water and establish procedures by which persons may transport and dispose of produced water, drilling fluids and other liquid oil field waste. Such rules do not change the requirement that development of a federal lease must comply with all applicable federal and state laws and regulations.

Recent studies indicate that the water used for hydraulic fracturing may be retained within the shale formation, with only a small fraction of the fresh water injected into the ground returning as flowback water; water returning to the surface is highly saline, is difficult to treat, and is often disposed through deep-injection wells (Kondash et al. 2018). In 2019, NMED entered into a memorandum of understanding (MOU) with New Mexico State University to develop new technologies for treating produced water to inform future policies for produced water reuse; an updated MOU was signed on November 10, 2022 (NMED 2022).

3.6.4 Issue 4: Dunes Sagebrush Lizard and Lesser Prairie-Chicken

How would future potential development of the nominated lease parcels affect dunes sagebrush lizard (DSL) and lesser prairie-chicken (LPC)?

The analysis area established to analyze effects on LPC and DSL is the 20 million-acre BLM PDO, comprising the CFO and RFO, in which habitat for these species is located. For the purposes of this analysis, short-term effects to LPC and DSL are defined as those that cease after well construction and completion (30–60 days); long-term effects are defined as those associated with operation, which would cease after well operation or until habitat is successfully reclaimed.

3.6.4.1 *Affected Environment*

Species proposed for listing under the ESA as threatened or endangered are managed with the same level of protection as listed species. BLM policy for candidate species is contained in BLM Manual 6840 (BLM 2008b). The BLM carries out management consistent with the principles of multiple use for the conservation of special status species and candidate species and their habitat. The BLM must ensure that

[11] The State of New Mexico House Bill 546, which included the Produced Water Act, went into effect July 1, 2019. Amendments to NMAC 19.15.34, Produced Water, Drilling Fluids and Liquid Oil Field Waste, became effective on October 13, 2020.

actions authorized, funded, or carried out do not contribute to the need to list any of these species as threatened or endangered, and that BLM actions would not adversely affect the likelihood of recovery of any threatened or endangered species (BLM 2008b). Under the ESA, DSL was petitioned for listing in 2018 (USFWS 2021b), and LPC was petitioned for relisting in 2016 (USFWS 2021c). The LPC southern distinct population segment (DPS) is currently listed as endangered under the ESA (Federal Register 87:72674–72755), and DSL petitioned listing is under review under the ESA.

DUNES SAGEBRUSH LIZARD

The DSL is a habitat specialist native to the shinnery oak sand dune habitats within the RFO and CFO. These habitats extend from the San Juan Mesa in northeastern Chaves County, Roosevelt County, and through eastern Eddy and southern Lea Counties. Approximately 65% to 75% of DSL the habitat distribution area occurs within New Mexico, with the majority of this portion occurring within the planning area (Smolensky and Fitzgerald 2011; USFWS 2021b). This species has an extremely strong affinity for bowl-shaped depressions in active dune complexes referred to as sand dune blowouts, with a preference for relatively large blowouts and select microhabitat within a given blowout (BLM 2007, 2008a). Within their geographic range, the presence of this species is also associated with composition of the sand; they only occur at sites with relatively coarse sand.

Currently, the species is listed as sensitive by the BLM NMSO and endangered by the State of New Mexico. This species was petitioned for federal listing in 2018 and is under review under the ESA. This species' current management within the State of New Mexico is currently being driven by the state listing status and protections afforded under the Candidate Conservation Agreement (CCA) (USFWS et al. 2008) and Candidate Conservation Agreement with Assurances (CCAA) prescriptions (USFWS et al. 2014; USFWS and Texas Comptroller of Public Accounts [CPA] 2019), as well as the Special Status Species RMPA of 2008 (BLM 2008a). The CCA and CCAA are voluntary agreements limited to existing participants.

Texas A&M University developed a mapped DSL habitat distribution area in New Mexico based on known occupied, suitable, and interconnecting unsuitable DSL habitat and its connectivity (Laurencio and Fitzgerald 2010). Based on this model, a total of 543,527 acres are within the New Mexico DSL mapped habitat distribution area. The portions of the species' habitat distribution area that contain suitable and/or occupied DSL habitat are a spatially dynamic system of patches of shinnery oak and sand dune complexes with interspersed flat areas without dunes. Based on habitat suitability analysis and occupancy data, the BLM estimates approximately 66% (358,727 acres) of the species' mapped habitat distribution area contains suitable dune complexes and vegetation that meet the species' habitat requirements (Allen 2020; Laurencio and Fitzgerald 2010).

The connectivity of dune complexes and the ability of DSL to locally migrate between occupied dunes is essential to reproductive success (Smolensky and Fitzgerald 2011). The utilization of microhabitats within a greater system, in conjunction with the species' small size and restricted ability to travel long distances, places this species at risk of significant adverse effects from surface occupancy development that directly disturbs dunal habitat or results in fragmentation of habitat (Smolensky and Fitzgerald 2011). This species is most sensitive to long-term surface disturbances (e.g., well pads, access roads, facility sites, etc.); that may deter movement between suitable dunal complexes, which are inherently dispersed.

LESSER PRAIRIE-CHICKEN

The LPC southern distinct population segment (DPS) is currently listed as endangered under the ESA (Federal Register 87:72674–72755). The BLM CFO management of the LPC is determined by the 2008 Special Status Species RMPA (BLM 2008a), which designates five LPC management areas totaling 1,499,746 acres. BLM management of LPC includes protection of the species' sensitive breeding system

in which males form display groups on arenas called leks and make vocalizations to attract females (BLM 2008a).

LPC was proposed for listing as threatened in December 2012 (Federal Register 77:73828–73888), and the USFWS announced the final listing of the species as threatened under the ESA in April 2014 (Federal Register 79:19974–20071). In July 2016, the LPC was removed from the Federal List of Endangered Species and Threatened Wildlife (Federal Register 81:47047–47048). The listing decision was vacated by the U.S. District Court for the Western District of Texas on September 1, 2015, and was not due to the successful recovery of populations and/or habitat. The LPC was then petitioned for relisting to the Federal List of Endangered Species and Threatened Wildlife in November 2016 (Federal Register 81:86315–86318). The species was relisted on November 25, 2022 (Federal Register 87:72674–72755) effective January 2023. Given the recent relisting of the LPC, the BLM NMSO is planning to initiate programmatic ESA consultation with USFWS to addresses potential effects to LPC associated with BLM oil and gas leasing actions which fall outside of occupied LPC habitat (i.e., 5 miles or greater from occupied habitat), including but not limited to the PDO May 2023 nominated lease parcels. For future leasing actions that occur within 5 miles or less of occupied LPC habitat, BLM would initiate Section 7 consultation for potential effects to LPC on a case-by-case basis.

In addition, in the state of New Mexico, management is currently being driven by listing status and protections afforded under the LPC/DSL CCA (USFWS et al. 2008) and CCAA prescriptions (USFWS et al. 2014; USFWS and Texas CPA 2019). The CCA and CCAA are voluntary agreements limited to existing participants.

In New Mexico, the LPC formerly occupied a range that encompassed the easternmost third of the state, extending from the Pecos River to 30 miles west near Fort Sumner. This occupied area covered about 14,672 square miles in nine eastern counties: Union, Harding, Chaves, De Baca, Quay, Curry, Roosevelt, Lea, and Eddy, at the beginning of the twentieth century. Remnant populations are known to exist only in parts of Lea, Eddy, Chaves, and Roosevelt Counties. The currently occupied area comprises approximately 20% of the species' historical range.

LPC are found throughout dry grasslands that contain shinnery oak (*Quercus havardii*) or sand sagebrush (*Artemisia filifolia*). Currently, they are most commonly found in mixed-grass vegetation, sometimes in short-grass prairie habitat. They are occasionally found in farmland and smaller fields, especially in winter. Shinnery oak shoots are used as cover and produce acorns, which are an important food source for the species. The current geographic range of shinnery oak is nearly congruent with that of the LPC, and these species sometimes are considered ecological partners. Population densities of LPC are greater in shinnery oak habitat than in sand sagebrush habitat (BLM 2007, 2008a).

LPC use a breeding system in which males form display groups on arenas called leks. During mating displays, male vocalizations, called booming, attract females to the lek. Leks are often on knolls, ridges, or other raised areas; however, leks are just as likely to be on flat areas in New Mexico due to topography constraints. Leks may be completely bare, covered with short grass, or have scattered clumps of grass or short tufts of plants. The visibility of surroundings and the ability of the females to hear the male vocalizations are important characteristics of occupied leks. Due to their breeding system and obligate vegetation requirements, LPC are particularly sensitive to anthropomorphic development (including oil and gas development) and habitat fragmentation. Lek use and nesting activity in Eddy and Lea Counties substantially decreased (and in many areas ceased to exist) during increased oil and gas development periods accompanied by severe droughts, affecting the same LPC habitat components. A number of active leks (33) were documented well into the 1990s by BLM biologists, who conducted the primary lek surveys during that era within both the BLM CFO (Eddy and Lea Counties) and BLM RFO (Chaves and Roosevelt Counties) (Sherman 2020). There are currently no known active leks within the BLM CFO. Within the BLM RFO planning area, where there is a greater density of LPC, there were 297 known

active leks, 179 of which were surveyed for LPC in 2019 (Baggao 2020). Of the 179 leks surveyed, 57 were found to be active (Baggao 2020). Adult LPC are known to stay within approximately 3 km (1.9 miles) of their lek and nesting site, with the exception of juveniles traveling upwards of 12 km (7.5 miles) once fledged to establish territory (Hunt and Best 2004).

As a species that inhabits expansive grasslands lacking in tall canopy vegetation, the species has been theorized to be inherently fearful of anthropomorphic aboveground structures. Linear infrastructure such as roads and overhead transmission lines, as well as noise produced by oil and gas infrastructure, have been determined to be the more impactful disturbance types for LPC; however, effects of overgrazing within suitable grassland habitat has also been determined to contribute to the decrease in New Mexico populations (Hunt and Best 2004). Analysis of LPC tolerance for development disturbance within their habitat has shown that the species is susceptible to noise, activity, and visual alterations within their habitat (Hunt and Best 2004; Pruett et al. 2009; Thompson et al. 2015). It was also found that LPC avoid crossing roads and have a strong avoidance of overhead power lines. The primary predators of LPC are avian raptor species that perch on tall objects (natural and industrial alike) to survey for prey, thus increased tall structure density within habitat may increase predation pressure and avoidance of these areas by existing populations (Pruett et al. 2009; Thompson et al. 2015).

The analysis area contains five designations of LPC management areas totaling 1,499,746 acres: the Core Management Area, totaling 221,402 acres; the Primary Population Area (PPA), totaling 265,730 acres; the Sparse and Scattered Population Area, totaling 218,126 acres and found only in the RFO, and the Isolated Population Area (IPA), totaling 794,487 acres, and which include 17 Habitat Areas [HAs]; totaling 112,989 acres). Management practices, including areas open and closed to leasing, are outlined in the 2008 Special Status Species RMPA (BLM 2008a). In the future, new leasing in occupied LPC habitat would be linked to the status of the species or habitat in New Mexico, as identified in the annual USFWS candidate notice of review or other periodic agency review.

REASONABLY FORESEEABLE ENVIRONMENTAL TRENDS AND PLANNED ACTIONS

The BLM PDO, which is composed of the CFO and RFO, encompasses over 20 million acres within the planning area boundary. This includes 3.6 million acres of BLM surface and 7.6 million acres of federally managed minerals. Reasonably foreseeable environmental trends and planned actions within the PDO that would affect DSL and LPC include land use authorizations, livestock grazing, recreational uses (including off-highway vehicles, non-motorized recreation, etc.), mineral exploration and development, fire and fuels treatments, and other vegetation treatments, including noxious weeds management.

Additionally, reasonably foreseeable environmental trends and planned actions within the PDO would result in a 110,740 acres of new surface disturbance for a total of 427,740 acres of total landscape-level surface disturbance, of which the future potential development of the nominated lease parcels would comprise approximately 85.5 acres (0.02% of total landscape-level surface disturbance; see Table 3.2). The estimated surface disturbance from future potential development of the nominated lease parcels is approximately 0.0004% of the 20 million-acre PDO (see Table 3.2). Additionally, the RFD scenario projected approximately 800 new wells per year, for a total of 16,000 new wells over a 20-year period. The CFO is currently undertaking an RMP plan revision, and as part of that, is revising its RFD well projections. Roads, pads, and other associated infrastructure of oil and gas development may further contribute to additional fragmentation of habitat depending on the site-specific conditions. Oil- and gas-related traffic may also result in direct mortalities. Habitat fragmentation can reduce the overall fitness of a species by isolating populations from one another, making it more difficult for intra- and inter-population movement between patches of suitable habitat. This can lead to less resilience to stochastic events and lead to reduced genetic diversity of this species (genetic bottlenecks). Further, the effects on

climate change from federal oil and gas leasing could result in an increase in habitat fragmentation, alteration and/or loss, and drought conditions resulting in cumulative significant adverse effects to ESA-listed species.

Prior to the application of species-specific protections for LPC and DSL by BLM management decisions (RMPA 2008), voluntary conservation agreements, and implementation of USFWS and NMDGF protection measures designed to conserve and avoid effects to species habitat, historic high-density oil and gas development was known to have reduced the amount of suitable and occupied habitat of these species. Additionally, BLM management decisions have a continued focus on conserving lands (habitat) for special status species, including LPC and DSL, as disclosed in the 2008 RMPA and those managed by candidate conservation agreements (BLM 2007, 2008a, 2008c; USFWS et al. 2008; USFWS et al. 2014; USFWS and Texas CPA 2019) (see Section 3.3.2).

For DSL, the development of the RFD scenario would be subject to management per the LPC/DSL 2008 RMPA as well as standard terms and conditions if development is to occur within the species' distribution range and surrounding areas (BLM 2008a). However, surface development may incrementally contribute to barriers between suitable dune complexes within the DSL habitat distribution area in New Mexico (habitat fragmentation). Habitat fragmentation may decrease habitat connectivity and reduce opportunity for expansion of occupied habitat into discontinuous suitable habitat. Note that the standard terms and conditions have the ability to minimize effects of surface occupancy, including habitat fragmentation through site selection, and are dependent on location and ecological conditions. Future potential development associated with the Proposed Action (an estimated 19 wells, or one well per parcel) is approximately 0.12% of the RFD and would occur outside of the areas of greatest conservation concern for this species.

For LPC, habitat fragmentation and increased surface use associated with the RFD scenario risk reducing available habitat. The BLM's land management decisions include closure to leasing or leasing with NSO stipulations within IPA-Has (depending on individual Habitat Area conditions). The BLM also has the ability to close leasing to suitable and occupied habitat within the PPA on a site-specific basis (BLM 2008a). These management decisions allow the BLM to prevent surface occupancy related to energy development (BLM 2008a) in order to protect habitat occupied by this species and help prioritize these areas for reclamation efforts to increase the availability of non-fragmented and suitable LPC habitat. In addition, the BLM has previously and plan to continue working with a multi-stakeholder group to restore and improve habitat conditions (e.g., revegetation, reclamation of historic surface development, water access, and species surveys and monitoring) across the LPC range, including efforts related to the LPC and DSL CCA/CCAA and Restore New Mexico. Future potential development associated with the Proposed Action (an estimated 19 wells, or one well per parcel) is approximately 0.12% of the RFD and would occur outside of the areas of greatest concern for this species.

3.6.4.2 *Environmental Effects*

Due to application of lease stipulations and standard terms and conditions, surface disturbance from future potential development of the nominated lease parcels is not likely to result in a decrease in available suitable or occupied habitat for DSL and LPC. Potential effects to LPC and DSL and their habitats related to surface-disturbing activities from future potential development of the nominated lease parcels is analyzed in detail below. Effects related to surface disturbance would be long-term, continuing until well operations cease and habitat is successfully reclaimed.

DUNES SAGEBRUSH LIZARD

Nominated lease parcels 420, 6751, 6790, 6803, and 6804 are within the mapped DSL habitat distribution area (analysis area). Table 3.32 presents acreage and percentage of parcels within the DSL habitat

distribution area and adjacent suitable habitat, as well as applicable stipulations and lease notices. None of the remaining nominated lease parcels are located within DSL habitat and are therefore not anticipated to result in adverse impacts to the species or its' habitat. Depending on the selected location of surface disturbance, development of the nominated lease parcels could result in up to 22.5 acres of surface disturbance within the DSL habitat, and a potential decrease in DSL habitat quality from human presence and loss of vegetation (see Table 3.32). Both effects would be considered long-term because they would result in a loss of habitat and increased fragmentation until operations cease and habitat is successfully reclaimed.

The nominated lease parcels located within the DSL habitat distribution area would be subject to stipulation SENM-S-23-CSU, which would not allow development in documented occupied habitat areas or within up to 200 m of suitable habitat associated with occupied habitat areas. Additionally, lease notice SENM-LN-2 notifies the lessee that a pre-disturbance presence/absence biological survey may be required within these nominated lease parcels (see Appendix B for full descriptions of stipulations). In addition, the BLM has the authority under standard terms and conditions to attach COAs at the site-specific level to minimize adverse impacts on resource values, including special status species, at the time operations are proposed. An appropriate development distance from suitable and/or occupied habitat would be determined by the BLM at the lease development stage, following a review of data including but not limited to habitat suitability models, occupied dune survey data, general biological surveys, aerial imagery, and species-specific survey habitat occupancy data (BLM 2008a, n.d.-c; Laurencio and Fitzgerald 2010). The aforementioned site-specific analysis also allows for avoidance of unsuitable habitat within the species' range that provides connectivity corridors between interspersed dunal complexes as determined by the BLM.

Table 3.32. Potential Effects on Dune Sagebrush Lizard Mapped Habitat Distribution from Future Potential Development of the Nominated Lease Parcels

Lease Parcel (acres within DSL habitat)	Description of Overlap	Total Surface Disturbance (acres)	Applicable Stipulations and Lease Notices
420* (80 acres)	Parcel 420 is 100% within DSL habitat.	4.5 acres (0.0008% of mapped DSL habitat distribution [543,527 acres])	SENM-LN-2; SENM-S-23-CSU
6751† (40 acres)	Parcel 6751 is 100% within DSL habitat	4.5 acres (0.0008% of mapped DSL habitat distribution [543,527 acres])	SENM-LN-2; SENM-S-23-CSU
6790† (238.75 acres)	Parcel 6790 is 99% within DSL habitat	4.5 acres (0.0008% of mapped DSL habitat distribution [543,527 acres])	SENM-LN-2; SENM-S-23-CSU
6803† (40 acres)	Parcel 6803 is 100% within DSL habitat	4.5 acres (0.0008% of mapped DSL habitat distribution [543,527 acres])	SENM-LN-2; SENM-S-23-CSU
6804* (40 acres)	Parcel 6804 is 100% within DSL habitat	4.5 acres (0.0008% of mapped DSL habitat distribution [543,527 acres])	SENM-LN-2; SENM-S-23-CSU

Note: DSL is not listed under the ESA. However, if this species is listed in the future, stipulation HQ-TES-1 would offer protections for this species for all parcels listed in this table.

* Mapped DSL habitat distribution area 1-mile buffer in New Mexico is according to the DSL TAMU polygon model and includes occupied, suitable, and interconnecting unsuitable habitat (Laurencio and Fitzgerald 2010).

† Mapped DSL habitat distribution area in New Mexico is according to the DSL TAMU polygon model and includes occupied, suitable and interconnecting unsuitable habitat (Laurencio and Fitzgerald 2010).

LESSER PRAIRIE-CHICKEN

Nominated lease parcels 420, 6751, 6790, 6803, 6804, and 6805 are within the 794,487-acre LPC IPA (analysis area). Table 3.33 presents acreage and percentage of parcels within the LPC IPA, as well as applicable stipulations and lease notices. None of the remaining nominated lease parcels are located within an LPC management area and are therefore not anticipated to result in adverse impacts to the species or its' habitat. Depending on the selected location of surface disturbance, development of the nominated lease parcels could result in up to 27 acres of surface disturbance within the LPC IPA, and a potential decrease in LPC habitat quality from human presence and loss of vegetation (see Table 3.33). Both effects would be considered long term because they would result in a loss of habitat and increased fragmentation until operations cease and habitat is successfully reclaimed. Within the IPA, occupied LPC habitat (defined as areas within 1.5 miles of a lek site) is generally closed to new leasing. There is one lek within nominated lease parcel 6790 and two leks within 200 m of parcel 6790 (BLM 2020b).

Table 3.33. Potential Effects on LPC Management Areas from Future Potential Development of the Nominated Lease Parcels

LPC Management Areas (acres)	Lease Parcel (acres)	Description of Overlap	Total Surface Disturbance (acres)	Applicable Stipulations and Lease Notices
IPA (794,487)	420 (80.15 acres)	Parcel 0420 is 100% within the LPC IPA.	4.5 acres (0.0005% of the LPC IPA)	SENM-S-22-CSU
IPA (794,487)	6751 (40 acres)	Parcel 6751 is 100% within the LPC IPA.	4.5 acres (0.0005% of the LPC IPA)	SENM-S-22-CSU
IPA (794,487)	6790 (240 acres)	Parcel 6790 is 100% within the LPC IPA.	4.5 acres (0.0005% of the LPC IPA)	SENM-S-22-CSU
IPA (794,487)	6803 (40 acres)	Parcel 6803 is 100% within the LPC IPA.	4.5 acres (0.0005% of the LPC IPA)	SENM-S-22-CSU
IPA (794,487)	6804 (40 acres)	Parcel 6804 is 100% within the LPC IPA.	4.5 acres (0.0005% of the LPC IPA)	SENM-S-22-CSU
IPA (794,487)	6805 (321.92 acres)	Parcel 6805 is 100% within the LPC IPA.	4.5 acres (0.0005% of the LPC IPA)	SENM-S-22-CSU

Note: IPA = Isolated Population Area. See Section 3.6.4.1 for description.

Stipulation SENM-S-22-CSU is applied to parcels 420, 6751, 6790, 6803, 6804, and 6805, which prohibits drilling for oil and gas and 3-D geophysical exploration operations during the period of March 1 through July 15 of each year, and may provide protections to LPC (see Appendix B). The stipulation applied to the nominated lease parcels would minimize impacts to LPC and LPC habitat within those parcels. Site-specific analysis and pre-disturbance biological surveys at the lease development stage would contribute to avoidance, minimization, and reduction of impacts to suitable habitat. In addition, as previously described in Section 3.6.4.1, the BLM NMSO is planning to initiate programmatic ESA consultation with USFWS to addresses potential effects to LPC associated with BLM oil and gas leasing actions which fall outside of occupied LPC habitat (i.e., 5 miles or greater from occupied habitat), including but not limited to the May 2023 nominated lease parcels.

3.6.4.3 *Mitigation Measures and Residual Effects*

Under the authority granted in standard terms and conditions attached to each lease, measures to reduce impacts on or avoid resource values, land uses, or users would be attached as COAs to the APD. Potential mitigation would reduce the risk of impacts on species; however, residual impacts may still include habitat fragmentation especially from roads and associated infrastructure outside of key habitat areas avoided through lease stipulations.

CHAPTER 4. CONSULTATION AND COORDINATION

The following consultation and coordination efforts with tribes, individuals, organizations, and agencies were conducted for the proposed leasing actions.

4.1 ENDANGERED SPECIES ACT CONSULTATION

BLM PDO biologists have reviewed the proposed leasing and determined the Proposed Action would comply with threatened and endangered species management guidelines outlined in the 1988 CFO RMP as amended in 1997 (Consultation #2-22-96-F-128), and in the Roswell RMP (BLM 1997b), Biological Assessments (BAs) and in accordance with the requirements of the FLPMA and NEPA. In April 2008, the BLM PDO Special Status Species RMPA and associated September 2006 Biological Assessment (Consultation #22420-2007-TA-0033) amended both of these land use plans in portions of Chaves, Roosevelt, Eddy, and Lea Counties to ensure continued habitat protection of two BLM special status species: LPC and DSL.

Given the listing of the LPC under the ESA effective January 2023 (Federal Register 87:72674–72755), the BLM NMSO is planning to initiate programmatic ESA consultation with USFWS to addresses potential effects to LPC associated with BLM oil and gas leasing actions which fall outside of occupied LPC habitat (i.e., 5 miles or greater from occupied habitat), including but not limited to the PDO May 2023 nominated lease parcels. For future leasing actions that occur within 5 miles or less of occupied LPC habitat, BLM would initiate Section 7 consultation for potential effects to LPC on a case-by-case basis.

Additionally, in October and November 2022, the BLM also completed a review of the current species listings within the vicinity of the nominated lease parcels using the USFWS IPaC system (Consultation Code: 2023-0003897 Chaves County (USFWS 2022a); Consultation Code: 2023-0016556 for Eddy County (USFWS 2022b); and Consultation Code: 2023-0003912 for Lea County (USFWS 2022c)). No federally listed fish species were found to have potential to be present on the nominated lease parcels. Based on the understanding that water use for drilling and operations would be properly permitted from existing legal sources (i.e., no new water depletions), no federally listed fish species would be impacted by future potential development of the lease parcels. Therefore, outside of the programmatic consultation, no further consultation with the USFWS is required at this stage for these species. BLM would initiate Section 7 consultation with the USFWS in compliance with the ESA for species not previously analyzed in the 1997 RMP Biological Assessment (BLM 1997a, 1997b) if during site selection federally listed species are found to have a potential to be present or effected during lease development. If during site selection federally listed species are found to have a potential to be affected during lease development, the BLM would initiate Section 7 consultation with the USFWS in compliance with the ESA.

While federal regulation and policies require the BLM to make its public land and resources available on the basis of the principle of multiple uses, it is BLM policy to conserve special status species and their habitats, and to ensure that actions authorized by the BLM do not contribute to the need for the species to become listed as threatened or endangered by the USFWS. Official species lists, whether obtained via IPaC or local USFWS offices, are valid for 90 days. After 90 days, project proponents should confirm their results on IPaC by requesting an updated official species list for their project.

The BLM continues to review the available climate science in connection with its statutory responsibilities, including under NEPA, and has found that despite advances in climate science, “global climate models are unable to forecast local or regional effects on resources as a result of specific emissions.” Any contribution to global climate processes from the issuance of leases is simply too remote, speculative, and undetectable to trigger ESA Section 7 consultation, given accumulated and persisting GHGs already in the atmosphere, the annual volume of GHG emissions that will occur globally regardless

of additional lease issuance, and projected continued climate change. See, for example, the BLM 2021 Annual GHG Report (finding that, "[u]nlike other common air pollutants, the ecological impacts that are attributable to the GHGs are not the result of localized or even regional emissions but are entirely dependent on the collective behavior and emissions of the world's societies"; and noting "the lack of climate analysis tools and techniques that lend themselves to describing the physical climate or earth system responses, such as changes to sea level, average surface temperatures, or regional precipitation rates, that could be attributable to emissions associated with any single [land management] action or decision" [BLM 2022c:18, 65]); see also USFWS, Threatened Species Status for Emperor Penguin With Section 4(d) Rule, 87 Federal Register 64,700, 64,704 (October 26, 2022) ("based on the best scientific data available we are unable to draw a causal link between the effects of specific GHG emissions and take of the emperor penguin in order to promulgate more specific regulations under [ESA Section] 4(d)").

4.2 TRIBAL CONSULTATION

Tribal consultation for the leasing actions is done on a government-to-government basis.
The 19 nominated lease parcels were originally nominated for auction in the BLM PDO May 2023 Competitive Oil and Gas Lease Sale.

The PDO initiated government-to-government consultation for the May 2023 Competitive Oil and Gas Lease Sale under NEPA and NHPA on November 7, 2022, with the Apache Tribe of Oklahoma, Comanche Nation, Hopi Tribe, Kiowa Tribe of Oklahoma, Mescalero Apache Tribe, Pueblo of Isleta, and Ysleta del Sur Pueblo.

Tribal consultation is ongoing, and the BLM PDO will remain available to engage with tribes and Pueblos and respond to any consultation requests. If the nominated parcels are leased, future potential development would go through separate NEPA and NHPA processes as directed by regulation and current policy.

4.3 STATE HISTORIC PRESERVATION OFFICE AND TRIBAL HISTORIC PRESERVATION OFFICE CONSULTATION

Section 106 of the NHPA and its implementing regulations (36 CFR 800) require federal agencies to consider what effect their licensing, permitting, funding, or otherwise authorizing an undertaking, such as an APD or right-of-way, may have on properties listed in or eligible for listing in the NRHP. 36 CFR 800.16 gives specific definitions for key cultural resource management concepts such as undertakings, effects, and areas of potential effects.

The New Mexico BLM has a two-party agreement with the SHPO that implements an authorized alternative to 36 CFR 800 for most undertakings (BLM and SHPO 2014). This agreement, called the State Protocol, offers a streamlined process for reporting and review that expedites consultation with the SHPO. However, certain circumstances, including intense public controversy over an undertaking, may result in the SHPO or BLM requiring use of the standard Section 106 consultation procedures outlined in 36 CFR 800 rather than the State Protocol.

The State Protocol details how the New Mexico BLM and SHPO consult and regulate their relationship. The State Protocol also addressed the necessity of case-by-case SHPO consultation for specific undertakings, the procedures for evaluating the effects of common types of undertakings, and resolution of significant adverse effects on historic properties. These common types of undertakings regularly include actions undertaken by the BLM.

The BLM PDO cultural heritage resources specialists determined that there would be *no effect* to historic properties as a result of the undertaking. The use of State Protocol Appendix C.I.a for this undertaking is appropriate because the lease sale itself does not directly authorize surface disturbance. Rather, leaseholders are granted future right of development to the leased mineral estate that is subject to site-specific analysis under NEPA and Section 106 of the NHPA at the stage of lease development. Such lease development activities are considered undertakings separate from the lease sale. These undertakings would be subject to additional detailed analysis under NEPA and Section 106. Any significant adverse effects identified for development of the lease parcels would be subject to mitigation or avoidance, as appropriate.

The BLM PDO also entered the PBPA as an option for compliance with Section 106 of the NHPA for energy-related projects in the PBPA project area. None of the 19 nominated lease parcels available for lease are within the PBPA area; therefore, development on these parcels would not be eligible for enrollment to the PBPA. See the Programmatic Agreement fact sheet for further information (BLM 2019b). The PDO sent a letter notifying the SHPO of their intent to use the State Protocol Appendix C.I.a. and/or the PBPA on November 9, 2022. Consultation is considered on going. Please refer to Section 4.2 for information regarding tribal consultation.

CHAPTER 5. LIST OF PREPARERS

Table 5.1 contains a list of individuals that contributed to preparation of this EA.

Table 5.1. List of EA Preparers

Name	Area of Expertise	Organization
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Bob Ballard	Supervisor Natural Resource Specialist	BLM CFO
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Ellen Trautner	Cave Specialist	BLM CFO
James Rutley	Solid Minerals Geologist (Potash)	BLM CFO
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Tracy Hughes	Outdoor Recreation Planner	BLM CFO
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Name	**Area of Expertise**	**Organization**
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APPENDIX A. MAPS

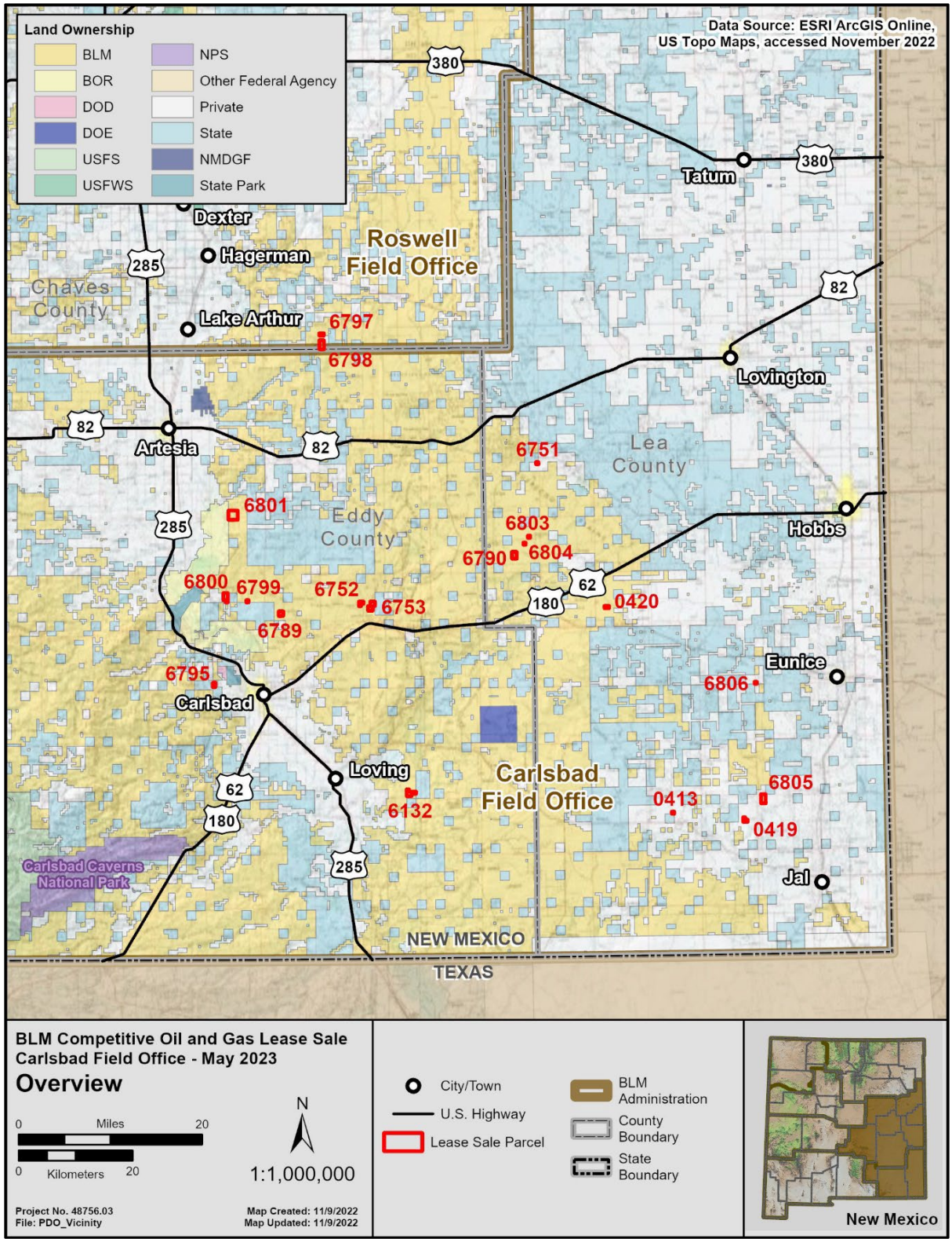

Figure A.1. Location of the nominated lease parcels analyzed within this EA, within the BLM PDO.

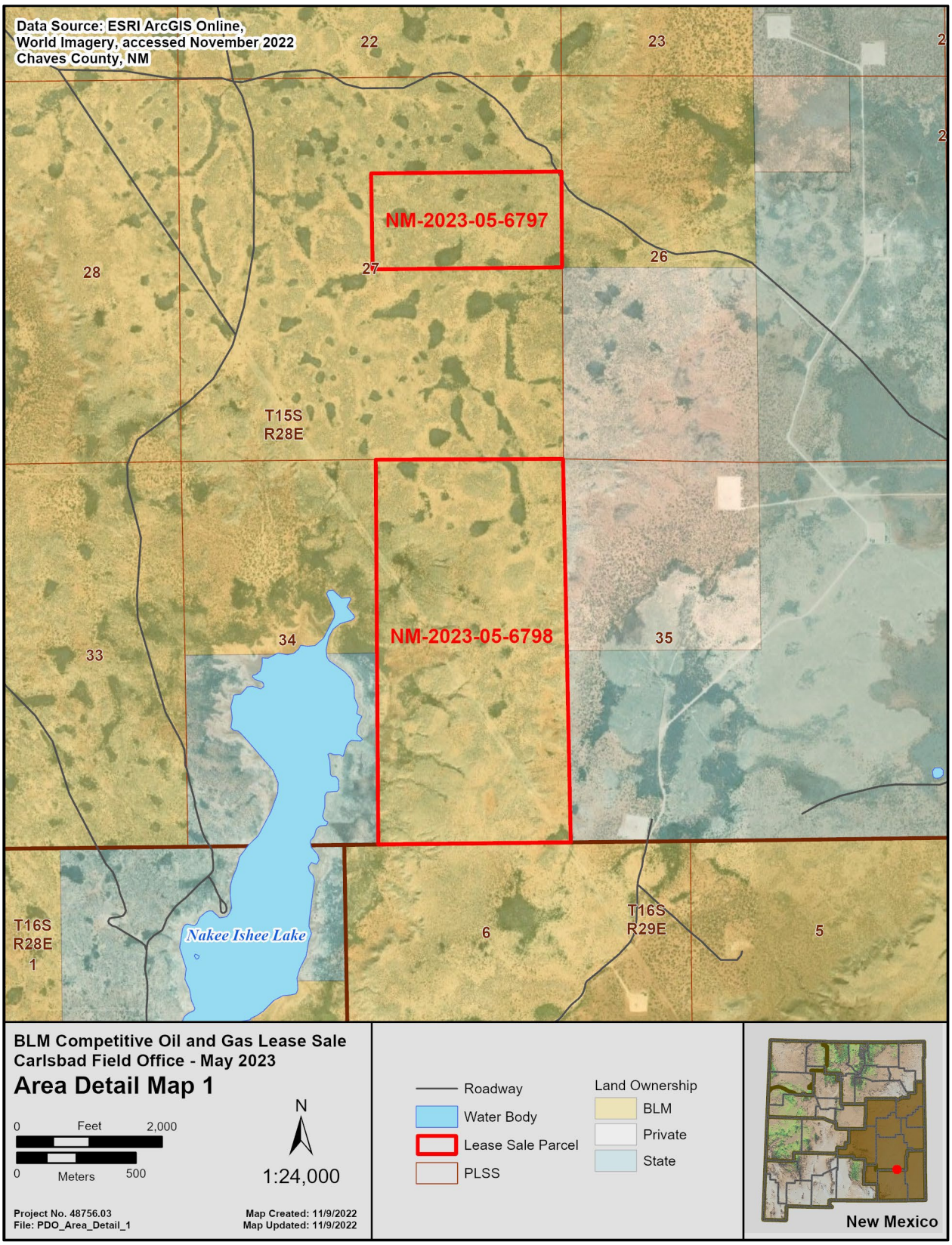

Figure A.2. Detailed map of nominated lease parcels 6797 and 6797 analyzed in this EA, within Chaves County and the BLM PDO.

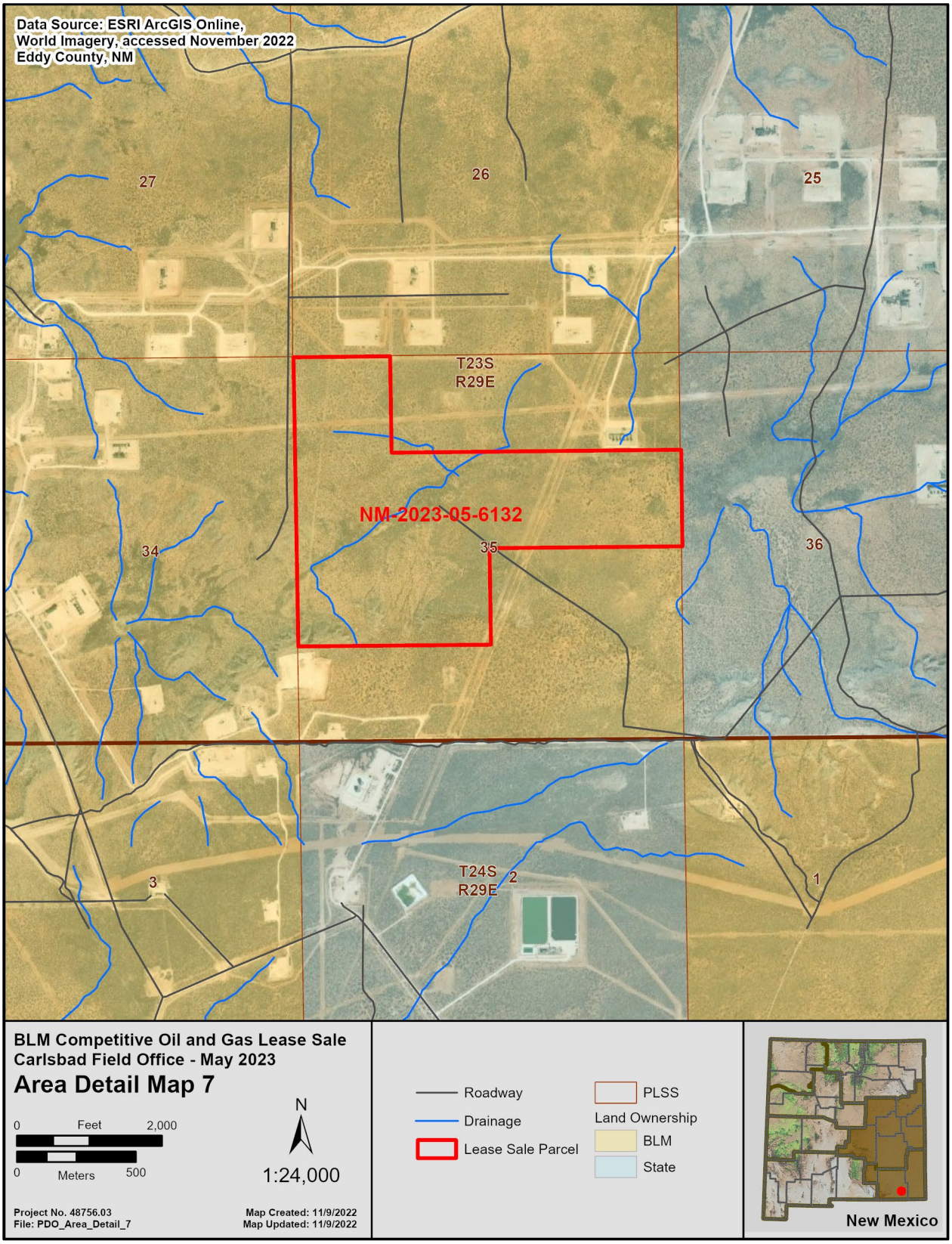

Figure A.3. Detailed map of nominated lease parcel 6132 analyzed in this EA, within Eddy County and the BLM PDO.

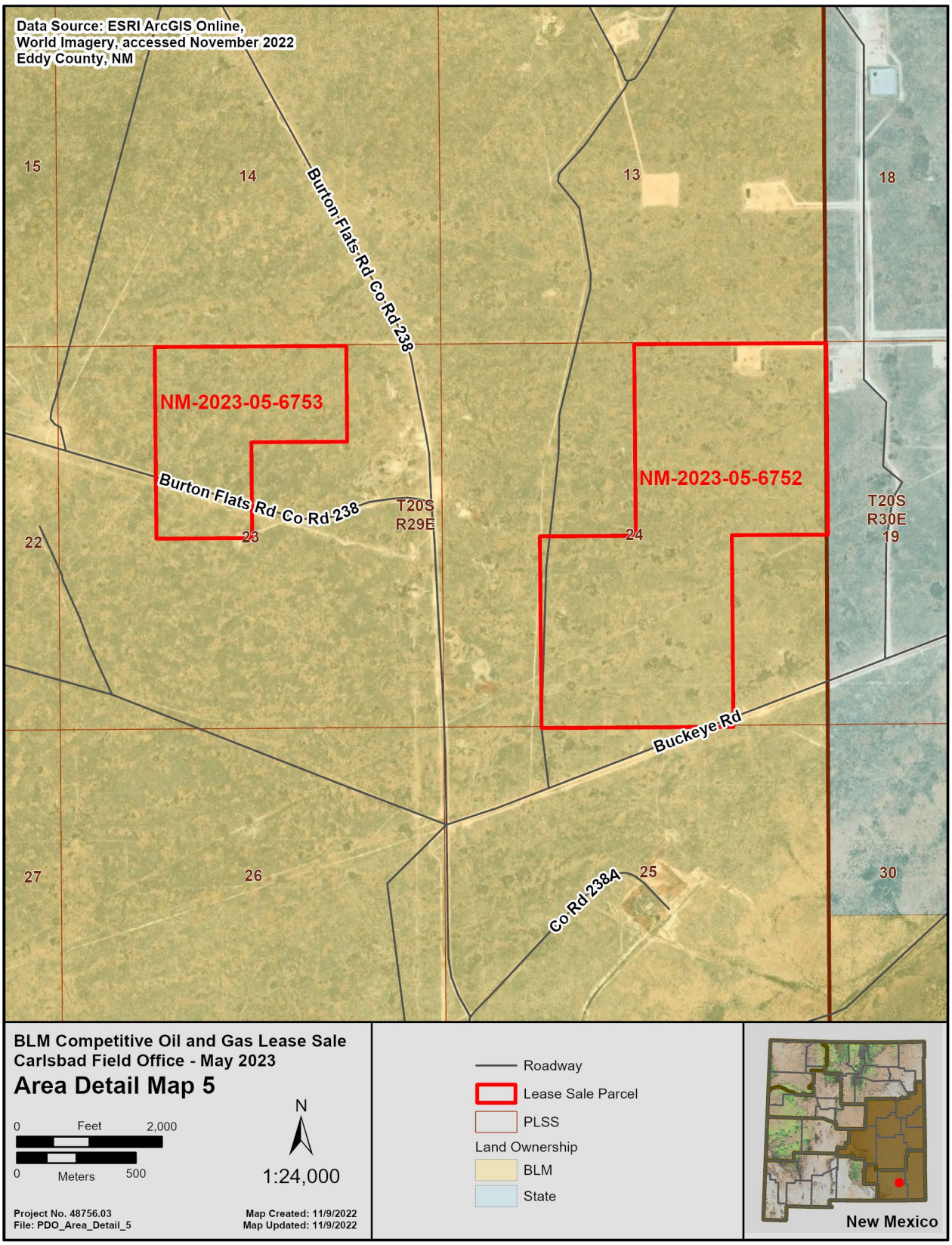

Figure A.4. Detailed map of nominated lease parcels 6752 and 6752 analyzed in this EA, within Eddy County and the BLM PDO.

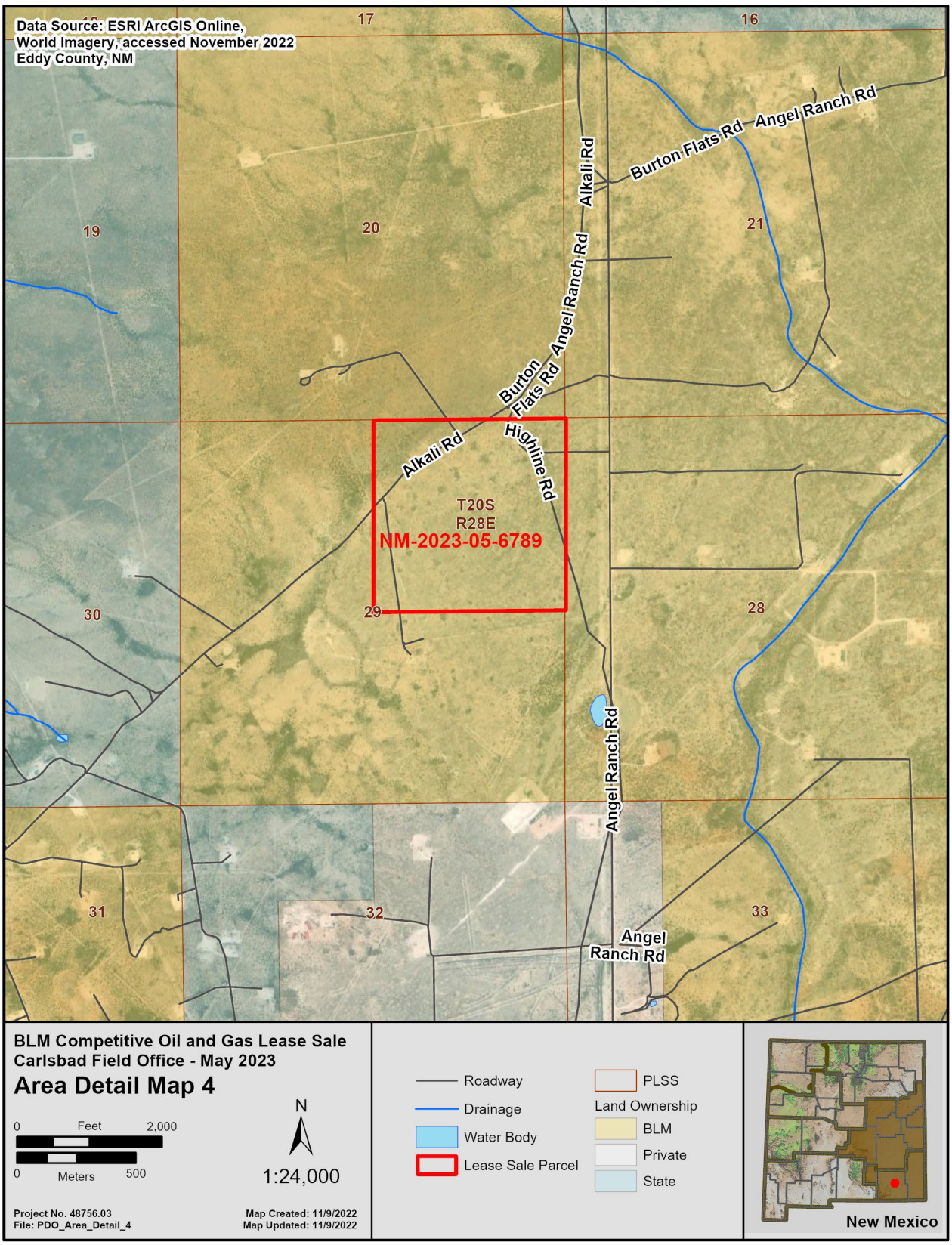

Figure A.5. Detailed map of nominated lease parcel 6789 analyzed in this EA, within Eddy County and the BLM PDO.

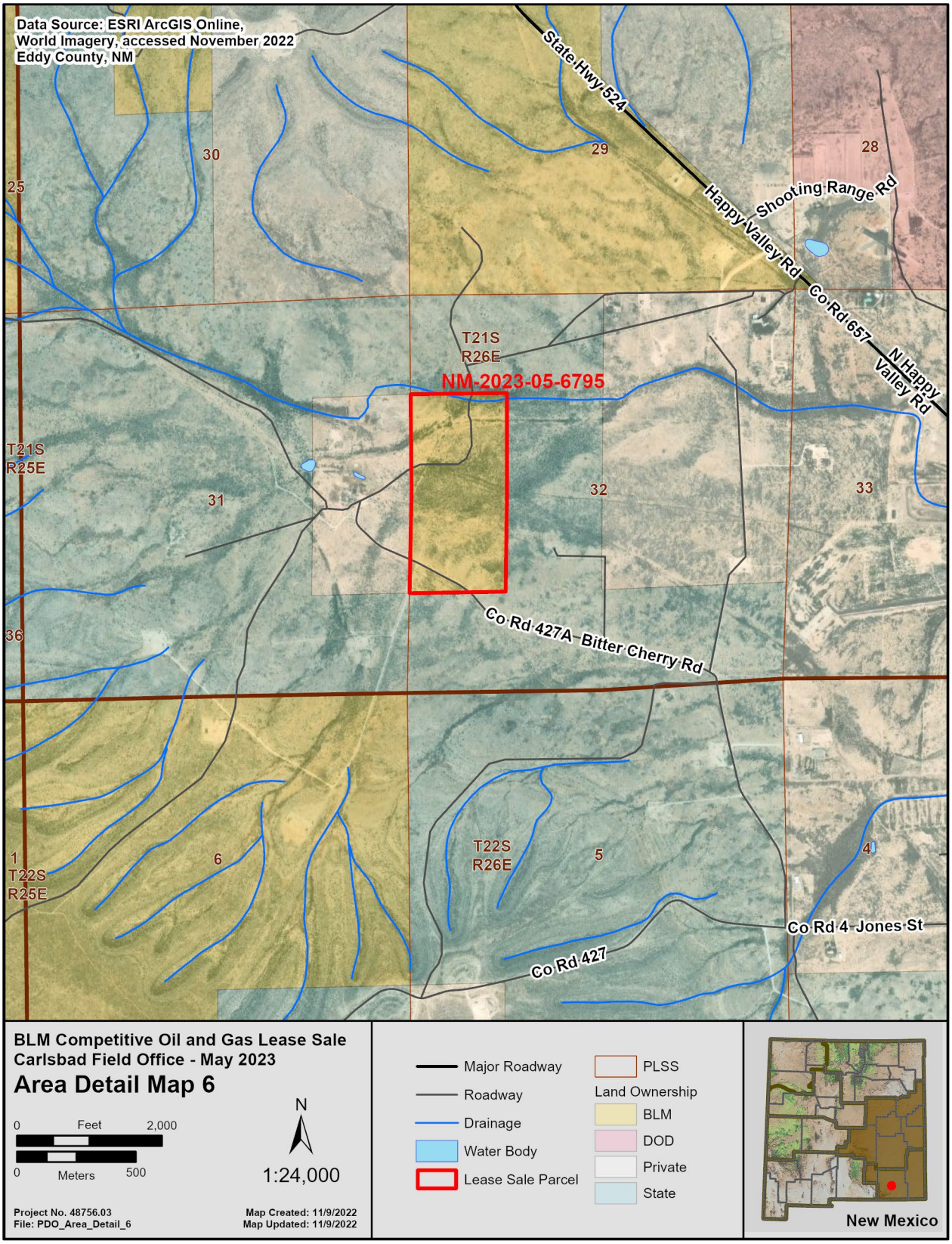

Figure A.6. Detailed map of nominated lease parcel 6795 analyzed in this EA, within Eddy County and the BLM PDO.

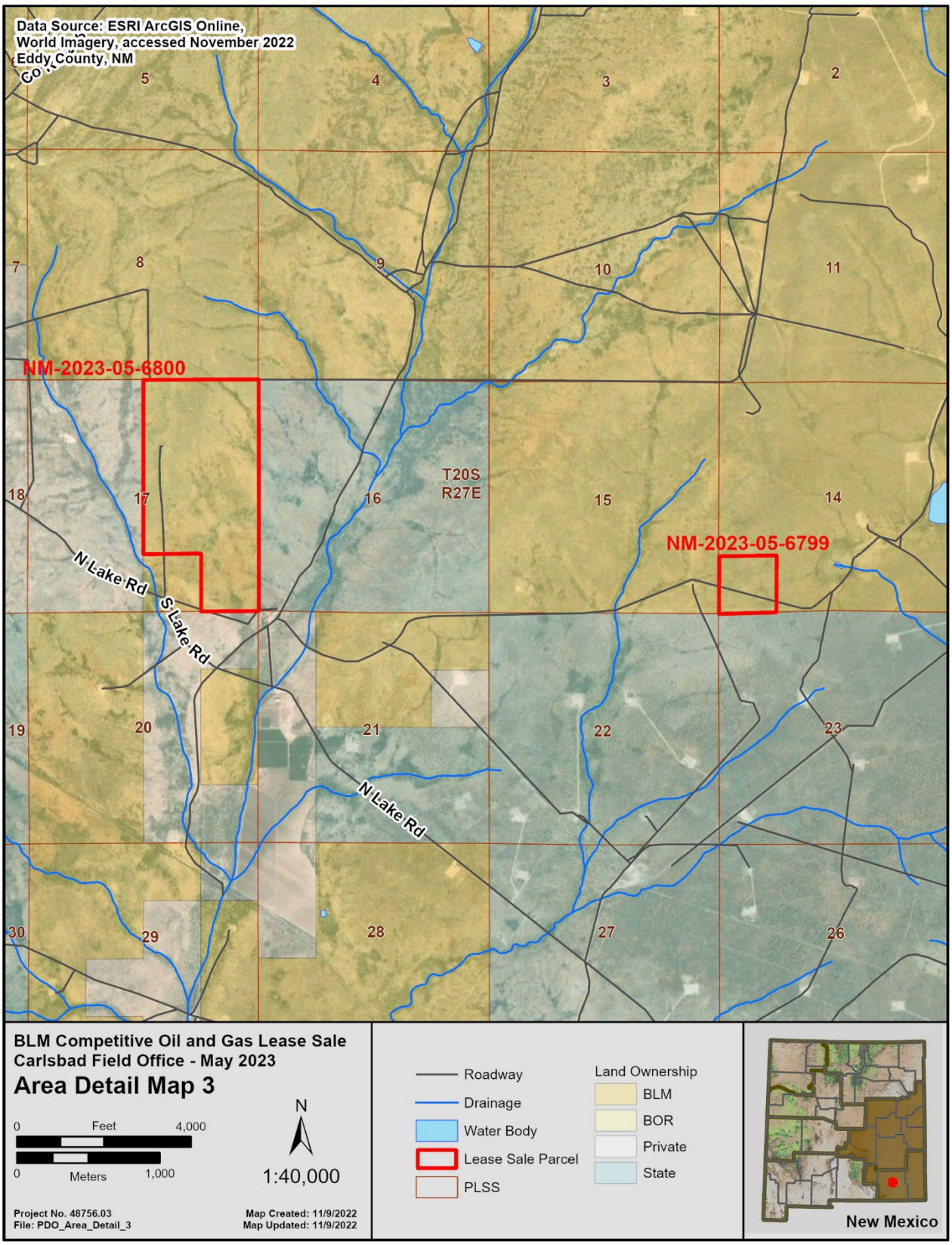

Figure A.7 Detailed map of nominated lease parcels 6799 and 6800 analyzed in this EA, within Eddy County and the BLM PDO.

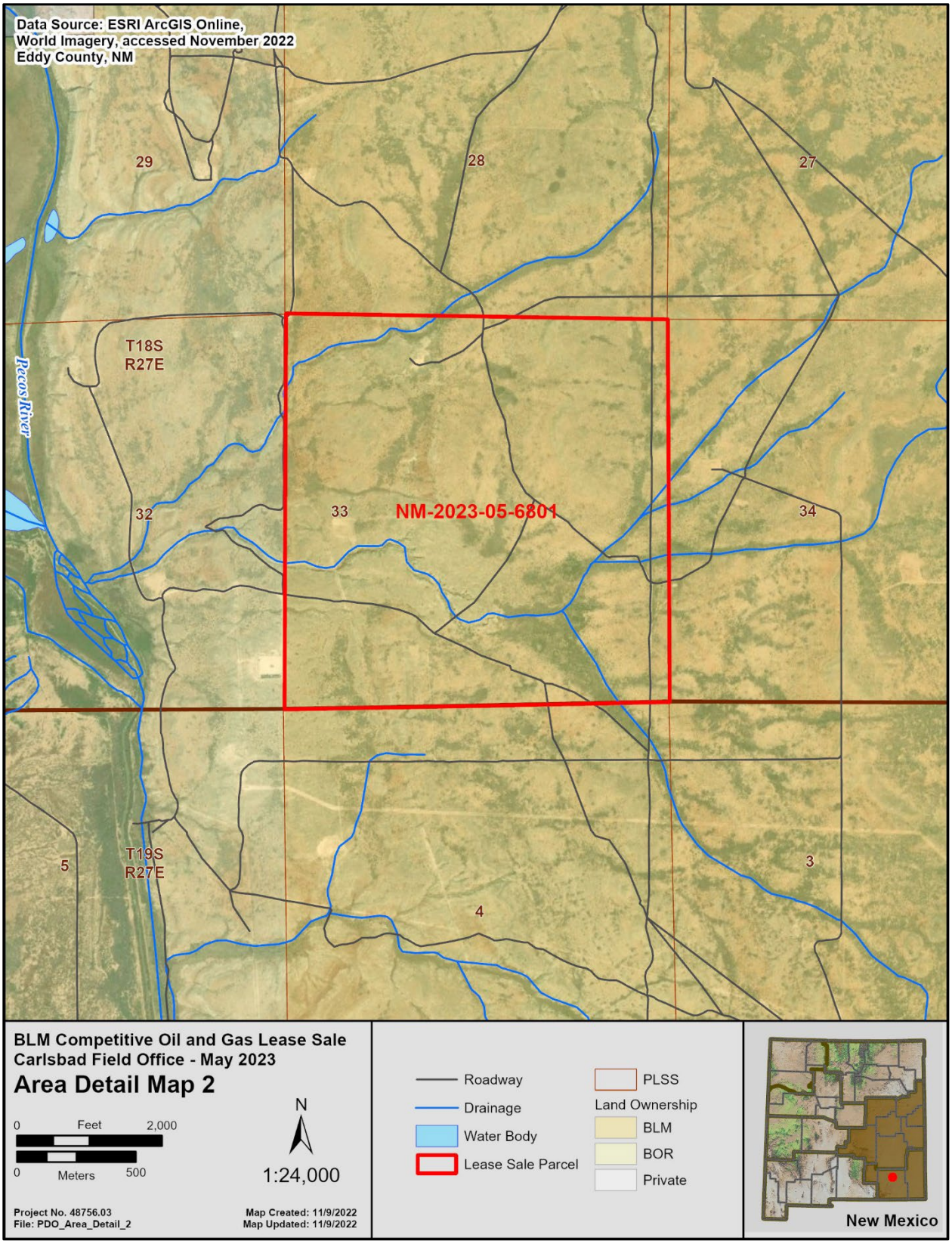

Figure A.8. Detailed map of nominated lease parcel 6801 analyzed in this EA, within Eddy County and the BLM PDO.

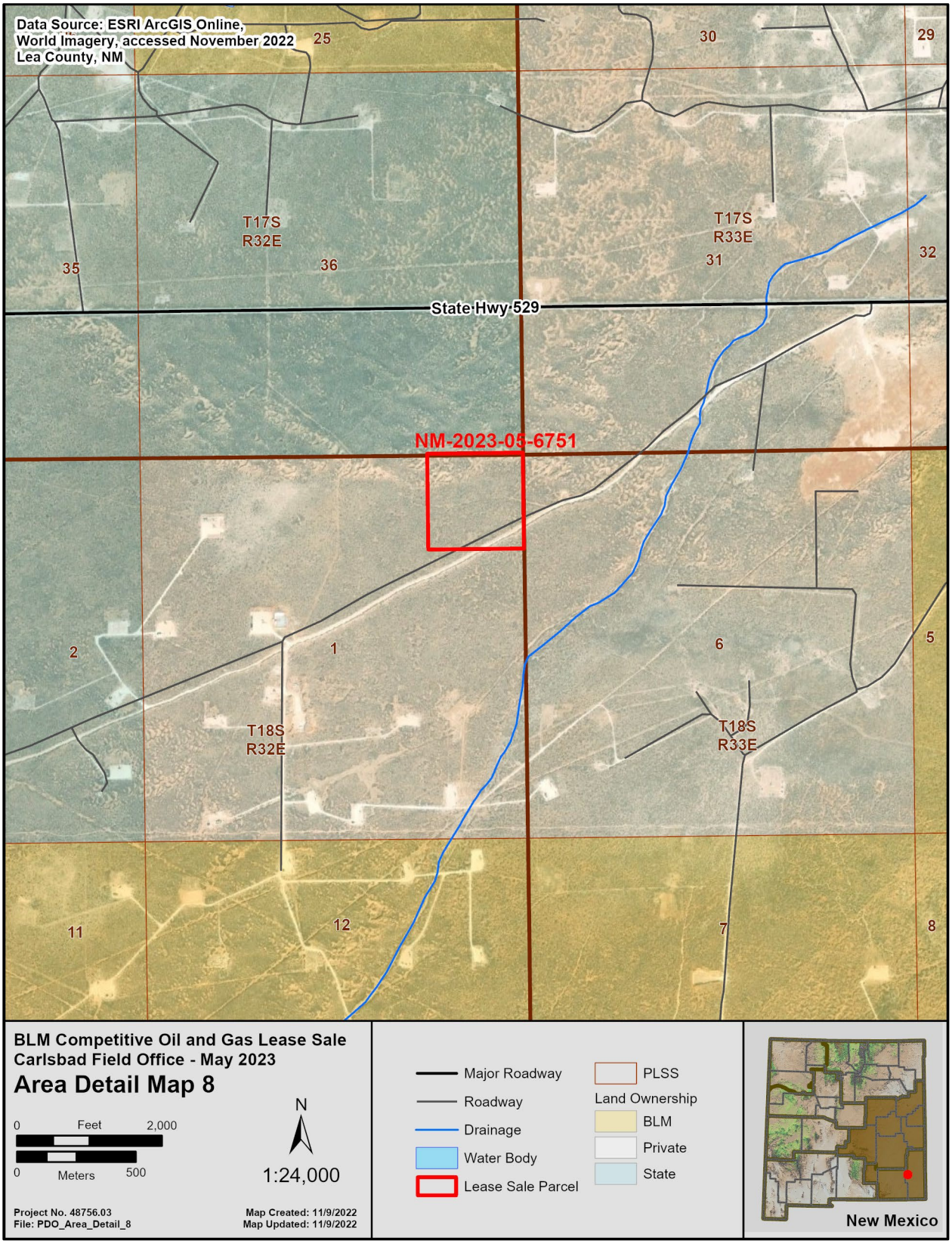

Figure A.9. Detailed map of nominated lease parcel 6751 analyzed in this EA, within Lea County and the BLM PDO.

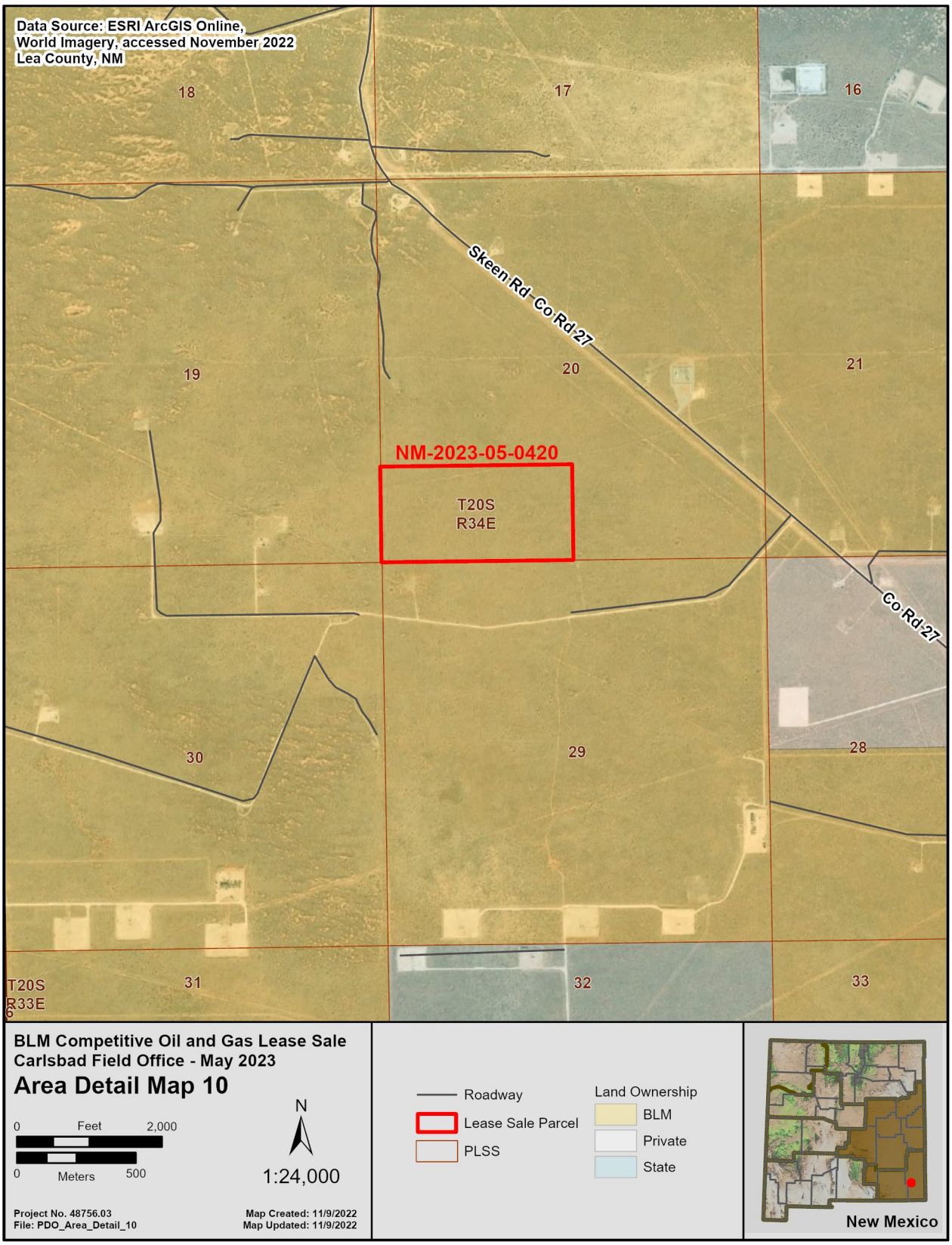

Figure A.10. Detailed map of nominated lease parcel 420 analyzed in this EA, within Lea County and the BLM PDO.

Figure A.11. Detailed map of nominated lease parcel 413 analyzed in this EA, within Lea County and the BLM PDO.

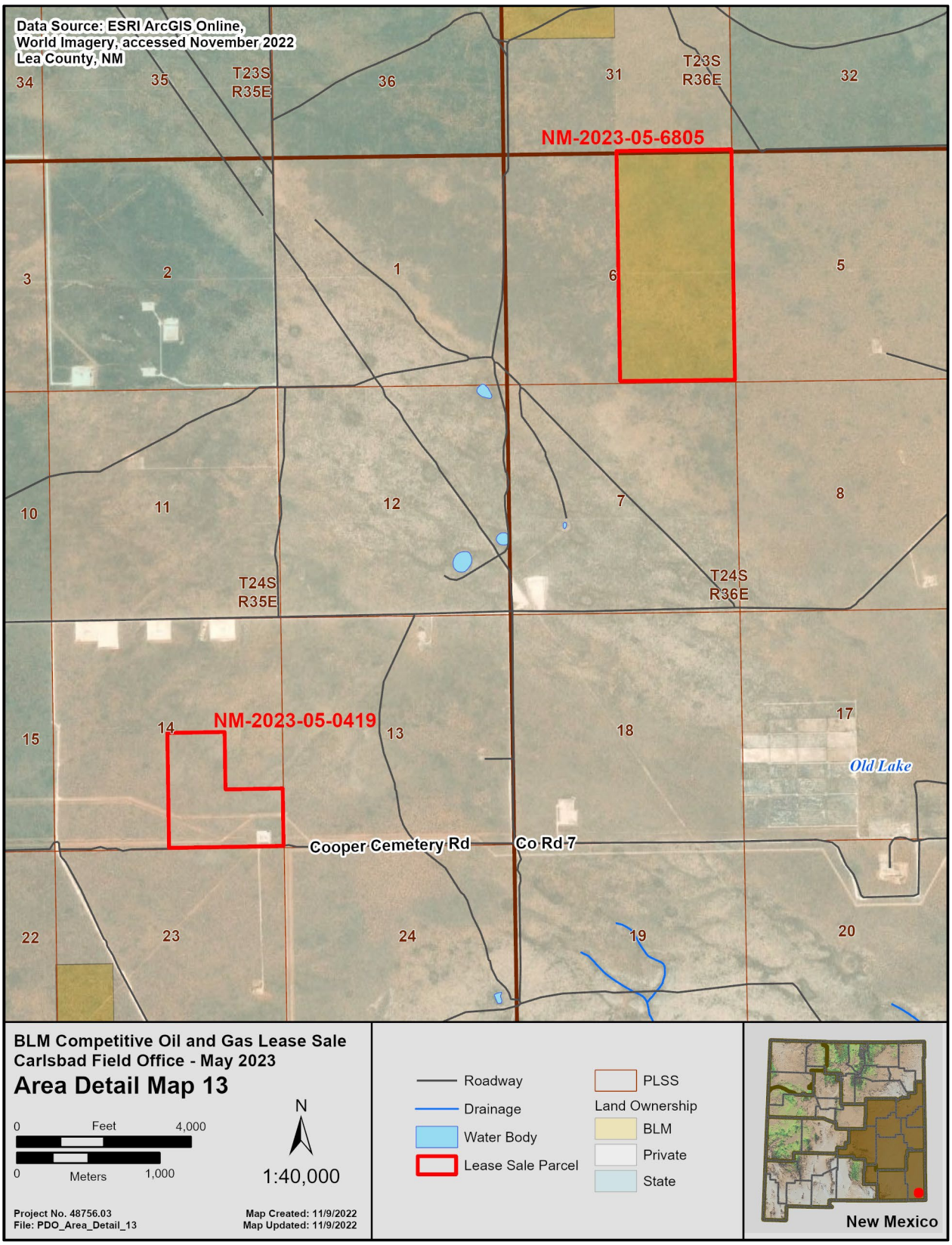

Figure A.12. Detailed map of nominated lease parcels 419 and 6805 analyzed in this EA, within Lea County and the BLM PDO.

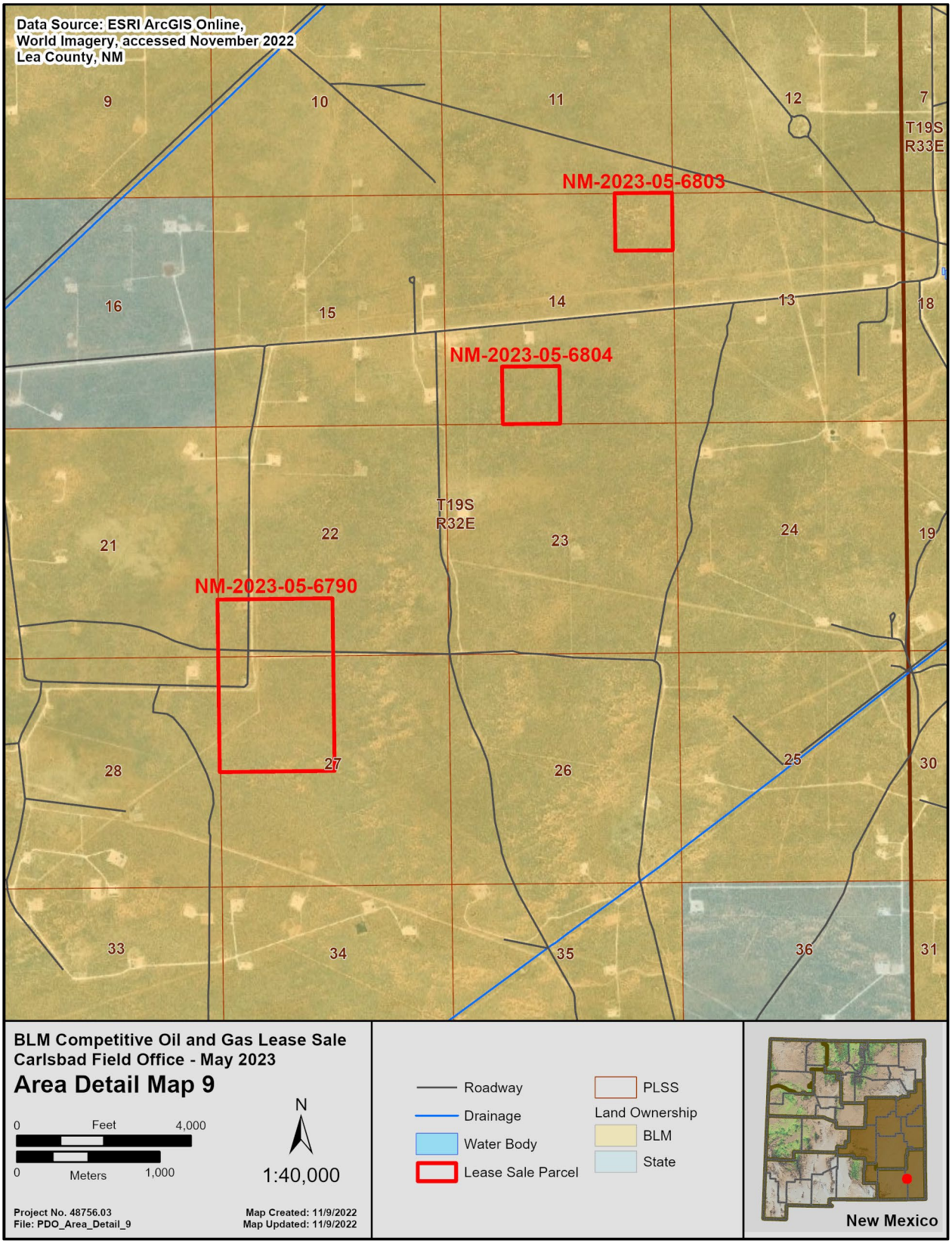

Figure A.13. Detailed map of nominated lease parcels 6790, 6803, and 6804 analyzed in this EA, within Lea County and the BLM PDO.

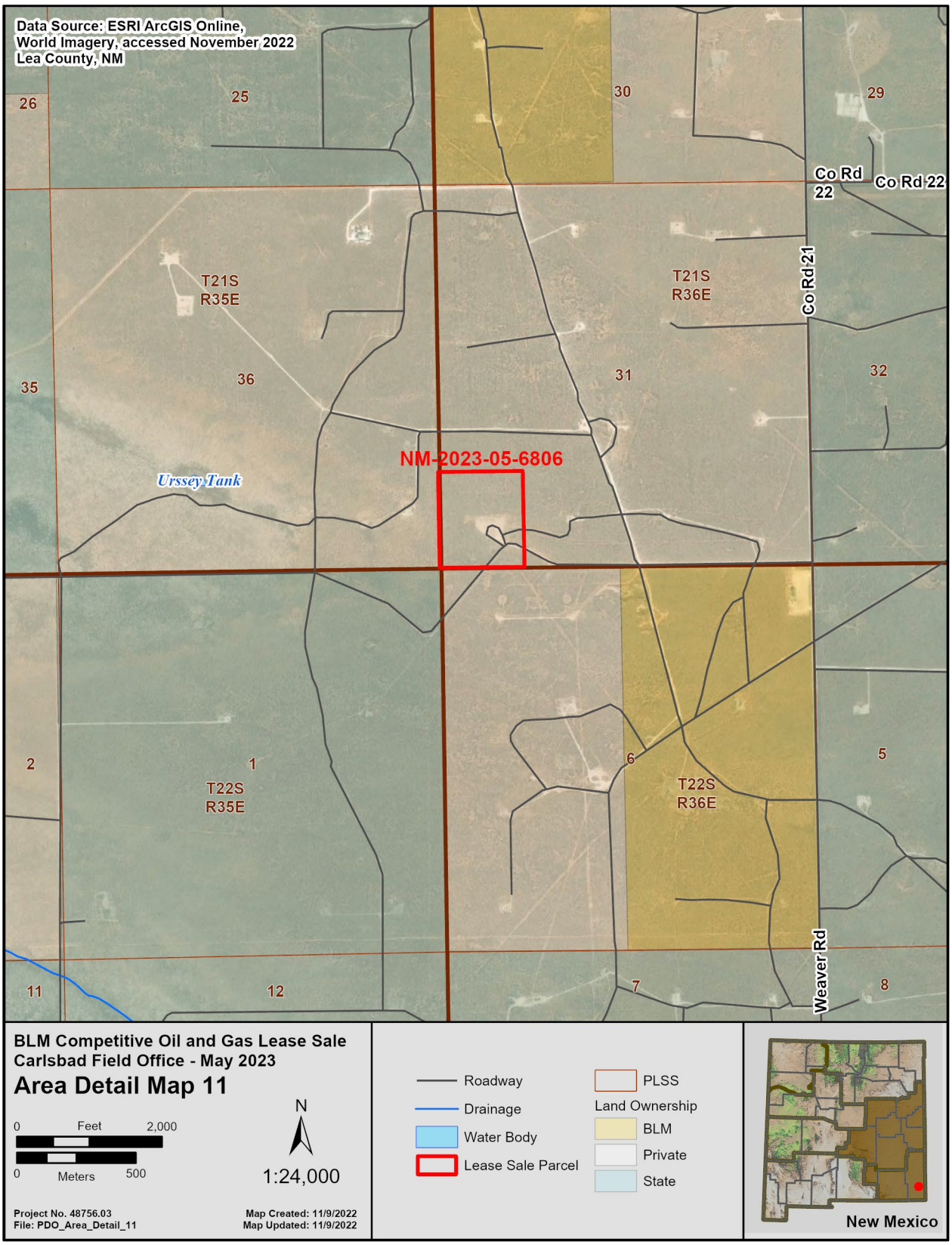

Figure A.14. Detailed map of nominated lease parcel 6806 analyzed in this EA, within Lea County and the BLM PDO.

APPENDIX B. PECOS DISTRICT OFFICE LEASE STIPULATION AND LEASE NOTICE SUMMARY

Table B.1. Lease Stipulations and Lease Notices

Stipulation	Description/Purpose*
NM-13-CSU	**CONTROLLED SURFACE USE STIPILATION = PROTECTION OF PALETONTOLOGICAL RESOURCES** All development in this lease will be subject to compliance with the Paleontological Resources Preservation Act (PRPA), the National Environmental Policy Act (NEPA), and the Federal Land Policy and Management Act (FLPMA). Surface occupancy or use is subject to the flowing special operating constraints: motorized vehicle use associated with lease operations are restricted to approved roads. Prior to approved operations, any vehicle use necessary for well stakings and surveys should be constrained to existing roads and trails when possible; a pedestrian survey must be conducted for paleontological material, using a qualified permitted paleontologist determined by the BLM as part of the permit application for the proposed lease activity in geologic units that are classified on the BLM's Potential Fossil Yield Classification (PFYC) scale as a PFYC U- Unknown, 4, or 5. A survey is also required in areas that are known to contain fossil localities. The survey and report will be used to determine the presence of paleontological material exposed on the surface, and if necessary, the appropriate mitigation of ground-disturbing activities such as monitoring, avoidance, project redesign, data recovery, stabilization, protective barriers and/or signs; and/or the lessee shall immediately notify the BLM Authorized Officer (AO) of any paleontological resources discovered as a result of approved surface-disturbing operations. The lessee shall suspend all activities in the vicinity of such discovery until notified to proceed by the AO and shall protect the discovery from damage or looting. The AO will evaluate, or will have evaluated, such discoveries after being notified and determine, after consulting with the operator and the BLM Regional Paleontologist, the appropriate measures to mitigate adverse effect to significant paleontological resources. Upon approval of the AO, the operator will be allowed to continue construction through the site or will be given the choice of either following the AO's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the fossil resource, or following the AO's instructions for mitigating impacts to the fossil resource prior to continuing construction through the project area. The lessee is responsible for any cost associated for mitigating paleontological resources discovered as a result of their activities.
NM-1-LN	**LEASE NOTICE – SPECIAL STATUS PLANT SPECIES** The lease contains potential, suitable, and/or occupied habitat for special status plant species; therefore, special status plant species clearance surveys may be required prior to approving any surface-disturbing activities within or adjacent to BLM Special Status Plant Species' potential, suitable, and occupied habitats. Based on the results of the survey, COAs may be applied to land use authorizations and permits that fall within the area of direct/indirect impacts or affected habitat, as appropriate. Possible mitigation strategies may include, but are not limited to avoidance/restriction of development, minimizing the area of disturbance, dust abatement measures, deterrents to reduce human disturbance, construction outside of the blooming season, specialized reclamation procedures, long-term monitoring of impacts, general oversight by qualified and independent third-party contractors, non-native or invasive species monitoring and control in occupied and suitable habitat, or any other on-site habitat protection or improvements.
NM-11-LN	**LEASE NOTICE – SPECIAL CULTURAL RESOURCE** All development activities proposed under the authority of this lease are subject to compliance with Section 106 of the NHPA and Executive Order 13007. The lease area may contain historic properties, traditional cultural properties (TCPs), and/or sacred sites currently unknown to the BLM that were not identified in the Resource Management Plan or during the lease parcel review process. Depending on the nature of the lease developments being proposed and the cultural resources potentially affected, compliance with Section 106 of the NHPA and Executive Order 13007 could require intensive cultural resource inventories, Native American consultation, and mitigation measures to avoid adverse effects—the costs for which will be borne by the lessee. The BLM may require modifications to or disapprove proposed activities that are likely to adversely affect TCPs or sacred sites for which no mitigation measures are possible. This could result in extended time frames for processing authorizations for development activities, as well as changes in the ways in which developments are implemented.

Stipulation	Description/Purpose*
NM-14-LN	**LEASE NOTICE – PALEONTOLOGICAL RESOURCES** All development in this lease will be subject to compliance with the Paleontological Resources Preservation Act (PRPA), the National Environmental Policy Act (NEPA), and the Federal Land Policy and Management Act (FLPMA). The lessee shall immediately notify the BLM Authorized Officer (AO) of any paleontological resources discovered as a result of approved surface disturbing operations. The lessee shall suspend all activities in the vicinity of such discovery until notified to proceed by the AO and shall protect the discovery from damage or looting. The AO will evaluate, or will have evaluated, such discoveries after being notified and determine after consulting with the operator and the BLM Regional Paleontologist, the appropriate measures to mitigate adverse effect to significant paleontological resources. Upon approval of the AO, the operator will be allowed to continue construction through the site, or will be given the choice of either following the AO's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the fossil resource, or following the AO's instructions for mitigating impacts on the fossil resource prior to continuing construction through the project area. The lessee is responsible for any cost associated for mitigating paleontology resources discovered as a result of their activities. In addition, surface occupancy or use may be subject to, but not limited to the special operating constraints:
SENM-LN-1	**LEASE NOTICE – POTENTIAL CAVE OR KARST OCCURRENCE AREA** All or a portion of the lease is located in a potential cave or karst occurrence area. Due to the sensitive nature of the cave or karst systems of this area, special protective measures may be developed during environmental analyses and be required as part of approvals for drilling or other operations on this lease. These measures could include: changes in drilling operations; special casing and cementing programs; modifications in surface activities; or other reasonable measures to mitigate impacts on cave or karst values.
SENM-LN-2	**LEASE NOTICE – PROTECTION OF DUNES SAGEBRUSH LIZARD (DSL)** This lease may encompass suitable and occupied habitat of the dunes sagebrush lizard (*Sceloporus arenicolus*). The lessee may be required to conduct an examination of the lands to determine the occurrence of the DSL (peak activity is May–August). Protocol for these surveys can be found in the 2008 Pecos District Special Status Species Resource Management Plan Amendment. The survey would be conducted by a qualified biologist or herpetologist approved by the BLM. A report of the findings would be submitted to the Authorized Officer. Exploration and lease development activities may be limited to areas outside of suitable or occupied habitat within the lease.
SENM-LN-6	**LEASE NOTICE – OIL AND GAS DEVELOPMENT WITHIN THE DESIGNATED POTASH AREA** This lease is located within the Secretary of the Interior's Designated Potash Area. It is subject to Secretarial Order No. 3324, signed December 3, 2012, the Federal Land Policy and Management Act (FLPMA), the Mineral Leasing Act (MLA) and regulations, orders, and directives of the Bureau of Land Management. The Order provides procedures and guidelines for more orderly co-development of oil, gas and potash deposits owned by the United States within the Secretary's Potash Area. Pursuant to applicable laws; the terms, conditions and attached stipulations to the Lease; the Secretary of the Interior's formal orders; and regulations; drilling of an oil and gas well from a surface location within the Designated Potash Area will only be permitted if drilling occurs under the following conditions: (1) a Drilling Island associated with a Development Area established under this Order or a Drilling Island established under a prior Order; (2) a Barren Area and the Authorized Officer (AO) determines that such operations will not adversely affect active or planned potash mining operations in the immediate vicinity of the proposed drill-site; or, (3) a Drilling Island, not covered by (1) above, or single well site established under this Order by the approval and in the sole discretion of the AO, provided that such site was jointly recommended to the AO by the oil and gas lessee(s) and the nearest potash lessee(s). In addition, the lessee may be required to participate in an approved Development Area.
SENM-S-1-CSU	**CONTROLLED SURFACE USE – OIL AND GAS DEVELOPMENT WITHIN THE DESIGNATED POTASH AREA** All or a portion of the lease is located within the Secretary of the Interior's Designated Potash Area. It is subject to Secretarial Order No. 3324, signed December 3, 2012. Pursuant to applicable laws; the terms, conditions and attached stipulations to the Lease; the Secretary of the Interior's formal orders; and regulations; this lease is subject to special requirements.
SENM-S-17-CSU	**CONTROLLED SURFACE USE – PROTECTION OF SLOPES OR FRAGILE SOILS** Surface disturbance will not be allowed on slopes over 30%. Occupancy or use of fragile soils will be considered on a case-by-case basis.
SENM-S-18-CSU	**CONTROLLED SURFACE USE – PROTECTION OF STREAMS, RIVERS, FLOODPLAINS** Surface disturbance will not be allowed within up to 200 meters of the outer edge of 100-year floodplains, to protect the integrity of those floodplains.

Stipulation	Description/Purpose*
SENM-S-19-CSU	**CONTROLLED SURFACE USE – PROTECTION OF PLAYAS AND ALKALI LAKES** Surface disturbance will not be allowed within up to 200 meters from the edge of playas or alkali lakes.
SENM-S-21-CSU	**CONTROLLED SURFACE USE – PROTECTION OF CAVES AND KARSTS** Surface disturbance will not be allowed within up to 200 meters of known cave entrances, passages, or aspects of significant caves, or significant karst features.
SENM-S-22-CSU	**CONTROLLED SURFACE USE – PROTECTION OF LESSER PRAIRIE-CHICKEN (LPC)** Drilling for oil and gas, and 3-D geophysical exploration operations will not be allowed in lesser prairie-chicken habitat during the period of March 1 through July 15, each year. During that period, other activities that produce noise or involve human activity, such as the maintenance of oil and gas facilities, geophysical exploration other than 3-D operations, and pipeline, road, and well pad construction, will be allowed except between 3:00 a.m. and 9:00 a.m. Additionally, no new drilling will be allowed within up to 200 meters of leks known at the time of permitting. Normal vehicle use on existing roads will not be restricted. Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 dB measured at 30 feet from the source of the noise. Open-top tanks, disposal pits, or other open pits will be required to be covered with a fine mesh netting to make them inaccessible to avian species and other wildlife. A low-profile marker will be required for a plugged or abandoned well. The well marker must be approximately 2 inches above ground level.
SENM-S-23-CSU	**CONTROLLED SURFACE USE – PROTECTION OF DUNES SAGEBRUSH LIZARD (DSL)** Surface disturbance will not be allowed in documented occupied habitat areas, or within up to 200 meters of suitable habitat associated with occupied habitat areas identified through field
SENM-S-25-CSU	**CONTROLLED SURFACE USE – VISUAL RESOURCE MANAGEMENT** Surface occupancy or use is subject to the following special operating constraints: Painting of oil field equipment and structures to minimize visual impacts is to be conducted according to the requirements of Notice to Lessees (NTL) 87-1, New Mexico. Low profile facilities also may be required, when needed to reduce the contract of a project with the dominant color, line, texture, and form of the surrounding landscape. Other surface facilities or equipment approved by the BLM, such as large-scale range improvements or pipelines, will be painted, when needed, to conform to the requirements of visual resource management to minimize visual impacts. Paint colors will be selected from the environmental color chart approved by the Rocky Mountain Coordinating Committee. The selected paint color will match as closely as possible the predominant soil or vegetation color of the area. Upon completion of the well and installation of the production facilities (if the well is a producer) the pad will be reclaimed back to a size necessary for production operations only. The edges will be re-contoured and the extra caliche and pad material (excluding top soil) will be hauled off-site. The BLM may require additional reclamation depending upon vegetation recovery. The reclaimed area will be re-contoured and reseeded according to vegetation and soil type.
HQ-TES-1	**ENDANGERED SPECIES ACT SECTION 7 CONSULTATION** The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 USC 1531 et seq., including completion of any required procedure for conference or consultation.
HQ-CR-1	**CULTURAL RESOURCES AND TRIBAL CONSULTATION** This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer (SHPO) and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.

Stipulation	Description/Purpose*
HQ-MLA-1	**LEASE NOTICE- MINERAL LEASING ACT SECTION 2(A)(2)(A)** Provisions of the Mineral Leasing Act (MLA) of 1920, as amended by the Federal Coal Leasing Amendments Act of 1976, affect an entity's qualifications to obtain an oil and gas lease. Section 2(a)(2)(A) of the MLA, 30 U.S.C. 201(a)(2)(A), requires that any entity that holds and has held a Federal Coal Lease for 10 years beginning on or after August 4, 1976, and that is not producing coal in commercial quantities from each such lease cannot qualify for the issuance of any other lease granted under the MLA. 43 CFR 3472 explains coal lessee compliance with Section 2(a)(2)(A). In accordance with the terms of this oil and gas lease with respect to compliance by the initial lessee with qualifications concerning Federal coal lease holdings, all assignees and transferees are hereby notified that this oil and gas lease is subject to cancellation if: (1) the initial lessee as assignor or as transferor has falsely certified compliance with Section 2(a)(2)(A) because of a denial or disapproval by a state office of a pending coal action, i.e., arms-length assignment, relinquishment, or logical mining unit; (2) the initial lessee as assignor or as transferor is no longer in compliance with Section 2(a)(2)(A); or (3) the assignee or transferee does not qualify as a bona fide purchaser and, thus, has no rights to bona fide purchaser protection in the event of cancellation of this lease due to noncompliance with Section 2(a)(2)(A). The lease case file, as well as in other Bureau of Land Management (BLM) records available through the state office issuing this lease, contains information regarding assignor or transferor compliance with Section 2(a)(2)(A).

* Stipulation descriptions are summarized for brevity. The full text of all stipulations, including all modifications, waiver, and exceptions, can be found in the Carlsbad Approved RMP (BLM 1988), as amended (BLM 1997a, 2008a) and Roswell Approved RMP and Record of Decision (BLM 1997b), as amended (BLM 2008a).

APPENDIX C. LEASING PREFERENCE RATINGS FOR NOMINATED LEASE PARCELS

In accordance with Instruction Memorandum (IM) 2023-007, *Evaluating Competitive Oil and Gas Lease Sale Parcels for Future Lease Sales*, the BLM has evaluated the nominated lease parcels against five criteria to determine each parcel's leasing preference. All the parcels nominated are rated as low preference based on one or more criteria. The IM states that if there are no high-preference parcels available for the sale, the office will select one or more low-preference parcels that present the least number of conflicts based on the criteria listed. Given the BLM's ability to mitigate resource impacts through the attachment of stipulations and lease notices at the leasing stage (see Appendix B) and coupled with site-specific analysis and pre-disturbance biological surveys at the lease development stage, impacts to resources are expected to be avoided, minimized, and reduced, such that any reasonably foreseeable impacts can be effectively addressed. Therefore, the BLM is proposing to move the parcels listed forward for leasing, furthering the intent of Section 50265 of the Inflation Reduction Act of 2022, which states that the BLM may not issue a right-of-way for wind or solar energy development on federal land unless it has 1) held an onshore oil and gas lease sale during the past 120 days, and 2) offered the lessee a "sum total" of either 2,000,000 acres or 50% of the acreage for which EOIs have been submitted for lease sales during the previous 1-year period.

Leasing Preference Rating Based on the Following Criteria								
Parcel Information		**Preference Criteria**					**Preference for Leasing**	
Office	**Parcel**	**1 Proximity to Existing Development**	**2 Habitat[1]**	**3 Cultural Resources[2]**	**4 Recreation/ Other Resources[3]**	**5 High Potential**	**High**	**Low**
PDO	NM-2023-03-6789	High	High	High	Low	High		x
PDO	NM-2023-03-6752	High	Low	High	Low	High		x
PDO	NM-2023-03-6803	High	Low	High	High	High		x
PDO	NM-2023-03-6804	High	Low	High	High	High		x
PDO	NM-2023-03-6790	High	Low	High	High	High		x
PDO	NM-2023-03-6805	High	Low	High	High	High		x
PDO	NM-2023-03-6795	High	High	High	Low	High		x
PDO	NM-2023-03-6801	High	High	High	Low	High		x
PDO	NM-2023-03-6799	High	High	High	Low	High		x
PDO	NM-2023-03-6800	High	High	High	Low	High		x
PDO	NM-2023-03-6797	High	High	High	Low	High		x
PDO	NM-2023-03-6798	High	High	Low	Low	High		x
PDO	NM-2023-03-6753	High	High	High	Low	High		x
PDO	NM-2023-03-6132	High	High	High	Low	High		x
PDO	NM-2023-03-6751	High	Low	High	High	High		x
PDO	NM-2023-03-0420	High	Low	High	High	High		x
PDO	NM-2023-03-0413	High	Low	High	High	High		x
PDO	NM-2023-03-0419	High	Low	High	High	High		x

Leasing Preference Rating Based on the Following Criteria								
Parcel Information		**Preference Criteria**					**Preference for Leasing**	
Office	**Parcel**	**1 Proximity to Existing Development**	**2 Habitat[1]**	**3 Cultural Resources[2]**	**4 Recreation/ Other Resources[3]**	**5 High Potential**	**High**	**Low**
PDO	NM-2023-03-6806	High	Low	High	High	High		x

[1] Low determinations for this column were made if the parcel are within either the mapped DSL habitat distribution area, or the LPC IPA. Parcels within the DSL habitat distribution area would be subject to stipulation SENM-S-23-CSU, which would not allow development in documented occupied habitat areas or within up to 200 m of suitable habitat associated with occupied habitat areas. Additionally, lease notice SENM-LN-2 notifies the lessee that a pre-disturbance presence/absence biological survey may be required within these nominated lease parcels. Stipulation SENM-S-22-CSU is applied to parcels in the LPC IPA, which prohibits drilling for oil and gas and 3-D geophysical exploration operations during the period of March 1 through July 15 of each year. See Appendix B for full descriptions of stipulations. Due to the protections offered through stipulations and COAs, the BLM proposes moving these parcels forward for leasing.

[2] Low determinations for this column were made if a cultural site exists within the parcel. The nominated lease parcels assessed within this EA have been assigned the National HQ-CR-1 Lease Stipulation, which requires additional cultural resources analyses pursuant to Section 106 of the NHPA, to include identification, effects assessment, consultation, and if necessary, resolution of adverse effects, prior to the authorization of any ground-disturbing activities associated with the oil and gas lease. Additionally, the nominated lease parcels assessed within this EA have also been assigned Lease Notice NM-11-LN, which requires compliance with Section 106 of the NHPA and Executive Order 13007 (see Appendix B). Due to the protections offered through stipulations and COAs, the BLM proposes moving this parcel forward for leasing.

[3] Low determinations for this column were made if the parcel is located in medium, high, or critical karst areas, or if the parcel has surface water present. The parcels located within karst areas list have lease notice SENM-LN-1 and Stipulation SENM-S-21-CSU (each of which provide protections for caves and karst resources applied to them (see Table 3.12). Parcels with surface water features have stipulation SENM-S-18-CSU, which states that surface disturbance will not be allowed within up to 200 m from the edge of streams, rivers, or floodplains and/or stipulation SENM-S-19-CSU, which states that surface disturbance will not be allowed within up to 200 m from the edge of playa or alkali lakes. See Appendix B for full descriptions of stipulations. Due to the protections offered through stipulations and COAs, the BLM proposes moving these parcels forward for leasing.

APPENDIX D. SUMMARY OF THE TYPICAL PHASES OF OIL AND GAS DEVELOPMENT

INTRODUCTION

The phases of oil and gas development include construction, drilling operations, completion operations, hydraulic fracturing, and production. During the construction activity phase, the area is cleared of vegetation and the pad is constructed. Throughout the drilling operation phase, equipment is moved on site and used to install the drill rig and other associated infrastructure. At this stage, the well is drilled. Well completion follows well drilling. Well completion includes setting the casing to depth, cementing the casing,[12] and perforating the casing in target zones. If a well is going to be drilled directionally,[13] horizontally,[14] or vertically[15] this phase may be followed by hydraulic fracturing, which involves pumping fracturing fluid into a formation at a calculated, predetermined rate and pressure to generate fractures or cracks in the target formation. The production phase begins when the well starts producing. The well abandonment and reclamation phases occur after the productive life of the well has concluded. Well abandonment and reclamation involve plugging wells and reclaiming the surface according to BLM guidelines and requirements.

Construction Activities

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

Next, heavy equipment, including but not limited to bulldozers, graders, front-end loaders, and/or track hoes, are used to construct the pad, along with other features, as needed for development. Other features may include, but are not limited to, an access road, reserve pit, pipeline, and/or fracturing pond. Cut and fills may be required to level the pad or road surfaces. Reserve pits, if authorized, are lined using an impermeable liner or other lining mechanism (i.e., bentonite or clay) to prevent fluids from leaching into the soil. Access roads may have cattle guards, gates, drainage control, or pull-outs installed, among a host of other features that may be necessary based on the site-specific situation. Long-term surface

[12] According to BLM regulations from 43 CFR 3160: Onshore Order No. 2, casing and cementing programs are conducted to protect and/or isolate all usable water zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. The casing setting depth is calculated to position the casing seat opposite a competent formation that will contain the maximum pressure to which it will be exposed during normal drilling operations. Determination of casing setting depth is based on all relevant factors, including presence/absence of hydrocarbons; fracture gradients; usable water zones; formation pressures; lost circulation zones; other minerals; or other unusual characteristics. Any isolating medium other than cement shall receive approval prior to use. The deepest casing may not be cemented and may remain open hole depending on the type of formation it is located in.

[13] Vertical drilling is the process of drilling a well from the surface vertically to a subsurface location where the target oil or gas reservoir is located (U.S. Department of Energy 2015).

[14] Horizontal drilling is the process of drilling a well from the surface to a subsurface location just above the target oil or gas reservoir called the "kickoff point," then deviating the well bore from the vertical plane around a curve to intersect the reservoir at the "entry point" with a near-horizontal inclination, and remaining within the reservoir until the desired bottom hole location is reached (North Dakota Department of Mineral Resources 2008).

[15] Directional drilling is the process of controlling the direction and deviation of drilling a well from the surface to a subsurface location without disturbing the land directly above the target oil or gas reservoir (U.S. Department of Energy 2015).

disturbances such as pads and roads are typically surfaced with a layer of crushed rock. Areas not needed for long-term development are reclaimed by recontouring the surface and re-establishing vegetation.

A pipeline, if needed, is laid within a right-of-way that is first cleared of vegetation. A backhoe, or similar piece of equipment, digs a trench to a depth at least 36 inches below ground surface. After the trench is dug, the pipeline is assembled by welding pieces of pipe together to fit the contour of the pipeline's path. Once inspected, the pipe can be lowered into the trench and covered with stockpiled subsoil originally removed from the trench. Each pipeline undergoes hydrostatic testing prior to natural gas being pumped through the pipeline. This ensures the pipeline is strong enough and absent any leaks. Table D.1 includes some of the common wastes (hazardous and nonhazardous) that are produced during construction.

Drilling Operations

When construction of the well-pad is complete, the drilling rig and associated equipment are moved on site and erected. Usually, a conventional rotary drill rig is used. The drill rig must be capable of withstanding all the anticipated conditions that may be encountered while drilling. Wells may be drilled directionally, horizontally, or vertically based on the target formation. The depth of the well is entirely dependent on the target formation depth and may be several hundred feet deep to over 20,000 feet deep.

When a conventional reserve pit[16]system is used, drilling fluid or mud is circulated through the drill pipe to the bottom of the hole, through the bit, up the bore of the well, and finally to the surface. When drilling mud emerges from the hole, it enters the reserve pit where it remains until all fluids are evaporated and the solids can be buried.

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

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

Once a well has been drilled, completion operations begin. Well completion involves setting casing to depth and perforating the casing in target zones.

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

Hydraulic Fracturing

Hydraulic fracturing is a formation stimulation practice used to create additional permeability in a producing formation, thus allowing oil and/or gas to flow more readily toward and into the wellbore.

[16] A conventional reserve pit is a lined earthen pit excavated adjacent to a well pad and is commonly used for the disposal of drilling muds and fluids in gas or oil fields (U.S. Fish and Wildlife Service 2009).

Hydraulic fracturing can be used to overcome natural barriers, such as naturally low permeability or reduced permeability resulting from near wellbore damage to the flow of fluids (gas or water) to the wellbore (Groundwater Protection Council 2017). The process has been a method for additional oil and gas recovery since the 1900s; however, with the advancement of technology, in both hydraulic fracturing and horizontal drilling, it is more commonly used than previous hydraulic fracturing and horizontal drilling technologies.

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

Hydraulic fracturing increases the flow rate and volume of reservoir fluids that move from the producing formation into the wellbore. The fracturing fluid is typically more than 99% water and sand, with small amounts of readily available chemical additives used to control the chemical and mechanical properties of the water and sand mixture. Because the fluid is composed mostly of water, large volumes of water are usually needed to perform hydraulic fracturing (estimates of water usage for hydraulic fracturing are provided in the BLM New Mexico Water Support Document [BLM 2022]). However, in some cases, water is recycled or produced water is used.

The predominant fluids currently being used for fracture treatments in the shale gas plays are water-based fracturing fluids mixed with friction-reducing additives, also known as slick water (Groundwater Protection Council 2017). The number of chemical additives used in a typical fracture treatment varies depending on the conditions of the specific well that is to be fractured. A typical fracture treatment uses very low concentrations of between three and 12 additive chemicals, depending on the characteristics of the water and the shale formation being fractured. Each component serves a specific, engineered purpose, from limiting the growth of bacteria to preventing corrosion of the well casing. The makeup of fracturing fluid varies from one geologic basin or formation to another. Because the makeup of each fracturing fluid varies to meet the specific needs of each area, there is no one-size-fits-all formula for the volumes for each additive. In classifying fracture fluids and their additives, it is important to realize that service companies that provide these additives have developed a number of compounds with similar functional properties to be used for the same purpose in different well environments. The difference between additive formulations may be as small as a change in concentration of a specific compound (Groundwater Protection Council 2017).

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

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

location during the casing and cementing of the surface casing, which is often the string of casing that protects groundwater, along with other critical casing and cementing intervals. Before hydraulic fracturing takes place, all surface casing and some deeper, intermediate zones are required to be cemented from the bottom of the cased hole to the surface. The cemented well is pressure tested to ensure there are no leaks, and in some cases, a cement bond log is run to ensure the cement has bonded to the casing and the formation. If the fracturing of the well is considered to be a "non-routine" fracturing job for the area, the BLM would always be on-site during those operations as well as when abnormal conditions develop during the drilling or completion of a well.

Some soils and geologic formations contain low levels of radioactive material. This naturally occurring radioactive material (NORM) emits low levels of radiation, to which everyone is exposed on a daily basis. When NORM is associated with oil and natural gas production, it begins as small amounts of uranium and thorium within the rock. These elements, along with some of their decay elements, notably radium-226 and radium-228, can be brought to the surface in drill cuttings and produced water. Radon-222, a gaseous decay element of radium, can come to the surface along with the shale gas. When NORM is brought to the surface, it remains in the rock pieces of the drill cuttings, remains in solution with produced water, or, under certain conditions, precipitates out in scales or sludges. The radiation is weak and cannot penetrate dense materials such as the steel used in pipes and tanks. Testing is required prior to disposal of pipes, tanks, and pipe deposits according to Section 19.15.35.8 of the New Mexico Administrative Code (NMAC). Radiation levels used to define "regulated NORM" in oil-field soils, equipment, sludges, or other materials related to oilfield operations or processes are defined at 20.3.14.1403 NMAC. Disposal of NORM (including in produced water) is regulated per 19.15.35.9 through 19.15.35.14 NMAC and the New Mexico environmental improvement board rule, 20.3.14 NMAC. Per 20.3.14.1403 NMAC, produced water is exempt from the requirements of these regulations if it is reinjected into a Class I or Class II Underground Injection Control (UIC) well permitted by the New Mexico Oil Conservation Division (NMOCD) and/or stored or disposed of in a double, synthetically lined surface impoundment permitted by the NMOCD.

Production Operations

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

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

Abandonment and Reclamation

Well abandonment (whether dry hole or depleted producer) and reclamation of location, access roads, and other facilities require BLM approval. After approval, wellbores are plugged with cement as necessary to prevent fluid or pressure mitigation and to protect and isolate mineral and water resources. Wellheads are removed, and both the surface casing and the production casing are cut off below ground in compliance with federal and state regulations. The well pad, reserve pit, and access roads are reclaimed according to BLM guidelines. This may include backfilling the pit, recontouring the surface to blend with natural surroundings, and redistributing topsoil. All surfaces are then reseeded according to BLM and state requirements specified in the Application for Permit to Drill (APD) approval.

Common Wastes

Table D.1 includes some of the common wastes (hazardous and nonhazardous) that are produced during oil and gas development.

Table D.1. Common Wastes Produced During Oil and Gas Development

Phase	Waste	
Construction, Well Drilling and Completion (including hydraulic fracturing)	Domestic wastes (i.e., food scraps, paper, etc.)	
	Excess construction materials	Woody debris
	Used lubricating oils	Paints
	Solvents	Sewage
	Drilling muds, including additives (i.e., chromate and barite) and cuttings; Well drilling, completion, workover, and stimulation fluids (i.e., oil derivatives such as polycyclic aromatic hydrocarbons [PAHs], spilled chemicals, suspended and dissolved solids, phenols, cadmium, chromium, copper, lead, mercury, nickel)	
	Equipment, power unit and transport maintenance wastes (i.e., batteries; used filters, lubricants, oil, tires, hoses, hydraulic fluids; paints; solvents)	
	Fuel and chemical storage drums and containers	
	Cementing wastes	Rig wash
	Production testing wastes	Excess drilling chemicals
	Excess construction materials	Processed water
	Scrap metal	Contaminated soil including hazardous and non-hazardous materials (potential)
	Sewage	Domestic wastes
Production	Power unit and transport maintenance wastes (i.e., batteries; used filters, lubricants, filters, tires, hoses, coolants, antifreeze; paints; solvents, used parts)	
	Discharged produced water	
	Production chemicals	
	Workover wastes (e.g., brines)	
Abandonment/ Reclamation	Construction materials	
	Decommissioned equipment	
	Contaminated soil (potential)	
	Equipment or wastes that could contain hazardous and nonhazardous materials	

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APPENDIX E. ENVIRONMENTAL JUSTICE MAPS AND DATA

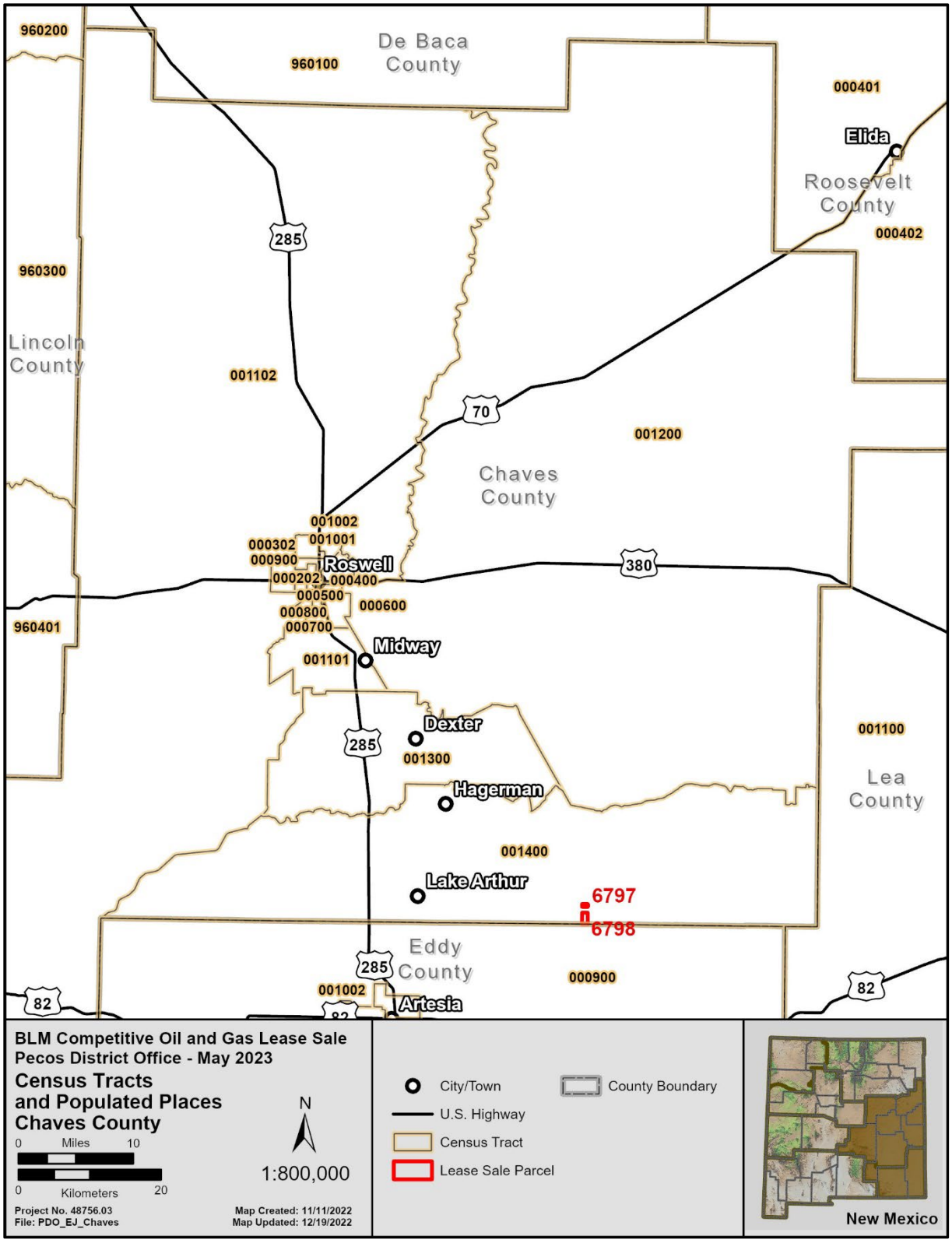

Figure E.1. Environmental justice analysis area and census tracts within Chaves County.

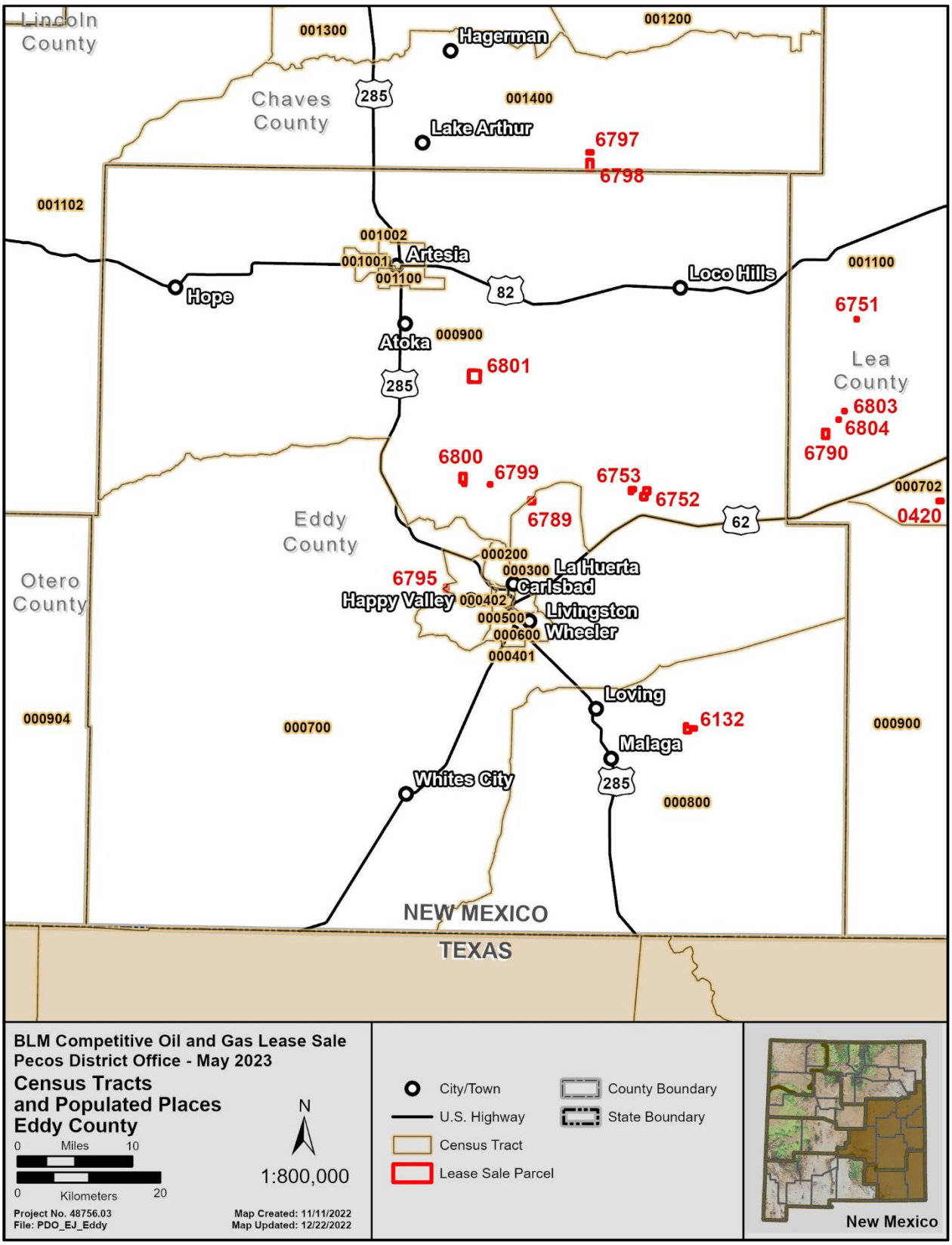

Figure E.2. Environmental justice analysis area and census tracts within Eddy County.

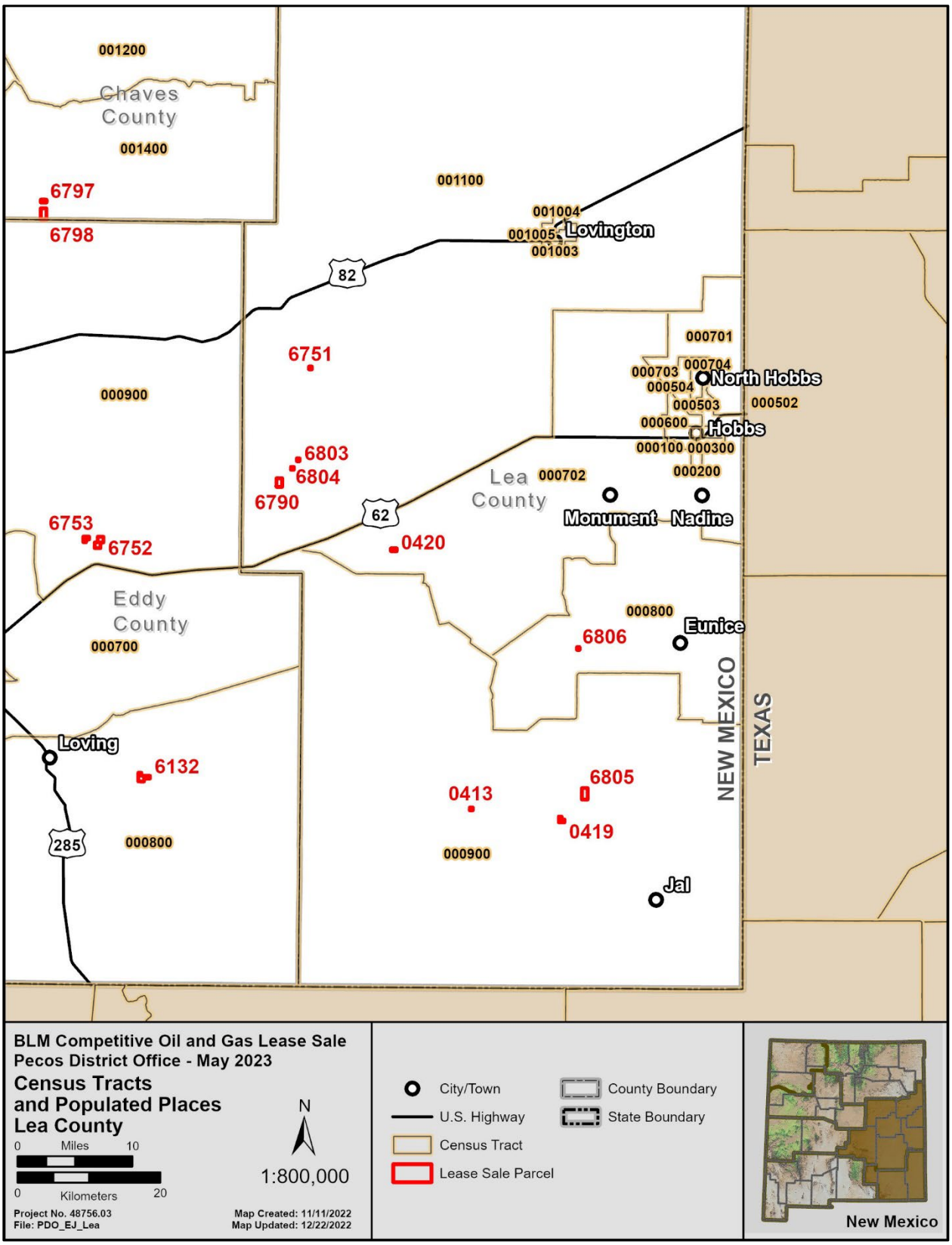

Figure E.3. Environmental justice analysis area and census tracts within Lea County.

Table E.1. Low-Income and Minority Populations Applicable to the Area of Analysis

Analysis Unit	Total Population	Minority Population[3]									Low-Income Population[4]	
		Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races	Hispanic or Latino (of any race)	White Alone[6]	Total Minority Population[6]	Individuals	Families
United States[1]	326,569,308	12.6%	0.8%	5.6%	0.2%	5.1%	5.2%	18.2%	60.1%	39.9%	29.8%	23.5%
New Mexico (110% meaningfully greater threshold)[2]	2,097,021	2.1% (2.3%)	9.3% (10.2%)	1.6% (1.8%)	0.09% (0.10%)	8.8% (9.7%)	8.1% (8.9%)	49.2% (54.1%)	36.7%	63.3% (69.6%)	39.5%	32.6%
Counties												
Chaves County, New Mexico	64,912	1.6%	1.6%	1.0%	0.0%	7.6%	7.6%	57.6%	38.1%	61.9%	47.1%	39.1%
Eddy County, New Mexico	57,865	1.5%	1.7%	0.7%	0.0%	5.5%	6.8%	50.0%	45.4%	54.6%	32.0%	27.2%
Lea County, New Mexico	70,359	3.7%	1.0%	0.6%	0.0%	5.1%	8.9%	59.7%	34.5%	65.5%	35.3%	28.4%
Census Tracts												
Chaves County												
Census Tract 2.01, Chaves County, New Mexico	3,073	3.1%	0.0%	0.0%	0.0%	10.1%	1.6%	65.3%	30.1%	69.9%	42.4%	45.4%
Census Tract 2.02, Chaves County, New Mexico	3,913	4.5%	1.0%	0.0%	0.0%	6.8%	11.1%	53.0%	37.7%	62.3%	57.7%	51.6%
Census Tract 3.01, Chaves County, New Mexico	3,502	1.2%	0.0%	6.9%	0.0%	12.1%	2.2%	58.4%	34.1%	65.9%	57.7%	43.3%
Census Tract 3.02, Chaves County, New Mexico	3,105	2.6%	0.2%	8.0%	0.2%	1.2%	6.8%	43.6%	44.5%	55.5%	47.8%	38.7%
Census Tract 4, Chaves County, New Mexico	5,032	0.1%	1.3%	0.6%	0.0%	10.6%	6.9%	68.9%	29.0%	71.0%	61.6%	52.7%
Census Tract 5, Chaves County, New Mexico	1,896	2.0%	0.8%	0.0%	0.0%	11.8%	15.6%	78.1%	19.0%	81.0%	67.4%	57.1%
Census Tract 6, Chaves County, New Mexico	4,444	1.5%	2.5%	0.0%	0.0%	11.9%	16.6%	81.9%	14.3%	85.7%	68.0%	65.6%
Census Tract 7, Chaves County, New Mexico	4,707	1.2%	0.2%	0.0%	0.0%	6.8%	8.4%	62.2%	35.1%	64.9%	51.1%	44.9%

Analysis Unit	Total Population	Minority Population[3]									Low-Income Population[4]	
		Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races	Hispanic or Latino (of any race)	White Alone[6]	Total Minority Population[6]	Individuals	Families
Census Tract 8, Chaves County, New Mexico	6,153	0.6%	4.0%	0.0%	0.0%	14.2%	4.7%	63.5%	34.7%	65.3%	47.7%	44.0%
Census Tract 9, Chaves County, New Mexico	3,313	4.9%	0.2%	0.0%	0.0%	2.1%	12.0%	53.2%	41.7%	58.3%	30.9%	22.1%
Census Tract 10.01, Chaves County, New Mexico	5,523	0.6%	0.0%	2.2%	0.0%	2.3%	12.9%	42.1%	54.5%	45.5%	14.6%	12.0%
Census Tract 10.02, Chaves County, New Mexico	4,273	0.4%	0.9%	0.0%	0.0%	1.0%	5.8%	36.8%	62.8%	37.2%	25.6%	15.3%
Census Tract 11.01, Chaves County, New Mexico	5,021	2.6%	6.4%	0.7%	0.0%	10.4%	1.2%	60.7%	30.0%	70.0%	61.9%	53.4%
Census Tract 11.02, Chaves County, New Mexico	3,646	0.8%	1.7%	0.0%	0.0%	4.1%	2.3%	35.3%	62.8%	37.2%	34.1%	25.8%
Census Tract 12, Chaves County, New Mexico	1,447	0.0%	1.1%	0.0%	0.0%	3.0%	14.9%	47.3%	51.3%	48.7%	42.5%	36.6%
Census Tract 13, Chaves County, New Mexico	3,326	1.2%	1.9%	0.0%	0.0%	8.7%	7.4%	69.0%	28.4%	71.6%	49.3%	42.8%
Census Tract 14, Chaves County, New Mexico	2,538	0.7%	1.1%	0.2%	0.0%	6.1%	6.8%	59.2%	38.5%	61.5%	51.7%	43.2%
Eddy County												
Census Tract 1, Eddy County, New Mexico	1,739	5.8%	1.9%	0.0%	0.0%	7.3%	11.2%	60.3%	32.1%	67.9%	32.8%	23.6%
Census Tract 2, Eddy County, New Mexico	6,380	0.1%	1.6%	4.2%	0.0%	5.5%	2.4%	36.2%	54.7%	45.3%	20.5%	17.7%
Census Tract 3, Eddy County, New Mexico	5,623	2.5%	0.1%	0.0%	0.0%	4.3%	6.9%	47.0%	49.9%	50.1%	22.9%	21.4%
Census Tract 4.01, Eddy County, New Mexico	3,452	0.0%	4.4%	0.9%	0.0%	6.1%	0.9%	45.0%	51.8%	48.2%	27.9%	24.6%

Analysis Unit	Total Population	Minority Population[3]									Low-Income Population[4]	
		Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races	Hispanic or Latino (of any race)	White Alone[6]	Total Minority Population[6]	Individuals	Families
Census Tract 4.02, Eddy County, New Mexico	4,249	1.0%	1.2%	0.0%	0.0%	6.8%	13.8%	48.8%	48.1%	51.9%	36.4%	32.5%
Census Tract 5, Eddy County, New Mexico	3,093	4.8%	0.9%	0.0%	0.0%	10.2%	16.7%	65.2%	30.4%	69.6%	48.2%	36.5%
Census Tract 6, Eddy County, New Mexico	6,580	2.1%	1.0%	0.3%	0.0%	5.0%	8.0%	47.6%	47.7%	52.3%	35.0%	29.4%
Census Tract 7, Eddy County, New Mexico	6,095	2.3%	1.5%	0.0%	0.0%	7.6%	0.9%	48.6%	47.8%	52.2%	21.7%	20.7%
Census Tract 8, Eddy County, New Mexico	2,035	0.0%	4.7%	0.0%	0.0%	1.1%	6.5%	66.6%	28.7%	71.3%	45.5%	38.7%
Census Tract 9, Eddy County, New Mexico	5,849	0.3%	1.8%	0.1%	0.0%	7.1%	8.8%	48.3%	48.5%	51.5%	35.4%	29.9%
Census Tract 10.01, Eddy County, New Mexico	2,834	0.5%	0.2%	0.0%	0.0%	6.7%	1.7%	58.2%	39.4%	60.6%	29.0%	24.0%
Census Tract 10.02, Eddy County, New Mexico	3,346	1.5%	7.9%	0.0%	0.0%	1.0%	17.2%	72.7%	18.8%	81.2%	65.5%	56.4%
Census Tract 11, Eddy County, New Mexico	6,590	1.4%	0.0%	1.4%	0.0%	2.9%	2.9%	44.7%	51.7%	48.3%	25.8%	22.5%
Lea County												
Census Tract 1, Lea County, New Mexico	3,005	2.8%	0.5%	0.1%	0.0%	13.4%	19.0%	73.4%	21.0%	79.0%	33.6%	24.9%
Census Tract 2, Lea County, New Mexico	4,204	3.4%	1.0%	0.0%	0.0%	9.7%	24.0%	79.4%	12.8%	87.2%	45.7%	49.4%
Census Tract 3, Lea County, New Mexico	3,714	14.1%	0.0%	0.0%	0.0%	15.1%	9.6%	78.2%	7.9%	92.1%	53.3%	62.6%
Census Tract 4, Lea County, New Mexico	4,279	9.0%	0.3%	0.0%	0.0%	8.5%	20.7%	84.4%	6.8%	93.2%	69.1%	60.0%
Census Tract 5.02, Lea County, New Mexico	7,987	4.5%	0.4%	2.9%	0.0%	1.7%	10.5%	55.0%	38.4%	61.6%	39.8%	30.4%

Analysis Unit	Total Population	Minority Population[3]									Low-Income Population[4]	
		Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races	Hispanic or Latino (of any race)	White Alone[6]	Total Minority Population[6]	Individuals	Families
Census Tract 5.03, Lea County, New Mexico	3,659	5.9%	5.0%	0.4%	0.0%	7.6%	6.9%	39.0%	47.6%	52.4%	20.6%	15.8%
Census Tract 5.04, Lea County, New Mexico	4,178	2.7%	0.4%	2.6%	0.0%	0.5%	12.4%	39.8%	51.8%	48.2%	12.5%	9.5%
Census Tract 6, Lea County, New Mexico	6,386	3.9%	0.3%	0.0%	0.0%	3.7%	2.2%	50.3%	44.0%	56.0%	32.2%	17.6%
Census Tract 7.01, Lea County, New Mexico	1,710	0.0%	0.0%	0.0%	0.0%	2.5%	0.2%	52.2%	47.2%	52.8%	38.0%	25.2%
Census Tract 7.02, Lea County, New Mexico	4,202	1.7%	4.0%	0.6%	0.2%	3.1%	4.2%	56.4%	38.0%	62.0%	32.1%	28.2%
Census Tract 7.03, Lea County, New Mexico	2,934	0.9%	0.6%	0.0%	0.0%	1.1%	11.3%	50.1%	46.8%	53.2%	19.1%	16.7%
Census Tract 7.04, Lea County, New Mexico	2,342	0.0%	2.0%	0.6%	0.0%	3.9%	0.0%	41.5%	57.8%	42.2%	21.9%	13.0%
Census Tract 8, Lea County, New Mexico	3,498	0.0%	2.9%	0.0%	0.0%	0.0%	11.2%	53.3%	43.9%	56.1%	29.2%	24.0%
Census Tract 9, Lea County, New Mexico	1,892	1.5%	1.2%	0.0%	0.0%	0.0%	0.0%	52.1%	45.7%	54.3%	35.8%	25.6%
Census Tract 10.03, Lea County, New Mexico	3,869	8.1%	0.3%	0.0%	0.0%	2.3%	3.0%	57.6%	33.1%	66.9%	26.3%	23.2%
Census Tract 10.04, Lea County, New Mexico	3,770	0.6%	0.6%	0.0%	0.0%	5.6%	12.5%	80.6%	18.7%	81.3%	22.4%	25.8%
Census Tract 10.05, Lea County, New Mexico	3,767	0.9%	0.6%	0.0%	0.0%	10.2%	1.3%	83.5%	14.6%	85.4%	57.7%	35.9%
Census Tract 11, Lea County, New Mexico	4,963	0.4%	0.0%	0.0%	0.0%	3.6%	2.4%	46.7%	53.1%	46.9%	31.8%	27.8%
Places												
Chaves County												
Dexter town, New Mexico	1,037	0.0%	0.0%	0.0%	0.0%	1.2%	27.7%	91.4%	7.4%	92.6%	52.3%	39.2%

Analysis Unit	Total Population	Minority Population[3]									Low-Income Population[4]	
		Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races	Hispanic or Latino (of any race)	White Alone[6]	Total Minority Population[6]	Individuals	Families
Hagerman town, New Mexico	765	1.6%	5.1%	1.0%	0.0%	10.1%	11.1%	70.8%	21.3%	78.7%	49.4%	43.2%
Lake Arthur town, New Mexico	431	0.0%	0.0%	0.0%	0.0%	9.5%	11.4%	63.6%	36.4%	63.6%	52.0%	46.1%
Midway CDP, New Mexico	653	0.0%	0.0%	0.0%	0.0%	8.1%	5.5%	67.7%	32.3%	67.7%	38.3%	39.2%
Roswell city, New Mexico	48,347	1.7%	1.2%	1.4%	0.05%	11.7%	10.8%	59.9%	35.0%	65.0%	49.8%	42.3%
Eddy County												
Artesia city, New Mexico	12,637	1.7%	3.1%	0.4%	0.0%	8.9%	11.3%	54.4%	39.0%	61.0%	32.2%	27.6%
Atoka CDP, New Mexico	1,420	0.0%	0.0%	0.0%	0.0%	4.9%	20.8%	75.6%	24.4%	75.6%	49.5%	36.0%
Carlsbad city, New Mexico	31,525	1.7%	1.4%	1.3%	0.0%	8.8%	11.4%	52.3%	42.4%	57.6%	31.4%	25.0%
Happy Valley CDP, New Mexico	918	0.0%	0.0%	0.0%	0.0%	7.0%	4.5%	28.9%	66.7%	33.3%	36.7%	39.5%
Hope village, New Mexico	102	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	57.8%	42.2%	57.8%	70.6%	59.3%
La Huerta CDP, New Mexico	1,213	0.0%	0.0%	1.2%	0.0%	3.2%	4.4%	31.6%	67.2%	32.8%	12.6%	14.2%
Livingston Wheeler CDP, New Mexico	577	0.0%	0.0%	0.0%	0.0%	22.2%	0.0%	22.2%	77.8%	22.2%	32.6%	41.2%
Loco Hills CDP, New Mexico	53	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	50.9%	0.0%
Loving village, New Mexico	1,452	0.0%	0.9%	0.0%	0.0%	0.0%	17.0%	83.7%	15.4%	84.6%	47.2%	39.5%
Malaga CDP, New Mexico	172	0.0%	0.0%	0.0%	0.0%	14.0%	0.0%	100.0%	0.0%	100.0%	12.2%	0.0%
Morningside CDP, New Mexico	648	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	100.0%	100.0%
Whites City CDP, New Mexico	0	-	-	-	-	-	-	-	-	0.0%	0.0%	0.0%
Lea County												
Eunice city, New Mexico	3,026	0.0%	0.0%	0.0%	0.0%	0.0%	15.7%	54.6%	44.5%	55.5%	39.3%	32.4%

Analysis Unit	Total Population	Minority Population[3]									Low-Income Population[4]	
		Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races	Hispanic or Latino (of any race)	White Alone[6]	Total Minority Population[6]	Individuals	Families
Hobbs city, New Mexico	39,476	6.3%	1.3%	1.0%	0.0%	7.1%	17.3%	60.7%	30.5%	69.5%	36.7%	30.5%
Jal city, New Mexico	2,110	2.27%	0.6%	0.0%	0.0%	3.3%	5.2%	51.6%	46.2%	53.8%	37.2%	28.5%
Lovington city, New Mexico	11,505	3.6%	0.3%	0.1%	0.0%	8.5%	14.4%	74.2%	21.8%	78.2%	43.0%	35.2%
Monument CDP, New Mexico	143	0.0%	0.0%	0.0%	0.0%	0.0%	43.4%	29.4%	27.3%	72.7%	29.4%	26.6%
Nadine CDP, New Mexico	268	0.0%	0.0%	0.0%	0.0%	7.5%	0.0%	38.1%	61.9%	38.1%	7.8%	0.0%
North Hobbs CDP, New Mexico	6,148	0.0%	1.8%	0.1%	0.0%	4.7%	12.1%	50.8%	48.6%	51.4%	26.4%	17.0%
Tatum town, New Mexico	765	2.6%	0.0%	0.0%	0.0%	12.2%	24.8%	58.3%	34.9%	65.1%	45.1%	54.7%

Note: Gray shaded cells indicate where EJ communities of concern are present (i.e., the percentage of population meets or exceeds the criterion for identifying EJ populations).

[1] National data are provided for context only and do not represent a reference area used in identifying EJ populations.

[2] The state of New Mexico is used as the reference area for determining whether minority or low-income EJ populations exist within the counties or census tracts.

[3] Source: ACS 2020 5-year estimates Table DP05.

[4] Defined as the total population minus the White alone (non-Hispanic) population.

[5] Defined as Individuals or Families with Income Below 200 Percent of Federal Poverty Level. Source: ACS 2020 5-year estimates Tables S1701 (Individuals) and S1702 (Families).