

**United States Department of the Interior
Bureau of Indian Affairs
Navajo Regional Agency
Federal Indian Minerals Office**

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**Federal Indian Minerals Office
Oil and Gas Lease Sale, April 2018**



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The Federal Indian Mineral Office's (FIMO) mission is to provide and improve Indian trust services to the Navajo individual mineral owners in the management of oil and gas interests on Navajo allotted mineral estate.

The Bureau of Indian Affairs (BIA) Navajo Regional Office's mission is to enhance the quality of life, facilitate economic opportunity, carry out the responsibility to protect and improve the trust assets of the Navajo Nation and individual Indians.

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1 Introduction

1.1 Background

The Secretary of the Interior is authorized on behalf of the federal government to administer the leasing of Indian allotted land (Allotment) for oil and gas mineral development governed by the 1909 Mineral Leasing Act for Allotments. Additional laws for leasing and development of Indian minerals include the Indian Mineral Leasing Act of 1938 and the Indian Mineral Development Act of 1982. Federal Agencies maintain a trust responsibility and a fiduciary relationship with tribes, nations, and individual Indian allottee(s).

The Department of Interior (DOI) established the Federal Indian Minerals Office (FIMO) to provide and improve services to individual Indian beneficiaries in the management of their oil and gas mineral resources. FIMO has been structured to consolidate and integrate Indian allotted oil and gas management functions under one line of authority. The Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Office of Natural Resources Revenue (ONNR), and Office of Special Trustee for American Indians (OST) share in administering regulatory functions related to oil and gas activities on Indian Allotments. These agencies are the four (4) pillars of FIMO.

Given the shared regulatory functions between the four (4) federal agencies and varying missions, the agencies establish common standards and methods for creating efficient and effective working relationships to achieve the overarching DOI goal of accurate energy and minerals accountability for Indian Allotted leases under the FIMO authority.¹ In addition, on August 17, 2017 an updated Memorandum of Understanding (MOU) was signed. The MOU outlined the working relationships between the agencies for Indian allotment minerals management and the administrative roles and responsibilities.

The Onshore Energy and Mineral Lease Management Interagency Standard of Operating Procedures (SOP) were signed September 2013. The purpose of the SOP is to establish common standards and methods for creating efficient and effective working relationships to achieve the DOI goal of accurate energy and minerals accountability for onshore Federal and Indian leases.

The SOP outlines the role and responsibilities for Indian oil and gas activities within the various federal agencies. It defines the roles from the beginning of the oil and gas lease to the expiration (of its own terms) or termination (cease of production) of the lease. During the life of the lease, FIMO is responsible for the administration & compliance and BLM is responsible for the operational phase in concurrence with FIMO.

The SOP bridges and streamlines the gap between BIA and BLM regulations. BIA regulates leasing; BLM regulates the operation of the lease and both work hand in hand. BIA regulation under 25 CFR Parts 211 & 212 and BLM is under 43 CFR 3160 and the 2003 Resource Management Plan. In staying true to the intent of the SOP, FIMO follows regulations mandated by BIA and BLM. FIMO utilizes the SOP to bridge the gap along with the consent decree directives, dated March 1989 and the FIMO MOU, dated August 2017.

The SOP and the MOU help recognize FIMOs' responsibility for identifying allotments offered for oil and gas development or leasing purposes. At the pre-leasing stage the allotment(s) offered for leasing are identified based on the following criteria:

¹ Onshore Energy and Mineral Lease Management Interagency Standard Operating Procedures, 2013.

- Allotment(s) nominated by interested parties,
- Allotment(s) recommended by the BLM,
- Allotment(s) in danger of trespass or loss due to economic conditions,
- Allotment(s) requested by the Indian mineral owner
- Allotment(s) recommended by the BIA.

After receipt of request, it is necessary to properly identify the allotment(s), evaluate the potential for mineral development and advertise the lands for lease by competitive bidding or subsequent negotiations. Expressions of Interest (EOI) of the interested allotment(s) for leasing allotment(s) would be defined by Title Status Reports (TSR) requested from the Land, Titles and Records Office (LTRO).

LTRO describes lands by allotment(s) number(s), proper legal description, correct acreage and current ownership. Within 30 days of receipt of FIMO's request to BLM for a Fair Market Value (FMV) analysis, BLM will provide FIMO a FMV recommendation, which includes at a minimum: royalty rate, rental, and minimum bonus. Notices are sent out to mineral owners for a meeting to discuss the EOI.

The meeting(s) with mineral owners disseminate information concerning the proposed allotment(s); oil and gas lease sale process; and preparation for advertisement of the allotment(s) is reviewed and amended if necessary and forwarded for legal and technical review. In meeting (upholding) the requirements in 4.3 Competitive Bid Sales of Fluid Minerals from July 2012 DOI-BIA Fluid Mineral Estate Procedural Handbook, an Environmental Assessment (EA) is initiated for the nominated allotments.

After the draft EA is prepared, the draft EA along with the list of available allotment(s) and stipulations are reviewed by the Navajo BIA Regional Office and pertinent working agencies. FIMO works continuously to follow a transparency process and conducts outreach meetings at three oil and gas prominent Navajo Nation chapter houses: Counselor Chapter, Huerfano Chapter, and Nageezi Chapter. The twenty-two (22) nominated allotments are within these chapter communities. FIMO attended chapter planning meetings at all three of these chapters and presented the purpose of a competitive lease sale tentatively offered in April 2018. FIMO also scheduled a briefing with the President and staff of the Navajo Nation, February 8, 2018.

If an allotment does not receive a successful bid at the time of the proposed lease sale, FIMO may re-advertise the allotment at a later time. Subject to the consent of the Indian mineral owners, a lease maybe let through a private negotiation in accordance to CFR 211.20. A lease is held a maximum of five (5) years, after which time the lease expires on its own terms unless the allotment is drilled or there is actual production. A producing lease is held indefinitely by economic production.

Once leased, the lessee submits an Application for Permit to Drill (APD) (Form 3160-3) to BLM and FIMO for review and approval. The APD is a site-specific application that will have conditions of approval (COA) and any other mitigation measures prior to any surface disturbance in preparation for drilling. Any stipulations attached to the standard lease must be complied with before an APD may be approved.

Standard lease terms provide for reasonable measures to minimize adverse impacts to specific resource values, land uses, or users (Standard lease terms are contained in the Oil and Gas Mining Lease—Allotted Indian Lands Form, U.S. Department of the Interior, BIA, 2012 or later edition – Appendix A). The lease action is to encumber the land for potential oil and gas development only after the APD is issued by the BLM.

Operations must be conducted in a manner that avoids unnecessary or undue degradation of the environment and minimizes adverse impacts to the land, air, water, cultural, biological, and visual elements of the environment, as well as other land uses. Compliance with valid, nondiscretionary statutes (applicant is not given an option for compliance with statutes - required) and laws are a further obligation of the standard lease terms and would apply to all lands and operations that are part of all of the alternatives.

Examples of nondiscretionary actions include the BIA's requirements under federal environmental protection laws, such as but not limited to, the Clean Water Act, Clean Air Act, Endangered Species Act, and National Historic Preservation Act, which are applicable to all actions on Indian lands even though they are not reflected in the oil and gas stipulations in the governing land use plans and would be applied to all potential leases regardless of their category. Also, included in all leases are mandatory stipulations as referenced within Oil and Gas Mining Lease—Allotted Indian Lands.

BLM and FIMO are responsible for ensuring that drainage does not occur. Drainage is the uncompensated loss of hydrocarbons, inert gases or geothermal resources from wells on adjacent non-jurisdictional lands or jurisdictional lands resulting in revenue losses to the Indian Mineral Owners. Regulations found at 43 CFR 3162.2-2 outline the BLM's authority to protect leased and unleased lands, acquired, Indian tribal and allotted mineral interests from the loss of oil and gas or geothermal resources by drainage and the resulting loss of royalty revenues. BLM coordinates with FIMO to ensure that drainage of allotted mineral does not occur.

This Environmental Assessment (EA) will analyze the proposed action which may result in a decision to defer or drop specific allotment(s), if any, from the lease sale. In addition, the EA will determine the need for additional stipulations to be attached to specific allotment(s).

1.2 Purpose and Need for the Proposed Action

In accordance with 25 CFR §212.1 the United States, trustee for individual Indian Allotment(s), obligated "to ensure that Indian mineral owners desiring to have their resources developed are assured that they will be developed in a manner that maximizes their best economic interest and minimizes any adverse environmental impacts or cultural impacts resulting from such development."

In order for FIMO to meet this obligation, FIMO plans to conduct a competitive closed bid lease sale in April 2018. FIMO reviewed and determined twenty-two (22) nominated Individual Indian allotments encompassing approximately 3,520.44 acres (Table 1, Section 2.3) that will be part of the April 2018 Lease Sale. FIMO has also determined under what terms and conditions that are in the best interest of the Indian mineral owner (25 CFR §212.3).

Approval of leases related to the FIMO's oil and gas program is essential in guaranteeing the continued opportunity for the Indian Allottees to obtain economic stability and accomplish the FIMO and BIA mission to develop, conserve and preserve trust assets.

1.3 Conformance with Applicable Land Use Plan(s)

The Farmington Resource Management Plan (September 2003) assesses impacts within the planning area that encompasses the New Mexico portion of San Juan Basin (Appendix D: (Map 1 - General Location of Planning Area). The nominated allotments are within the 2003 RMP planning area. The basin supports approximately 18,000 active oil and gas wells and there are more than 2,400 existing wells in the planning area. FIMO manages the Indian allotted minerals with guidance set forth by the 2003 RMP. Leasing, development, and management of Indian allotted minerals were not analyzed in this document;

however, FIMO will be incorporating by reference (40 CFR 1502.21; 43 CFR 46.135) the affected resources and cumulative impacts. This EA will include a brief synopsis of the incorporated information.

Pursuant to 40 CFR 1508.28 and 1502.21, this EA incorporates by reference the affected information and cumulative impacts analysis contained in the 2003 Farmington RMP Final Environmental Impact Statement Alternative D analysis of Oil and Gas Leasing and Development (pp 4-105 to 4-119). These pages include analysis of oil and gas leasing and development as it pertains to geology and minerals, soils, water resources, air quality, upland vegetation, riparian areas and wetlands, federally listed species, wildlife, rangeland, lands and access, visual resources, cultural resources, paleontology, noise, social and economic conditions, and environmental justice. Assumptions based on the Reasonable Foreseeable Development (RFD) for Northern New Mexico (October 2014) are used in the analysis of impacts in this EA.

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

Purchasers of oil and gas leases are required to comply with all applicable Indian, federal, state, and local laws and regulations, including obtaining all necessary permits prior to any oil and gas development activities.

This EA is a leasing level document and addresses the indirect and cumulative impacts to the Proposed Action; however, since the site specific information, such as, well pads, roads, and pipeline corridors are unknown the direct impact analyses is limited. In addition, the EA does evaluate potential impacts to federally-listed species and critical habitat in Section 2.11. Literature review was also conducted for the Area of Potential Affect which identifies previously recorded cultural resources in accordance with 36 CFR Part 800.

Prior to the start of any construction activities, the FIMO must be in possession of all the necessary federal, tribal, and state permits or licenses from the respective and appropriate entities (*i.e.*, Navajo Nation, BIA, United States Environmental Protection Agency, Army Corps of Engineers, NMDOT, etc.). Regulatory compliance issues/procedures relevant to the Proposed Project and any appurtenant permits/certifications are as follow:

- 50 CFR §402 – Endangered Species Act, section 7: FIMO evaluated and analyzed impacts to federally-listed species and critical habitat and made determinations;
- 36 CFR §800 – National Historic Preservation Act, section 106 – FIMO would have to consult with the Navajo Nation Tribal Historic Preservation Officer (THPO) regarding determinations related to cultural resources;
- Navajo Nation Clean Water Act, NNC Title 4 – Environmental Protection;
- Navajo Nation Solid Waste Regulations 4 NNC§§101 et seq, as amended by Navajo Nation Council Resolution No. CJY-51-97;
- Navajo Nation Surface Water Quality Standards pursuant to 4 NNC §104 (b) and §201 of the Navajo Nation Clean Water Act, CJY-81-99;
- Navajo Nation Primary Drinking Water Regulations pursuant to 22 NNC §2501 et seq.;
- Clean Water Act §402 National Pollutant Discharge Elimination System (NPDES) Permit - As of March 2003, construction activities that disturb one acre or more are now regulated under the NPDES storm water program. The United States Environmental Protection Agency (EPA) Construction General Permit (CGP) regulation states that construction sites must develop and implement storm water pollution prevention plans (SWPPP) and obtain permit coverage from the primacy agency if more than one acre of land is disturbed.
- Navajo Preference in Employment Act, as amended October 1990, codified as Title 15 Chapter 7 of the NNC.

Additional federal regulations and laws include the Migratory Bird Treaty Act; Eagle Protection Act; Clean Air Act; Native American Graves Protection and Repatriation Act of 1990; and Executive Order 12898 of 1994 (Environmental Justice).

Once an allotment is granted a lease, no disturbance of any kind shall begin until all required clearances, consultation, determinations, easements, permits, and surveys are in place. The issuance of the Application for Permit to Drill (APD) by BLM is a federal action; BLM will complete a site-specific NEPA analysis before making a decision to issue, or deny the APD application. The NEPA analysis will contain appropriate conditions of approval and the applicant must agree to take all appropriate actions, to avoid, minimize, and mitigate unacceptable environmental consequences. Applicants must also agree to follow Best Management Practices (BMP) and appropriate monitoring mitigations.

Compliance with Section 7 of the Endangered Species Act (16 USC 1531 et seq) will be determined on a site-specific basis. Subsequent NEPA analysis will be completed before implementations of any oil and gas field development or productions activities that may occur as a result of leasing actions covered under this EA. The FIMO will be the lead federal agency for the Section 7 consultation associated with the leasing action. This consultation will include the Navajo Nation Department Fish and Wildlife (NNDFW) as a technical advisor to FIMO under a Public Law 93-638 contract through BIA. The APD stage will include a site-specific analysis, including any direct, indirect, or cumulative impacts to federally-listed species with the BLM.

Compliance with Section 106 responsibilities of the National Historic Preservation Act (NHPA) is adhered to by a literature review within the Area of Potential Affect. This information is summarized in the EA. In accordance with 36 C.F.R. 800, culturally affiliated tribes will have an opportunity to comment during the 30-day EA comment period. In addition, there will be site-specific determinations, if any, during the subsequent NEPA analysis to be completed before oil and gas field development or productions activities occur

FIMO will then contact the Individual Indian Allottee(s) and notify them of the expression of interest, the proposed date for competitive closed bidding, and their oil and gas rights.

1.5 Identification of Issues and Scoping

The Council on Environmental Quality (CEQ) regulations state: “NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail” (40 CFR § 1500.1(b)). 40 CFR § 1500.4(g) directs 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 EIS process accordingly.”

Scoping: May 2017, FIMO conducted outreach sessions with Counselor and Nageezi chapter officials to discuss the twenty-two (22) nominated Indian allotments and with Huerfano Chapter Community members in January 2018. The location and official legal land descriptions along with photographs were presented before the Chapter Officials and Committees. Questions and answering session included the potential of drainage, surrounding activities, Unit formations, so forth.

FIMO meet with Navajo Nation President Russell Begaye on February 8, 2018, in Window Rock, AZ for a Government-to-Government consultation. The issues identified are incorporated in the bulleted list below.

Issues Identified:

Based on internal efforts, the following issues have been determined relevant to the analysis of this action:

- Air quality and climate impacts from leasing allotments for oil and gas development.
- The effects of oil and gas leasing on cultural resources, including historic properties, properties listed on the National Register of Historic Places or New Mexico State Register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, National Historic Trails, or other places of traditional religious and cultural importance.
- The effects on leasing of oil and gas allotments on socioeconomics and environmental justice.
- The effect of oil and gas leasing regarding mineral resources drained from wells on adjacent lands.
- The effects on leasing of oil and gas allotments on night sky and visual resources.
- The effects on oil and gas leasing on federally listed special status species, raptors, and migratory birds, wildlife habitat and migration corridors.

Issues:

CEQ NEPA regulations explain this delineation in 40 CFR § 1501.7, “...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (40 CFR § 1506.3)...”

Non-significant issues are identified as those:

- outside the scope of the proposed action;
- per determined by law, regulation, or other higher level decision;
- unrelated to the decision to be made; or
- conjectural and not supported by scientific or factual evidence

2 Description of Alternatives

2.1 Introduction

This chapter identifies and describes the alternative evaluated in this EA: No Action, Proposed Action and No Surface Occupancy Action Alternatives. The potential environmental effects of these alternatives are compared in Chapter 3. A brief explanation of other alternatives that were considered but dismissed from further analysis is provided later in this chapter. The chapter concludes with a summary of impacts from the No Action, Proposed Action and No Surface Occupancy Action alternatives.

2.2 Alternative A: No Action

The Indian Affairs NEPA Guidebook (59 IAM 3-H) states that for EAs on externally initiated proposed actions, the No Action alternative generally means that the action would not take place. In the case of a lease sale, this would mean that an EOI to lease (allotment nomination) would be deferred, and the twenty-two (22) allotments would not be offered for lease during the April 2018. Surface management and any ongoing oil and gas development on surrounding federal, private, Indian allotted, Navajo tribal trust and state leases would continue under current guidelines and practices.

Since, FIMO and BLM are mandated by law to ensure that drainage of the Indian minerals do not occur the No Action may result in developing producing wells adjacent to the Indian mineral estate lands. The Indian Allottee(s) would enter into an agreement and result in the Compensatory Royalty Agreement (CRA) to collect royalties. The Allottee(s) would not be compensated for the lease resulting in decreased monetary compensation. Selection of the No Action alternative would not prevent these allotments from nomination for a future lease sale.

2.3 Alternative B: Proposed Action

The Proposed Action would offer for lease of twenty-two (22) nominated Indian allotments in surface and minerals administered by the FIMO, covering 3,520.44 acres. Standard terms and conditions, lease stipulations are listed in the FIMO stipulations.

Oil and gas leases are issued for a five (5)-year period and continue if oil and gas produced in paying quantities. If a lessee fails to produce oil and gas, does not make annual rental payments, does not comply with the terms and conditions of the lease, or relinquishes the lease, exclusive right to develop the leasehold reverts back to the federal government and the lease can be reoffered in another sale.

Drilling of wells are not permitted until the lease owner or operator submits a complete APD package in accordance with requirements under Onshore Oil and Gas Orders listed in 25 CFR 212, and the APDs are approved. An APD is not approved until site-specific NEPA analyses are conducted. Site-specific mitigation measures and BMPs would be brought forth from the NEPA document and attached as COAs for each proposed exploration and development activity authorized on a lease. The allotments recommended for leasing under Alternative B: Proposed Action are presented below in Table 1.

Standard terms and conditions, and lease stipulations from FIMO through the allotment review and analysis process would apply (as required by 43 CFR 3101.3) to address site-specific concerns or new information not identified in the land use planning process.

Table 1: Alternative B: Proposed Action

Allotment #	Legal Description	Acres	Lease Stipulations*
107	T.22N, R.8W, Sec. 30 NE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
116	T.22N, R.9W, Sec. 25 SW, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
117	T.22N, R.9W, Sec. 35 NE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
118	T.22N, R.9W, Sec. 35 NW, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
119	T.22N, R.9W, Sec. 35 SE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
120	T.22N, R.9W, Sec. 35 SW, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
121	T.22N, R.9W, Sec. 26 NE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
122	T.22N, R.9W, Sec. 26 SE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
128	T.22N, R.8W, Sec. 29 NW, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
131	T.22N, R.8W, Sec. 12 SW, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
172	T.22N, R.7W, Sec. 22 NE, Sandoval County Eastern Agency - Counselor Chapter	160	FIMO - 1,2,3, 4, 5, 6
180	T.22N, R.8W, Sec. 11 SE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
219	T.23N, R.11W, Sec. 25 NE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
220	T.23N, R.11W, Sec. 24 SE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
233	T.23N, R.10W, Sec. 27 SE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
234	T.23N, R.10W, Sec. 28 SE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
235	T.23N, R.10W, Sec. 28 SE, San Juan County Eastern Agency - Nageezi Chapter	160	FIMO - 1, 2, 4, 5, 6
211425	T.24N, R.9W, Sec. 2 NW, San Juan County Eastern Agency-Nageezi Chapter	160.44	FIMO - 1,2,3, 4, 5, 6

M 211452	T.24N, R.9W, Sec. 2 SW, San Juan County Eastern Agency-Nageezi Chapter	160	FIMO - 1,2,3, 4, 5, 6
211478	T.25N, R.9W, Sec. 35 SE, San Juan County Eastern Agency- Huerfano Chapter	160	FIMO - 1,2,3, 4, 5, 6
211609	T.24N, R.11W, Sec. 21 NE, San Juan County Eastern Agency-Huerfano Chapter	160	FIMO - 1,2,3, 4, 5, 6
211610	T.24N, R.11W, Sec. 21 NE, San Juan County Eastern Agency-Huerfano Chapter	160	FIMO - 1,2,3, 4, 5, 6

See Appendix C for summary of stipulations

2.4 Alternative Analyzed but Not Considered

FIMO analyzed a No Surface Occupancy (NSO) Alternative but was not considered. No surface occupancy is where the minerals (subsurface) can be extracted through horizontal drilling without impacts to the surface. The wells would be drilled in adjacent (non-allotments) to access the mineral with no developed well on the allotments. The NSO restrictions are intended for use when other limitations are insufficient to adequately protect the resource values and uses.

Analyzed data for the twenty-two (22) allotments concludes there are a total of the 22 allotments of five (5) neighboring units that are in close proximity to 17 of the 22 allotments. Approved units Blanco Wash and PGA have a total of five (5) neighboring allotments, pending unit South Escavada has one (1), and proposed units Lone Mesa and West Escavada have a total of eleven (11). Five (5) allotments remain that are not within the area of any units.

The analysis determines there are only two approved Units with five (5) allotments that can be selected for NSO. The other Units are not approved; there is a high likelihood the NSO allotments may be stranded, resulting in no lease(s). This is not beneficial to the allottee(s) and they will not have the opportunity to realize potential gains from the discovery and resulting development of resources on their allotment.

Affected Environment

This section describes the affected environment per CEQ Regulations: §1502.15-Affected Environment. The environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The description shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in a statement shall be commensurate with the importance of the impact, with less important material summarized, consolidated, or simply referenced. Agencies shall avoid useless bulk in statements and shall concentrate effort of the affected environment are themselves no measure of the adequacy.

2.5 General Analysis Assumptions and Data Limitations

Direct effects of leasing are the creation of valid mineral exploration rights, and the revenue generated by the lease sale receipts. The residual effects of leasing would only occur if or when the leases were developed. The level of development that might occur as an outcome leasing is unknown. The FIMO has determined that any estimate of development at this time is too speculative to be analyzed as part of this EA. Resource presence may change after this analysis and prior to development. Site-specific surveys and data gathering would occur prior to lease development, and conditions of approval may be added as necessary to protect resources.

2.6 Air Resources

Air quality and climate are components of air resources, which may be affected by FIMO applications, activities, and resource management. Therefore, the FIMO considers and analyzes the potential effects of FIMO and BIA authorized activities on air resources as part of the planning and decision making process. Additional information on air quality in this area is contained in Chapter 3 of the FFO RMP and FEIS (USDI BLM, 2003) which this analysis tiers to and incorporates by reference that FIMO uses as a

guideline. This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

2.6.1 Air Quality

The Air Resources Technical Report describes the types of data used for description of the existing conditions of criteria pollutants, how the criteria pollutants are related to the activities involved in oil and gas development, and provides a Table of current National and state standards. The USEPA Green Book web page (USEPA, 2013) reports all counties in the Eastern Navajo Agency area encompassing Navajo Allotments are in attainment of all National Ambient Air Quality Standards (NAAQS) as defined by the Clean Air Act. The area is also in attainment of all state air quality standards (NMAAQS). The current status of criteria pollutant levels in the Eastern Navajo Agency are described below.

“Design Values” are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2015 design values for criteria pollutants are listed below in Table 2. There is no monitoring for carbon monoxide (CO) and lead in San Juan County, but because the county is relatively rural, it is likely that these pollutants are not elevated. PM₁₀ design concentrations are not available for San Juan County.

Table 2: 2015 Criteria Pollutant Monitored Values in San Juan County (USEPA, 2015)

Pollutant	2015 Design Concentration	Averaging Time	NAAQS	NMAAQS
O3	0.067 ppm	8-hour	0.070 ppm ¹	
NO2	12 ppb	Annual	53 ppb ²	50 ppb
NO2	12 ppb	1-hour	100 ppb ³	
PM2.5	4.7 µg/m ³	Annual	12 µg/m ^{3,4}	60 µg/m ^{3,6}
PM2.5	13 µg/m ³	24 hour	35 µg/m ^{3,3}	150 µg/m ^{3,6}
SO2	0.0 ppb	1-hour	75 ppb ⁵	

¹ Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years

² Not to be exceeded during the year

³ 98th percentile, averaged over 3 years

⁴ Annual mean, averaged over 3 years

⁵ 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

⁶ The NMAAQS is for Total Suspended Particulate (TSP)

Table 3 shows total human caused emissions for each of the counties in the Eastern Navajo Agency based on USEPA’s 2014 emissions inventory (USEPA, 2014).

Table 3: Analysis Area Emissions in Tons/Year, 2014

County	NOX (1)	CO (2)	VOC (3)	PM10 (4)	PM2.5 (5)	SO2 (6)
McKinley	11,208.0	12,760.9	3113.8	4,8408.6	5,542.2	843.0
Rio Arriba	11,704.2	28,244.4	30,347.3	23,609.3	3,336.3	79.6
San Juan	40,492.8	50,338.6	38,277.9	52,556.3	6,620.8	5,232.0
Sandoval	5,945.8	20,864.8	6,617.2	28,245.6	3,584.1	139.4
La Plata	7,500.6	18,635.9	12,272.4	8,533.7	1,487.5	112.7
Total	76,851.4	130,844.6	90,628.6	161,353.5	23,607.6	6,406.7

⁽¹⁾ NOX – nitrogen oxides

⁽²⁾ CO – carbon monoxide

⁽³⁾ VOC – volatile organic compounds

⁽⁴⁾ PM10 – particulate matter with an aerodynamic diameter equal to or less than 10 microns

⁽⁵⁾ PM2.5 – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns

⁽⁶⁾ SO2 – sulfur dioxide

While all of San Juan County is in attainment of all NAAQS including ozone, the Navajo Dam monitoring station is the most closely watched due to the current design value of 0.068 ppm. While 0.068

ppm is below the attainment value of 0.070 ppm, it is the highest design value of the three monitoring stations in San Juan County. The potential amounts of ozone precursor emissions of NOx and VOCs from the proposed lease sale are not expected to impact the current design value for ozone in San Juan County under the Proposed Action Alternative.

In October 2012, USEPA promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds during gas well completions. In 2005, the USEPA estimates that there was less than 0.01 ton per square mile of lead emitted in FFO counties, which is less than two tons total (USEPA, 2012). Lead emissions are not an issue in this area and will not be discussed further.

Air quality in a given region can be measured by its Air Quality Index (AQI) value. The AQI is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI <50), moderate (50-100), unhealthy for sensitive groups (101-150), unhealthy (151-200), very unhealthy (201-300), and hazardous (301- 500). The AQI is a national index, the air quality rating and the associated level of health concern is the same everywhere in the country. The AQI is an important indicator for populations sensitive to air quality changes (USEPA, 2016).

Mean AQI values for San Juan County were generally in the good range (AQI <50) in 2015 with 72 percent of the days in that range. The median AQI in 2015 was 44, which indicates “good” air quality. The maximum AQI in 2015 was 115, which is “unhealthy” (USEPA, 2016).

As seen in Table 4 below, the number of days classified as “unhealthy for sensitive groups, have been very sporadic in the last decade (2006-2016). There are no patterns or trends to the occurrences. During this decade; air quality reached levels of “unhealthy” on seven (7) of the days, levels of “very unhealthy: and two (2) of the days. In 2010, there were five (5) days levels reached “unhealthy” and two (2) days levels reached “very unhealthy”. In 2006 and 2013, there was one (1) day that the level reached “unhealthy”. In 2009 and 2014, there were zero (0) days that levels reached “unhealthy for sensitive groups” or worse in air quality.

Table 4: Number of Days classified as “unhealthy for sensitive groups” (AQI 101-150) or worse (USEPA, 2016)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Days	23	45	3	0	13	19	12	5	0	2	2

2.6.2 Hazardous Air Pollutants

The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (USDI BLM, 2016). The USEPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the US. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. A review of the results of the 2005 NATA shows that cancer, neurological and respiratory risks in San Juan County are generally lower than statewide and national levels as well as those for Bernalillo County where urban sources are concentrated in the Albuquerque area (USEPA, 2012).

2.6.3 Greenhouse Gases and Climate Change

Climate change refers to any significant change in measures of climate (e.g., temperature or precipitation) lasting for an extended period (decades or longer). Climate change may result from natural processes, such as changes in the sun’s intensity or within the climate system (such as changes in ocean circulation)

as well as human activities that change the atmosphere's composition (such as burning fossil fuels) and the land surface (such as urbanization) (Intergovernmental Panel on Climate Change [IPCC], 2007). Climate is both a driving force and limiting factor for ecological, biological, and hydrological processes, and has great potential to influence resource management.

It is accepted within the scientific community that global temperatures has risen at an increased rate and the likely cause is gas has trapped heat in the atmosphere, referred to as greenhouse gases (GHG). GHGs are composed mostly of carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), water vapor, and ozone. The greenhouse gas effect is the process in which the radiation from the sun that heats the surface of Earth gets blocked by GHG molecules in Earth's atmosphere. Since GHGs are composed of molecules that absorb and emit infrared electromagnetic radiation (heat), they form an intrinsic part of the greenhouse effect.

Some GHGs such as CO₂ and water vapor occur naturally and are emitted into the atmosphere through natural processes. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. However, atmospheric concentrations of both the natural and man-made gases have been rising over the last few centuries due to the industrial revolution. The primary GHGs that enter the atmosphere as a result of anthropogenic activities include CO₂, CH₄, N₂O, and fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Fluorinated gases are powerful GHGs that are emitted from a variety of industrial processes including production of refrigeration/cooling systems, foams and aerosols. Fluorinated gases are not primary to the activities authorized by the BIA and will not be discussed further in this document. Ongoing scientific research has identified the potential impacts of anthropogenic GHG emissions and changes in biological sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks may cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy re-radiated by the earth back into space. However, other activities could help sequester carbon, such as managing vegetation to favor perennial grasses and increase vegetation cover, which could help build organic carbon in soils and function as "carbon sinks."

In addition, GHGs have a sustained climatic impact over different temporal scales. For example, recent emissions of CO₂ can influence climate for 100 years. In contrast, black carbon is a relatively short-lived pollutant, as it remains in the atmosphere for only about a week. It is estimated that black carbon is the second greatest contributor to global climate change behind CO₂ (Ramanathan and Carmichael, 2008). Black carbon is a highly light-absorbing component of particulate resulting from the incomplete combustion of fossil fuels, biofuels, and biomass. Most black carbon in the United States comes from mobile sources (diesel engines and vehicle use) or biomass burning (wildfires, residential heating, and industry) (USEPA, 2012). Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs may accelerate the rate of climate change in either a positive or negative direction depending upon location and site-specific factors.

Greenhouse gases are often presented using the unit of Metric Tons of CO₂ equivalent (MT CO₂e) or Million Metric Tons (MMT CO₂e), a metric to express the impact of each different greenhouse gas in terms of the amount of CO₂ making it possible to express greenhouse gases as a single number. For example, one ton of methane would be equal to 28 to 36 tons of CO₂ equivalent over a 100-year period, because it has a global warming potential (GWP) 28 to 36 times that of CO₂ (USEPA, 2017).

As defined by the USEPA, the GWP provides "ratio of the time-integrated radiative forcing from the instantaneous release of one kilogram of a trace substance relative to that of one kilogram of CO₂." The GWP of greenhouse gas is used to compare global impacts of different gases and used specifically to measure how much energy the emissions of one ton of gas will absorb over a given period of time (e.g.

100 years), relative to the emissions of one ton of CO₂. The GWP accounts for the intensity of each GHG’s heat trapping effect and its longevity in the atmosphere. The GWP provides a method to quantify the cumulative effects of multiple GHGs released into the atmosphere by calculating carbon dioxide equivalent for the GHGs.

- **Carbon dioxide (CO₂)**, by definition, has a GWP of one regardless of the time period used because it is the gas being used as the reference. CO₂ remains in the climate system for a very long time; CO₂ emissions cause increases in the atmospheric concentrations of CO₂ that will last thousands of years (USEPA, 2017).
- **Methane (CH₄)** is estimated to have a GWP of 28 to 36 times that of CO₂ over 100 years. CH₄ emitted today lasts about a decade on average, which is much less time period than CO₂. But CH₄ also absorbs much more energy than CO₂. The net effect of the shorter lifetime and higher energy absorption is reflected in the GWP. The methane GWP also accounts for some indirect effects, such as the fact that methane is a precursor to ozone, and ozone is in itself a greenhouse gas (USEPA, 2017).
- **Nitrous Oxide (N₂O)** has a GWP of 265 to 298 times that of CO₂ for a 100-year timescale. N₂O emitted today remains in the atmosphere for more than 100 years, on average (USEPA, 2017). Table 5 contains GHGs regulated by USEPA and global warming potentials.

Table 5: GHG Regulated by USEPA and Global Warming Potentials (USEPA, 2016b, 2017b)

Air Pollutant	Chemical Symbol / Acronym	Global Warming Potential
Carbon Dioxide	CO ₂	1
Methane	CH ₄	28 to 36
Nitrous Oxide	N ₂ O	298
Hydrofluorocarbons	HFCs	Varies
Perfluorocarbons	PFCs	Varies
Sulfur hexafluoride	SF ₆	22,800

Although still debated, GHG levels have varied for millennia, and it is theorized that recent industrialization and burning of fossil carbon sources have caused CO₂e concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The IPCC (2007) concluded that “warming of the climate system is unequivocal” and “most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations.” Extensive research and development efforts are underway in the field of carbon capture and sequestration (CCS) technology, which could help direct management strategies in the future. The IPCC has identified a target worldwide “carbon budget” to estimate the amount of CO₂ the world can emit while still having a likely chance of limiting global temperature rise to 2°C above pre-industrial levels. The international community estimates this budget to be one trillion tonnes of carbon (IPCC, 2014).

Because GHGs circulate freely throughout Earth’s atmosphere, climate change is a global issue. The largest component of global anthropogenic GHG emissions is CO₂. Global anthropogenic carbon emissions reached about 7,000,000,000 MT per year in 2000 and an estimated 9,170,000,000 MT per year in 2010 (Boden et al 2013). Oil and gas production contributes to GHGs such as CO₂ and methane. Natural gas systems were the largest anthropogenic source category of CH₄ emissions in the United States in 2014 with 176.1 MMT CO₂ e of CH₄ emitted into the atmosphere. Those emissions have decreased by 30.6 MMT CO₂ e (14.8 percent) since 1990 (USEPA, 2016). In 2006, natural gas production accounted for eight percent of global methane emissions, and oil production accounted for 0.5 percent of global methane emissions (URS Corporation, 2010).

Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (National Aeronautics and Space Administration Goddard Institute for Space Studies, 2007). In 2001, the IPCC (2007) indicated that by the year 2100, global average surface temperatures would increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels. The National Academy of Sciences (Hansen et al., 2006) has confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions. Observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Data indicate that northern latitudes (above 24° N) have exhibited temperature increases of nearly 1.2°C (2.1°F) since 1900, with nearly a 1.0°C (1.8°F) increase since 1970 alone. It also shows temperature and precipitation trends for the conterminous United States. For both parameters, we see varying rates of change, but overall increases in both temperature and precipitation.

Recently, pioneering research using space-borne (satellite) and airborne (aircraft) sensors have indicated anomalously large methane concentrations may occur in the Four Corners region (Kort et al., 2014). A subsequent study (Schneising et al., 2014) indicated larger anomalies over other oil and gas basins in the US. Methane is 28 to 36 times more potent at trapping greenhouse gas emissions than CO₂ when considering a time horizon of 100 years (USEPA, 2017). While space-borne studies can determine the pollutant concentration in a column of air, these studies cannot pinpoint the specific sources of air pollution. Further study is required to determine the sources responsible for methane concentrations in the Four Corners region; however, it is known that a significant amount of methane is emitted during oil and gas well completion (Howarth et al., 2011).

Methane is also emitted from process equipment, such as pneumatic controllers and liquids unloading, at oil and gas production sites. Ground-based, direct source monitoring of pneumatic controllers conducted by the Center for Energy and Environmental Resources (Allen, et al., 2014) show that methane emissions from controllers exhibit a wide range of emissions and a small subset of pneumatic controllers emitted more methane than most. Emissions measured in the study varied significantly by region of the US, the application of the controller, and whether the controller was continuous or intermittently venting. The Center for Energy and Environmental Resources had similar findings of variability of methane emissions from liquid unloading (Allen, et al., 2014a). In October 2012, USEPA promulgated air quality regulations controlling VOC emissions at gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds. These same mitigation measures have a co-benefit of reducing methane emissions. Future ground-based and space-borne studies planned in the Four Corners region with emerging pollutant measurement technology may help to pinpoint significant, specific sources of methane emissions in the region.

The Air Resources Technical Report summarizes information about greenhouse gas emissions from oil and gas development and their effects on national and global climate conditions. While it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change.

2.7 Heritage/Archaeological Resources

2.7.1 Cultural Resources

The Proposed Action would not impact cultural resources within the allotments as no ground disturbing activities are required at the leasing action as it is solely an administrative process. Subsequent NEPA analysis and permit approval would be required for future oil and gas field development and production activities that may occur as a result of the proposed leasing action.

As a result of the federal leasing action, Section 106 of the National Historic Preservation Act requires federal agencies to consider what effect their licensing, permitting, or otherwise authorizing of an

undertaking, such as mineral leasing, may have on properties eligible for the National Register. Below are the cultural resource legislations that must be considered in evaluating the impacts of the federal undertaking. These govern the protection, access and use of sacred sites, sacred items, protection and treatment of human remains, and the protection of archaeological resources ascribed with cultural or historic importance. These include the following:

- The American Indian Religious Freedom Act of 1978 (AIRFA; 42 USC 1996, P.L. 95-431 Stat. 469). Possession of sacred items, performance of ceremonies, access to sites.
- Executive Order 13007 (24 May 1996). Access and use of sacred sites, integrity of sacred sites.
- The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 USC 3001, P.L. 101-601). Protection, ownership, and disposition of human remains, associated funerary objects, unassociated funerary objects, sacred objects, or objects of cultural patrimony.
- The Archaeological Resources Protection Act of 1979 (ARPA; 16 USC 470, Public Law 96-95). Protection of archaeological resources on Federal and Indian lands.

In addition to federal legislation, FIMO must also consider Navajo Nation cultural resource protection laws and policies for Navajo Allotments. These include the following:

- Navajo Nation Cultural Resource Protection Act (CMA-19-88/NNCRPA),
- Navajo Nation Policy for the Protection of Jishcháá; Gravesites, Human Remains, and Funerary Items,
- Navajo Nation Policy to Protect Traditional Cultural Properties (TCPs),
- Navajo Nation Disposition of Cultural Resource Collections Policy.

2.7.2 Native American Cultural Concerns

Major issues and concerns of Native Americans who have cultural ties to the San Juan Basin which include but not limited to cultural resources such as archaeological sites, landscapes, traditional cultural properties or places. For this purpose, archaeological sites are identified by pedestrian surveys; however, TCPs need additional cultural inventory instrumental methods to identify them. In general, TCPs can only be identified in most cases in a two-step process which include a pedestrian cultural inventory survey(s) and ethnographic interview(s). Furthermore, most Native American TCPs are considered to involve esoteric knowledge which is considered confidential to specific Native American Tribes, groups, and individuals. Some TCPs are well known, while others may only be known to a small group of traditional practitioners, or otherwise only vaguely known.

Native American perspectives on what is considered a TCP are not limited by the definition of the National Register or eligible or lack thereof. For this reason, BIA often employs more generic and inclusive terminology.

Table 6 below identifies projects, cultural resource sites, and TCPs that have been previously recorded which are on or near the proposed action. The information is general in nature and specific information and specific locations of the cultural resources are confidential which are kept at Navajo Nation Heritage/Historic Preservation Office. All cultural resources were recommended to be avoided within the previous projects.

Table 6: Previous Cultural Resources Inventory Projects.

	Allotment #	Projects	Sites	Type of Site	TCPs
1	107	None	No Sites	N/A	562
2	116	HPD 05-845	No Sites	N/A	562
3	117	HPD 05-845	No Sites	N/A	562
4	118	HPD 05-845	No Sites	N/A	562
5	119	HPD 05-845	No Sites	N/A	562
6	120	HPD 05-845	No Sites	N/A	562
7	121	None	No Sites	N/A	None
8	122	None	No Sites	N/A	None
9	128	HPD 03-514 HPD 87-170	NM-G-62-101 NM-G-62-102 NM-G-62-103 NM-G-62-128	Unknown Historic Navajo Sweatlodge Unknown	562
10	131	None	No Sites	N/A	562
11	172	HPD 03-949 HPD 80-362	NM-G-52-31 NM-G-52-37	Multi-Component Navajo/Anasazi	None
12	M180	HPD 87-170	NM-G-52-2 NM-G-51-104	No information No information	562
13	219	None	No Sites	N/A	857
14	220	None	No Sites	N/A	857
15	233	None	No Sites	N/A	779, 781
16	234	None	No Sites	N/A	779, 781
17	235	None	No Sites	N/A	779, 781
18	211425	HPD 94-371 HPD 85-597	NM-G-47-15 No Sites	Navajo/Prehistoric N/A	None
19	211478	None	No Sites	N/A	None
20	211609	None	No Sites	N/A	782, 918
21	211610	HPD 06-1192	No Sites	N/A	782, 918
22	211452M	HPD 94-371 HPD 85-597	NM-G-47-15 No Sites	Navajo/Prehistoric N/A	None

When development occurs in proximity to sites sensitive to direct/indirect impacts, special BMPs or mitigations formulated through consultation between the BIA and affected tribes and/or individual traditional religious practitioners may be necessary to reduce direct/indirect impacts and achieve no effect or no adverse effect to important cultural resources. True determinations of effect and any necessary mitigation would be developed during future, site-specific analyses for individual development projects; however, the lease does include stipulations that minimize and mitigates effects (e.g., burial sites buffers).

2.7.3 Native American Religious Concerns

There are several pieces of legislation or Executive Orders that are considered when evaluating Native American religious concerns; these govern the protection, access and use of sacred sites, possession of sacred items, protection and treatment of human remains, and the protection of archaeological resources ascribed with religious or historic importance. These include the following:

- The American Indian Religious Freedom Act of 1978 (AIRFA; 42 USC 1996, P.L. 95-431 Stat. 469). Possession of sacred items, performance of ceremonies, access to sites.
- Executive Order 13007 (24 May 1996). Access and use of sacred sites, integrity of sacred sites.
- The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 USC 3001, P.L. 101-601). Protection, ownership, and disposition of human remains, associated funerary objects, unassociated funerary objects, sacred objects, or objects of cultural patrimony.
- The Archaeological Resources Protection Act of 1979 (ARPA; 16 USC 470, Public Law 96-95). Protection of archaeological resources on Federal and Indian lands.

Traditional Cultural Properties (TCPs; Parker and King 1998) is a term that has emerged in historic preservation management and the consideration of Native American traditional concerns. TCPs are places that are eligible for the National Register of Historic Places and have cultural values, often sacred, that transcend the values of scientific importance that are normally ascribed to cultural resources such as

archaeological sites and may or may not coincide with archaeological sites. Native American communities are most likely to identify TCPs, although TCPs are not restricted to those associations.

Some TCPs are well known, while others may only be known to a small group of traditional practitioners, or otherwise only vaguely known. In contrast with Federal definitions, Native American perspectives on what is considered a TCP are not limited by a places National Register eligibility or lack thereof. For this reason, BIA often employs more generic and inclusive terminology.

The identification of places of traditional religious and cultural importance (e.g. TCPs, sacred sites, *jishchaa'*, the Navajo word for places associated with death) within or near the allotments has been ongoing for decades. Most but not all of these efforts at identification were linked to land use planning efforts as well as evaluating potential energy extraction (e.g., coal, oil and gas) and rural infrastructure development (e.g., domestic water systems, power lines) in the area (e.g. Brugge 1986; Condie et al. 1982; Fransted and Werner 1975; Fransted 1979; Kelly et al. 2006; York and Winter 1988; Van Valkenburgh 1941, Van Valkenburgh 1974).

In both the published and gray literature the known places of traditional religious and cultural importance in the San Juan Basin is heavily weighted towards places of Navajo knowledge. This most likely is a byproduct of ongoing and historic occupancy of the area and retention of knowledge pertaining to that area. For example Brugge (1993:54) notes that in a research area of approximately 810 mi² with very minimal Navajo occupancy around Navajo Reservoir, Gobernador and Largo Canyons, only 66 place names and localities of Navajo use and knowledge had been recorded in the literature or otherwise identified by fieldwork. In a 540 mi² area around Chaco Canyon with significant ongoing Navajo occupation over 200 place names and localities was identified (Fransted and Werner 1975) suggesting that occupancy is an important factor in the retention of specific knowledge. In addition to Navajo places the area also encompasses other Native American Tribal TCPs and landscapes.

Identification of places of traditional religious and cultural importance near the proposed action was limited to reviewing these existing published and unpublished literature and ongoing BIA tribal consultation efforts with tribes and local Navajo chapters and communities.

Where development occurs in proximity to sites sensitive to indirect impacts, special BMPs or mitigations formulated through consultation between the BIA and affected tribes and/or individual traditional religious practitioners may be necessary to reduce visual contrast or other indirect impacts and achieve no effect or no adverse effect to important cultural resources. True determinations of effect and any necessary mitigation would be developed during future, site-specific analyses for individual development projects; however, the lease does include stipulations that minimize and mitigates effects (e.g., burial sites buffers).

2.8 Socioeconomics and Environmental Justice

The area for this proposed lease sale is home to a wide variety of cultural, ethnic, and tribal communities. The American Indian populations in the proposed project area are considered indigenous groups. The following discussion provides a descriptive summary of the human populations of the study area, their age and gender distribution, income levels, and ethnic and cultural affiliations. These data are provided as a context for analyzing what economic or social effects the proposed action may have on the residents of the study area, and whether or not; low income, minority, and local communities may be disproportionately affected.

Total population of the study area is relatively low, compared to more concentrations in the southwest, such as the Albuquerque and Phoenix metropolitan areas. The populations of the study area are relatively

stable in both size and composition, and exhibit an age and gender distribution similar to that of New Mexico in general (see Table 7).

Table 7: Total Population, Age-Gender Distribution, and Trend from 2000-2012.

	Sandoval County	San Juan County	Rio Arriba County	McKinley County	New Mexico
Total Population	131,302	128,600	40,201	71,888	2,055,287
Under 5 years	8,870	10,660	2,770	6,216	143,937
5 to 9 years	9,754	10,473	2,652	6,050	142,788
10 to 14 years	10,007	9,976	2,811	6,325	141,373
15 to 19 years	9,371	9,802	2,812	6,829	148,538
20 to 24 years	7,130	8,972	2,364	5,543	144,725
25 to 29 years	7,465	9,454	2,396	4,705	140,139
30 to 34 years	8,090	8,355	2,370	4,341	127,313
35 to 39 years	8,884	7,991	2,505	4,590	124,601
40 to 44 years	8,898	7,008	2,413	4,036	124,044
45 to 49 years	9,796	8,665	2,860	4,677	140,639
50 to 54 years	9,692	8,970	3,086	4,645	145,772
55 to 59 years	9,094	8,167	2,887	3,754	135,203
60 to 64 years	7,990	5,997	2,526	3,360	121,112
65 to 69 years	5,738	4,979	1,924	2,316	89,138
70 to 74 years	4,012	2,999	1,456	1,686	66,859
75 to 79 years	2,555	2,562	1,052	1,290	50,691
80 to 84 years	2,078	1,950	624*	847	35,942
85 years and over	1,878	1,620	693*	678*	32,473
Total Female	66,975	64,770	20,420	36,789	1,039,577
Total Male	64,327	63,830	19,781	35,099	1,015,710
Change in Median Age, 2000-2012*					
Median Age^ (2012*)	38.1	32.8	39.1	30.3	36.6
Median Age^ (2000)	35.1	31.0	34.5	26.9	34.6
Median Age % Change	8.5%	5.8%	13.3%	12.6%	5.8%

^ Median age is not available for metro/non-metro or regional aggregations.

* The data in this table are calculated by ACS using annual surveys conducted during 2008-2012 and are representative of average characteristics during this period.

Data derived from EPS-HDT Demographics Summary report, 2014.

The proposed lease sale analyzed in this EA is relatively small, and is not anticipated to cause large increases in employment or area populations. The lease sale itself is not anticipated to cause any significant impacts to demand for local government services, infrastructure, or housing. Given the high proportion of different ethnic and cultural groups in the proposed project area, the FIMO considers how agency authorized, permitted, or funded actions may affect minority, low-income, and local communities.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, requires that federal agencies identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

Environmental justice 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. It focuses on environmental hazards and human

health to avoid disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Guidance on environmental justice terminology developed by the President’s Council on Environmental Quality (CEQ 1997) is discussed below.

- **Low-income population.** A low-income population is determined based on annual statistical poverty thresholds developed by the US Census Bureau. In 2015, poverty level is based on total income of \$11,770 for an individual and \$24,250 for a family of four (US Census Bureau 2015d). A low-income community may include either a group of individuals living in geographic proximity to one another or dispersed individuals, such as migrant workers or Native Americans.
- **Minority.** Minorities are individuals who are members of the following population groups: American Indian, Alaskan Native, Asian, Pacific Islander, Black, or Hispanic.
- **Minority population area.** A minority population area is so defined if either the aggregate population of all minority groups combined exceeds 50 percent of the total population in the area or if the percentage of the population in the area comprising all minority groups is meaningfully greater than the minority population percentage in the broader region. Like a low-income population, a minority population may include either individuals living in geographic proximity to one another or dispersed individuals.
- **Comparison population.** For the purpose of identifying a minority population or a low- income population concentration, the comparison population used in this study is the state of New Mexico as a whole

2.8.1 Low-income Populations

Income and poverty data estimates for study area counties from the US Census Small Area Poverty Estimates model indicate that the percent of the population living below the poverty level in the socioeconomic study area as a whole is slightly above that of the state (21.3 percent and 20.6 percent), but it is much higher than the national average of 12.1 percent. Poverty levels ranged from 37.7 percent in McKinley County to 13.7 percent in Sandoval County. Only that of Sandoval County was below the state average (Table 8).

Table 8: Study Area County Population in Poverty (2002-2012).

	McKinley County	Rio Arriba County	Sandoval County	San Juan County	Study Area Total	New Mexico	United States
Percent of Population in Poverty 2002	21,766 30.2%	7,165 17.7%	19,934 11.1%	22,152 18.2%	71,017 21.3%	421,123 20.6%	34,569,951 12.1%
Percent of Population in Poverty 2012	27,296 37.7%	8,806 22.0%	18,502 13.7%	25,802 20.3%	80,406 21.5%	327,444 17.7%	48,760,123 15.9%
Median Household Income 2002	\$25,197	\$30,557	\$45,213	\$34,329	N/A	\$34,827	\$45,409
Median Household Income 2012	\$29,821	\$36,900	\$57,376	\$45,901	N/ A	\$42,828	\$51,371
Classified as Low Income Population in 2012 based on CEQ guidelines?	No	No	No	No	No	NA	NA

Source: US Census Bureau 2013b

Similarly, estimates from 2012 indicate that Sandoval and San Juan Counties had household median incomes (\$57,376 and \$45,901) that were above the state level of \$42,828. McKinley County (\$29,821) and Rio Arriba County (\$36,900) were below that of the state in 2012. While no area communities meet the CEQ definition of a low-income population area (50 percent or higher), the highest poverty rates were seen in Bloomfield (29 percent), Espanola (26.3 percent), and Bernalillo (24.1 percent) (Table 9).

Table 9: Study Area Key Community Race/Ethnicity and Poverty Data.

Community	Percent Population Racial or Ethnic Minority	Classified as Minority Population based on CEQ?	Percent of Individuals Below Poverty	Classified as Low-income Population based on CEQ?
Aztec	36.4%	N	14.4%	N
Bernalillo	78.8%	Y	24.1%	N
Bloomfield	55.8%	Y	29.0%	N
Espanola	91.6%	Y	26.3%	N
Farmington	48.8%	N	15.5%	N
Gallup	76.9%	Y	20.9%	N
Rio Rancho	46.7%	N	9.8%	N

Source: US Census Bureau 2012b

Note: American Community Survey estimates are based on data collected over a 5-year time period. The estimates represent the average characteristics of populations between January 2008 and December 2012 and do not represent a single point in time.

Census Tracts are geographic regions within the US that are defined by the US Census Bureau in order to track changes in a population over time. Census Tracts are based on population sizes and not geographic areas. The average population of a Census Tracts is about 4,000 people, so rural areas that are sparsely populated may have very large Census Tracts while densely populated urban areas may have very small Census Tracts.

When broken down by Census Tract, three out of 87 tracts in the socioeconomic study area have greater than 50 percent of individuals living below the poverty line: Census Tract 9440 in eastern McKinley County had an individual poverty rate of 54.6 percent; Census Tract 9405 in southwestern McKinley County had an individual poverty rate of 59.4 percent; and Census Tract 9409 in northwestern Sandoval County had an individual poverty rate of 51.9 percent (US Census Bureau 2012b). These three Census Tracts are all relatively large, indicating a sparsely populated, rural area.

2.8.2 Minority Populations

Based on 2008 to 2012 data, minorities made up 59.5 percent of the population in New Mexico, compared to 36.3 percent in the United States as a whole. The proportion of minorities in the socioeconomic study area (65.3 percent) substantially exceeded the US and is slightly higher than the state average. At the county level, the population ranged from 89.7 percent minority in McKinley County to 52.8 percent in Sandoval County. Within relevant tribal nations, Native Americans represented the vast majority of the population. The largest minority groups were Hispanics/Latinos in Rio Arriba and Sandoval Counties and Native Americans in McKinley and San Juan Counties (Table 10).

Table 10: Study Area County Population by Race/Ethnicity (2008 to 2012).

Population	McKinley County	Rio Arriba County	Sandoval	San Juan	Study Area	New Mexico	United States	Jicarilla Apache Nation	Navajo Nation	Ute Mountain Ute Nation
Hispanic or Latino ethnicity of any race	9,744	28,714	46,334	24,496	109,288	952,569	50,545,275	382	2,958	99
	13.6%	71.4%	35.3%	19%	29%	46.3%	16.4%	11.6%	1.7%	6.0%

White alone	7,413	5,370	61,977	54,218	128,978	831,543	196,903,968	74	3,762	47
	10.3%	28.6%	47.2%	42.2%	34.67%	40.5%	63.7%	2.3%	2.2%	2.9%
Black or African American alone	353	149	2,704	794	4000	35,586	37,786,591	0	250	5
	0.5%	0.4%	2.1%	0.6%	1.08%	1.7%	12.2%	0%	0.1%	0.3%
American Indian or Alaskan Native alone	52,358	5,629	15,964	46,676	120,627	176,766	2,050,766	2,692	162,920	1,429
	72.8%	14.0%	12.2%	36.3%	32.43%	8.6%	0.7%	82.0%	94.3%	87.0%
Asian alone	506	173	1,685	464	2828	25,411	14,692,794	73	834	14
	0.7%	0.4%	1.3%	0.4%	0.76%	1.2%	4.8%	2.2%	0.5%	0.9%
Native Hawaiian and Other Pacific Islander alone	38	7	100	72	217	989	480,063	0	209	0
	0.1%	0%	0.1%	0.1%	0.06%	<.01%	0.2%	0%	0.1%	0%
Some Other Race	7	22	437	84	550	3,623	616,191	0	102	0
	<.01%	0.1%	0.3%	0.1%	0.15%	0.2%	0.2%	0%	0.1%	0%
Two or more Races	1,469	137	2,101	1,796	5,503	28,800	6,063,063	62	1,660	49
	2.0%	0.3%	1.6%	1.4%	1.48%	1.4%	2.0%	1.9%	1.0%	3.0%
Classified as Minority Population based on	Yes	Yes	Yes	Yes		Yes	NA	Yes	Yes	Yes

Source: US Census Bureau 2012b

Note: American Community Survey estimates are based on data collected over a 5-year time period. The estimates represent the average characteristics of populations between January 2008 and December 2012 and do not represent a single point in time

Based on the CEQ definition of a minority population area (minority residents exceed 50 percent of all residents), Bernalillo, Bloomfield, Espanola, and Gallup all are considered minority communities.

When examined at the Census Tract level, there are 24 out of 87 tracts that have a minority population greater than 50 percent. These range from Census Tract 6.1 located just north of the city of Aztec with a minority population of 80.5 percent to Census Tract 107.17 located north of the city of Rio Rancho with a minority population of 50.2 percent (US Census Bureau 2012b). These Census Tracts are relatively small and are based around the city of Rio Rancho and the Aztec/Farmington/Bloomfield area.

2.8.3 Native American Populations

Study Area County Population by Race/Ethnicity (2008 to 2012) account for a substantial portion of the study area population in some areas, notably McKinley and San Juan Counties, where the population is 72.8 and 36.3 percent American Indian respectively. Three tribal governments have reservations within the planning area: the Jicarilla Apache Nation, the Navajo Nation, and the Ute Mountain Nation. The Southern Ute Nation has lands just north of the planning area in the state of Colorado, but none within the planning area. Almost one half of the planning area is tribal lands. Each tribe maintains a general concern for protection of and access to areas of traditional and religious importance, and the welfare of plants, animals, air, landforms, and water on reservation and public lands.

In addition, the Navajo Nation Chapter Houses of Counselor, Huerfano, and Nageezi are in the general area of the proposed nominated allotment(s). These Chapter Houses have expressed concerns about the impacts of continued oil and gas development on the condition of roads in the area, traffic safety, water quality, visual resources and air quality. FIMO received comments both from individual allottee(s) in favor of the proposed lease sale for economic reasons, and from the Chapter House officials requesting open communication in regards to roads, air, traffic, flaring, and dust to the local communities.

2.9 Night Skies

Yáidíhíł (Navajo word meaning universe or heavens) is very important to Navajo People. Navajos consider Yáidíhíł as the opposite to the Earth. It is commonly referred to Father Sky while the Earth as Mother Earth. Furthermore, it is considered a Holy Deity, it being a major deity; it is in every part of Navajo Lifeways including ceremonies/prayers known to Navajo People. As a result, every Navajo ceremony incorporates Yáidíhíł. It is very important to all ceremonies which includes the Blessing Way, Night Way, Mountain Top Way, Shooting Way, Beauty Way, Evil Way, Windways to name a few.

Yáidíhíł is also a traditional Navajo calendar that identifies the cycle of the Navajo fall, winter, spring, and summer seasons. Navajos track the constellations map of the dark skies to determine when certain Navajo activities/ceremonies can be conducted or performed. Dark skies is vital in tracking time and dates and any obstructions to the Dark Skies, i.e. light pollution, affects major lifeways and ceremonial practices.

The Four Corners region has a long history of stargazing, starting with the Ancestral Puebloan culture that inhabited the Chaco area. There has been substantial research in cultural astronomy, and multiple examples where manmade and natural features were used to mark the positions of the sun, moon, and other astronomical phenomena. For the past two decades, CCNHP has partnered with the astronomy community. Amateur astronomers regularly host stargazing events under the guidance of a park ranger with an archeoastronomy background.

2.10 Visual Resources

FIMO utilizes the BLM Visual Resource Management (VRM) system for guidance in inventorying and managing visual resources. According to the Onshore Energy and Mineral Lease Management Interagency SOP-Fluid Minerals Indian handbook states that the APD responsibilities are handle by the BLM. The primary objective of VRM is to manage visual resources so that the quality of scenic (visual) values is protected. As part of the VRM program, the BLM performs a landscape Visual Resource Inventory (VRI) of visual values of all its public lands. The inventory stage identifies the visual resources of an area and assigns them to an inventory class using the BLM's Visual Resource Inventory (VRI) process. The VRI process consists of the following:

- A scenic quality evaluation to rate the visual appeal of an area.
- A sensitivity level analysis to assess public concern of an area's scenic quality and their sensitivity to potential changes in the visual setting.
- A delineation of distance zones to indicate the relative visibility of the landscape from primary travel routes or observation points.

Based on these three factors, lands are placed into one of four VRI classes (Class I, Class II, Class III, and Class IV) that represent the relative value of the visual resources and provide the basis for considering visual values in the resource management planning process. VRI Classes II, III, and IV are determined based on a combination of scenic quality, sensitivity level, and distance-zone characteristics to assign the proper class. In the relative scale of visual values, Class II has a higher level of value than Class III, which is moderately valued. Class IV is least valued. VRI Class I is assigned to a special management area where a management decision has previously been made to maintain a natural landscape. These areas are the most valued landscapes. This includes areas such as Wilderness Areas or Wilderness Study Areas and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape.

The objective for each VRM Class describes how that area should be managed, as shown in Table 11. FIMO does not assign VRM Classes to FIMO administered surface. The twenty-two (22) Indian

allotments are all near or adjacent to VRM Class II, III and IV FIMO administered surfaces. FIMO does not have a VRM Class but would use the BLM’s VRM as a guideline.

Table 11: BLM VRM Class Objectives.

VRM Class	VRM Objective
Class I	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and should not attract attention.
Class II	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV	The objective of this class is to provide for management activities, which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements of the landscape.

2.11 Federal Listed Species

Section 7 of the Endangered Species Act (ESA) requires that federal agencies, in consultation with the Navajo Nation Department Fish and Wildlife (NNDFW), ensure that their actions are not likely to jeopardize the continued existence of any listed species, or result in adverse effects on designated critical habitat of such species. The ESA also prohibits any action that results in a “taking” of any listed federally protected plant, fish, or wildlife species. The applicant and the FIMO must ensure that the proposed action does not jeopardize the continued existence of a federally designated critical habitat of a listed species. Compliance with Section 7 of the ESA through the NNDFW will be determined of the project specific level during subsequent NEPA analysis to be completed before implementation of any subsequent oil and gas development or production activities that may occur as a result of leasing actions covered under this EA.

According to the Navajo Nation Department of Fish and Wildlife two (2) federally listed species could possibly occur within the vicinity of the proposed action (Table 12). The proposed action area does not contain habitat for any of the eleven federally listed species occurring in San Juan County. FIMO conducted field evaluations on August 15, 17, and 18, 2017. During the field evaluations there were no federally-listed species present and no critical habitat. In addition to the leasing level field evaluations, the BLM will also conduct field work prior to any future oil and gas development and production activities.

Table 12: NNDFW Listed TES Fauna Species with the Potential to Occur in the PPA

Species Name	Species Status	Species Habitat
Southwestern Willow Flycatcher <i>(Empidonas Traillii Eximus)</i>	NESL G2/listed endangered with critical habitat	Nesting is in dense riparian vegetation near surface water or saturated soil; either in monotypic or mixed stands of native (e.g. willow) and/or exotic (e.g. tamarisk or Russian olive) species, with or without an over-story. Vegetation is typically t3 m high, dense (i.e. a thicket) with a closed canopy, although the understory may be dispersed or clumped (especially when tamarisk or Russian olive).
Black-Footed Ferret <i>(Mustela Nigripes)</i>	NESL G2/listed endangered	Medium to large active prairie dog towns (>80 ha, and t20 burrows/ha) or complex of towns (two or more towns within 7 km). Prairie dogs are their main food source, and burrows are used for denning and rearing young.

2.11.1 Migratory Birds

The Migratory Bird Treaty Act of 1918 (DOI 2010a) protects migratory birds and most resident birds that are native to the United States. According to the MBTA, it is illegal to pursue; hunt; take; capture; kill; attempt to take capture, or kill; and active nests (and the eggs or young within). The MBTA does not prohibit harassment, disturbance, or habitat removal and alternations. The BIA required proposed projects to analyze impacts to migratory birds through NEPA process and implement BMPs during project implementation. BMPs include several measures for the project proponent to use to minimize their surface disturbance (habitat fragmentation) and the impacts to migratory bird habitat.

The proposed action would not impact migratory birds within the Eastern Navajo Agency as no ground disturbing activities are required as the leasing action is solely an administrative process and subsequent NEPA analysis and permit approval would be required for future oil and gas development and production activities that may occur as result of the leasing action.

2.12 Wildlife

The Eastern Navajo Agency contains varying densities of residential and seasonal big game populations. The proposed action would not impact wildlife within the nominated allotments with the Eastern Navajo Agency as no ground disturbing activities are required as the leasing action is solely an administrative process and subsequent NEPA analysis and permit approval would be required for future oil and gas development and production activities that may occur as a result of the leasing action.

3 Environmental Impacts

3.1 Alternative A: No Action

Under the No Action alternative, all of the proposed allotments would be deferred and not offered for sale in the April 2018, Competitive Oil and Gas Close Bid Lease Sale. There would be no subsequent impacts from oil and/or gas construction, drilling, and production activities. The No Action Alternative would result in the continuation of the current land and resource uses in the proposed lease areas.

3.1.1 Fluid Minerals

There would be no new impacts from oil and gas production on the proposed allotments. Oil and gas development of Federal, State, private, and Indian minerals would continue on the land surrounding the proposed allotments. No additional natural gas or crude oil from the proposed allotments would enter the public markets and no royalties would accrue for Indian allotted. An assumption is that the No Action Alternative (no lease option) would not affect current domestic production of oil and gas. However, this would not generate royalties for the Indian allotted mineral owners.

3.2 Alternative B: Proposed Action

The act of leasing the allotments would, by itself, have no impact on any resources. All impacts would be linked to undetermined future levels of lease development.

The standard lease states that if the allotments were developed, short-term impacts would be stabilized or mitigated and long-term impacts would substantially remain beyond the primary term of five years. Potential indirect impacts and mitigation measures of the Proposed Action are described below.

Cumulative impacts include the combined effect of pre-existing projects, specific planned projects and other reasonably foreseeable future actions such as other oil and gas wells located within the proposed allotments. Potential cumulative effects may occur should an oil and gas field be discovered, if the allotments were drilled, other oil and gas field wells are drilled within the proposed lease(s), or if the

proposed lease(s) becomes part of a new unit. All actions, not just oil and gas development, may occur in the area, including foreseeable non-federal actions.

3.3 Alternative C: Analyzed but Not Considered

The No Surface Occupancy (NSO) Action alternative was analyzed but will not be considered. There are no affected impacts to the land and the environment.

3.3.1.1 Greenhouse Gases

Gases that trap heat in the atmosphere are often called greenhouse gases (GHGs). Some GHGs such as carbon dioxide (CO₂) occur naturally and are emitted to the atmosphere through natural processes and human activities. Other GHGs (e.g. fluorinated gases) are created and emitted solely through human activities. The EPA (2017) identifies the principal GHGs that potentially enter the atmosphere because of human activities as the following:

- CO₂: CO₂ enters the atmosphere through the burning fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). CO₂ is also removed from the atmosphere when it is absorbed by plants as part of the biological carbon cycle.
- Methane (CH₄): CH₄ is emitted during the production and transport of coal, natural gas, and oil. CH₄ emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- Nitrous Oxide (N₂O): N₂O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- Fluorinated Gases: Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are typically emitted in small quantities, but are potent GHGs thought to contribute significantly to global warming process (EPA2017b)

CO₂ is the primary GHG, responsible for approximately 82.2% of radiative forcing (the rate of energy change as measured at the top of the atmosphere; can be positive [warmer] or negative [cooler]) (EPA 20117b) to simplify discussion of the various GHGs, the term “Equivalent CO₂ or CO₂e” has been developed. CO₂e is the amount of CO₂ ratio, is a common fugitive gas emission in oil and gas fields (EPA 2017b). Oil and gas production, however, is highly variable in potential GHG emissions. Oil and gas producers in the United States are not considered large GHG emitters by the EPA, and are not the subject of any current federal proposals that would regulate GHG emissions.

3.3.2 Air Resources

Methodology and assumptions for calculating air pollutant and greenhouse gas emissions are described in the Air Resources Technical Report. This document incorporates the sections discussing the modification of calculators developed by the BLM to address emissions for one well. The calculators give an approximation of criteria pollutant, HAP, and GHG emissions to be compared to regional and national levels. Also incorporated into this document are the sections describing the assumptions that the Eastern Navajo Agency used in developing the inputs for the calculator (USDI BLM, 2016).

3.4 Water Resources

The analysis area for impacts to surface water includes the Ah-shi-sle-pah, Blanco, Black lake, De-na-zin, and Escavada Wash watersheds. The impact indicator for analysis is acres of disturbance in the waterways. The area was evaluated for potential jurisdictional wetlands and other Waters of the U.S. Jurisdictional Waters of the U.S. are regulated by the U.S. Army Corps of Engineers (USACE). Under the Clean Water Act, USACE has jurisdiction over “waters of the U.S.” These jurisdictional waters include

those that have a “significant nexus” to traditional navigable waters. BLM and USACE Durango Regulatory Division have determined that jurisdictional waters may include USGS watercourses (i.e., “blue line” on USGS 1:24,000 topographic maps). Within the region, there is a network of ephemeral dendritic drainages that feed into USGS blue line drainages. These blue line drainages feed into Blanco or Chaco Wash to the west. All jurisdictional waters encountered by the proposed project contribute to Blanco or Chaco Wash.

There are no perennial surface water resources such as rivers, lakes, ponds, streams, wetlands or springs within the proposed project area.

3.4.1.1 Air Quality

Under the Proposed Action Alternative, leasing the subject allotments would have no direct impacts to air quality. Any potential effects to air quality from the sale of a lease allotment would occur if the lease is developed. Potential indirect impacts of leasing could include increased air borne soil particles blown from the development of new well pads or roads, exhaust emissions from drilling equipment, compressors engines, vehicles, flares, and dehydration and separation facilities, and volatile organic compounds during drilling or production activities.

There are three phases in the development of a well that result in different levels of emissions. The first phase occurs during the first year of development and may include pad construction, drilling, completion, interim reclamation, and operation of the completed well. The first year results in the highest level of emissions due to the equipment required during the construction and drilling, and the potential release of natural gas to the atmosphere during completion.

The second phase begins after the well is completed and is put on line for production. Emissions during the production phase may include vehicle traffic, engines to pump oil if necessary, compressor engines to move gas through a pipeline, venting from storage tanks, and storage tank heaters. A workover of the well may occasionally be required, but the frequency of workovers is not predictable since they result from mechanical difficulties of the well bore.

The third and final phase is to plug and abandon the well and reclaim the well pad and other associated disturbances (i.e. access roads and pipelines). The life of the well is unknown and emission estimates for this phase are not presented.

3.4.2 Heritage/Archaeological Resources

3.4.2.1 Cultural Resources

While the act of leasing a parcel would produce no impacts, subsequent development of the lease could have impacts/effects on cultural resources/historic properties.

Potential threats to cultural resources from leasing are variable and dependent upon the nature of the cultural resource and the nature of the proposed development. Effects normally and most often include alterations to the physical integrity of a cultural resource. The greatest potential impact to cultural resources stems from the construction of associated lease related facilities such as pipelines, power lines, roads, and well locations, as well as an increase in human activity or access to the area with the increased potential of unauthorized removal or other alteration to cultural resources in the area. These activities could affect one or more aspects of a historic properties physical integrity including location, design, materials, and workmanship. If a cultural resource is significant for other than its scientific information, effects may also include the introduction of audible, atmospheric, or visual elements that are out of character for the cultural site and diminish one or more of the historic properties aspects of integrity

including setting, feeling, and association, if those aspects of integrity contribute to conveying the significance of the historic property.

FIMO with the concurrence from NNHPD has applied the criteria of adverse effect to the proposed action and proposes that the effect will not be adverse provided that the design features enumerated for the proposed action are adhered to and avoidance and protective measures associated with the preservation of cultural resources are considered. The preferred course of action during individual lease development analysis and authorizations, including any effects that could reasonably involve the seven aspects of integrity for historic properties that may occur later in time, be further removed in distance, or be cumulative.

3.4.2.2 Cultural Landscapes

While Special BMPs or mitigations may be necessary to achieve no effect or no adverse effect to historic properties or other important cultural resources, the Proposed Action Alternative would not be expected to threaten or diminish the integrity or adversely affect the capability of considering any identified landscape characteristics of human use or activity in the APE (National Park Service 1999, Birnbaum and Peters 1996), nor would it compound the inherent problem associated with landscape approaches to archaeological remains (Zvelebil et al. 1992). It would not obligate the authorization of developments that would produce immitigable adverse effects to World Heritage Sites or Chaco Protection Sites.

3.4.2.3 Native American Religious Concerns

The Proposed Action Alternative is not known to physically threaten the integrity of any sacred places/TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere or otherwise hinder the performance of traditional ceremonies and rituals pursuant to AIRFA or EO 13007. There are currently no known remains that fall within the purview of NAGPRA or ARPA that are threatened by leasing. Use of lease notices/stipulations and other design features, such as Native American consultation (including Navajo Nation Chapters) and cultural resource avoidance will help ensure that new information is incorporated and taken into account during site-specific level analysis and authorizations.

3.4.3 Socioeconomics and Environmental Justice

While the act of leasing Indian allotted minerals itself would not result in significant social or economic impacts, subsequent development of a lease may generate impacts to people living near or using the areas in the vicinity of the lease allotments. Oil and gas exploration, drilling, or production could create a disruption to these people due to increased traffic and traffic delays, air pollution, noise, and visual impacts. Should APDs be filed for the lease allotment(s) considered in this sale, then the social and economic effects on adjacent populations would be assessed relative to known impacts.

At the lease sale stage, there is often not enough information available about how the lease will be developed to accurately determine whether there may be disproportionately high and adverse environmental justice impacts to identified populations of concern. Exact locations and equipment specifications are known at the APD stage, so the site-specific (APD) EA should assess whether there are disproportionately high and adverse impacts to identified environmental justice populations from the development of these leases.

The current population of the allotments should be considered an environmental justice population of concern, and should be addressed accordingly in any additional environmental analyses undertaken at the site-specific (APD) stage. The current residents of the allotments proposed for sale in this action may reasonably be defined as a discrete, though dispersed, local community for purposes of determining if disproportionately high and adverse environmental effects may be present at the APD stage.

Should APDs be filed for these allotments, residents would be given the opportunity to identify any environmental effects that might arise from development activities that they feel have a disproportionately high and adverse effect. These effects include, but are not limited to, increased noise, increased dust, and perceived threat from increased traffic in the area, disruption of quality of life factors, such as sense of isolation or privacy, and other issues. It is important to note that most disproportionate and adverse environmental effects must be defined by the group that would suffer such effects.

FIMO must provide these affected environmental justice populations reasonable opportunities to identify such effects, and should collaborate with the affected populations to determine possible mitigation methods and measures. FIMO cannot identify and mitigate any identified disproportionate and adverse effects unilaterally, but rather must do so in collaboration with the affected communities.

The amount of disruption would depend on the activity affected, traffic patterns within the area, noise levels, length of time, and season these activities occurred. In addition, any nearby residents may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. These impacts would be limited to the period of time during which drilling operations associated with hydraulic fracturing occur. Due to occupied residences located within several allotments, lease stipulation would apply. CFR 25 212.47 states that states that no surface occupancy is allowed within 200 feet of any occupied residences of a community to reduce impacts to the community of drilling and production activities.

The proposed action would not impact cultural resources within the Eastern Navajo Agency as no ground disturbing activities are required as the leasing action is solely an administrative process and subsequent NEPA analysis and permit approval would be required for future oil and gas development and production activities that may occur as the result of the leasing action.

3.4.4 Night Skies

Table 13 lists the light sources associated with drilling an oil and gas well. Sources typically include a light plant or generator, a light on the top of the rig, vehicle traffic, and flaring. The number of light sources and the duration of each source are identified. Flaring could occur in locations where pipelines are not available to transport gas to sale; however, the necessity for flaring and the duration of flaring varies widely from well to well and is difficult to predict.

Table 13: Light sources per well.

Light Source			Duration	
Location	Type	Number ¹	Days (average)	Hours ²
Foreground/Midground (0-5 miles)				
Estimated light sources per 1 well				
Rig Derrick	4-foot Fluorescent (1 Explosion Proof)	12	3	24
Light Tower	Explosion Proof	4	3	24
Light Tower	Explosion Proof	2	30	24
Rig Floor	Explosion Proof	2	17	24
Sub	Explosion Proof	4	17	24
Mud Tank	Explosion Proof	9	17	24
Mud Pump	Explosion Proof	6	17	24
Catwalk	Explosion Proof	2	17	24

Tool Shed	4-foot Fluorescent	4	17	24
Housing Unit	12-Volt	10	17	12
Background/Seldom Seen (greater than 5 miles)				
Estimated light sources per 1 well				
Rig Derrick	4-foot Fluorescent (1 Explosion Proof)	12	3	24
Light Tower	Explosion Proof	4	3	24
Light Tower	Explosion Proof	2	30	24
Rig Floor	Explosion Proof	2	17	24
Sub	Explosion Proof	4	17	24
Mud Tank	Explosion Proof	9	17	24
Mud Pump	Explosion Proof	6	17	24
Catwalk	Explosion Proof	2	17	24
Tool Shed	4-foot Fluorescent	4	17	24
Housing Unit	12-Volt	10	17	12
Estimated light sources per 1 well				
Rig Derrick	4-foot Fluorescent (1 Explosion Proof)	12	3	24
Light Tower	Explosion Proof	4	3	24
Light Tower	Explosion Proof	2	30	24
Rig Floor	Explosion Proof	2	17	24
Sub	Explosion Proof	4	17	24
Mud Tank	Explosion Proof	9	17	24
Mud Pump	Explosion Proof	6	17	24
Catwalk	Explosion Proof	2	17	24
Tool Shed	4-foot Fluorescent	4	17	24
Housing Unit	12-Volt	10	17	12

¹The number reflects the total number of light sources that may be required to drill wells necessary to develop the parcel. The total number of light sources present at any given time is likely to be lower as is unlikely that all wells will be drilled at the same time.

²This number reflects the number of hours the light may be on during a 24-hour period. Because the number of night-time hours varies depending on the time of year the well is drilled, lighting will not impact night skies during all of the hours identified.

Table 13 provides the total number of light sources required for the development of a well; however, for allotments requiring more than one well, it is unlikely that all of the wells would be drilled at one time. These artificial lighting and flaring activities could result in minor, short-term impacts to night skies as well locations typically do not have lighting as a permanent feature upon completion.

3.4.5 Visual Resources

The issuance of leases would not directly impact visual resource values. However, if issued, the proposed allotments could have future potential impacts on visual resources found in the existing inventory classification identified earlier. These impacts would include future development in the form of oil wells/pads, pipelines, compressors, power lines, constructed roads and other linear features in the areas adjacent to the proposed lease allotments. These impacts to the existing landscape found in the current VRI Classes would be allowable under the visual resource management decision which was established in the FFO RMPA (RMPA, 2014).

Further detailed analysis of these potential impacts to the VRI would be analyzed in the future as oil and gas development plans and as permits to drill are submitted. Mitigations and design features in order to reduce the potential impacts to the VRI would be addressed at that time.

Impact to visual resources would be considered relevant if the impacts of the proposed project do not conform to an area's designated VRM class objectives, which for this proposed action surrounds the VRM Class II, III and IV.

Short-term impacts are those that would affect visual resources for fewer than five years; long-term impacts would affect visual resources for more than five years. The potential direct adverse impacts to visual resources would include the visual contrasts created by construction equipment, pipelines, well pads, temporary and permanent access roads, and other forms of infrastructure associated with oil and gas exploration and development. In general, drilling rigs and equipment, construction and maintenance vehicles, development infrastructure, and surface disturbance, including roads, would impact an area's scenic quality and appearance of naturalness with human-made form, color, and linear contrasts. A visual contrast rating process would be used for the VRM analysis in areas with a VRM III classification, which involves comparing the project features with the major features in the existing landscape to determine whether the scenic values of the BIA managed lands adjacent to each parcel have been maintained.

As the proposed leases are developed, there is likely to be a visual impact for residents of allotted and tribal lands. However, those potential impacts cannot be analyzed until a site-specific application is submitted to the FIMO.

3.4.6 Federal Listed Species

The Proposed Action would not impact threatened and endangered species within the Eastern Navajo Agency as no ground disturbing activities are required as the leasing action is solely an administration process and subsequent NEPA analysis and permit approval would be required for future oil and gas development and production activities that may occur as a result of the leasing action.

3.4.6.1 Migratory Birds

Potential effects on birds from the Proposed Action Alternative are difficult to predict. Ongoing studies have shown mixed effects of oil and gas development, including compressor noise on nesting migratory birds. Site-specific analysis would be conducted to determine the impacts on migratory birds as proposed projects are submitted to the BIA but with concurrence from the NNDFW. Impacts to migratory birds will be reduced significantly with these management measures in place. However, not all impacts would be eliminated. Impacts such as habitat fragmentation and habitat loss will continue to impact birds and their habitat. FIMO will apply BMPs to reduce impacts on migratory birds with the concurrence from the NNDFW.

3.4.7 Wildlife

Wildlife common to the proposed area includes a wide variety of mammals, birds, and reptiles. Common mammals include desert cottontail, antelope, ground squirrel, spotted ground squirrel, coyote, gray fox, porcupine, raccoon, black bear, and mountain lion inhabit the region of the proposed action. Common birds include ravens and horned larks. A wide variety of songbirds and neo-tropical migratory birds also use the region.

The proposed action would not impact wildlife within the Eastern Navajo Agency as no ground disturbing activities are required as the leasing action is solely an administrative process and subsequent NEPA analysis and permit approval would be required for future oil and gas field development and production activities that may occur as a result of the leasing action.

4 Cumulative Impacts

Environmental impacts may accumulate either over time or in combination with similar events in the area. Unrelated and dissimilar activities may also have negative impacts on events in critical elements, thereby contributing to the cumulative degradation of the environment. Past and current disturbances within the

Eastern Navajo Agency include farming, grazing, roads, and other oil and gas wells. Farming and grazing activities occur in the Eastern Navajo Agency regardless of the density of oil and gas development, since divided interests in the allotment land surface, range permits, and agricultural leases are often held by different surface owners than those holding mineral rights, such that economic benefits of oil and gas activities currently exist.

Reasonably foreseeable impacts of future developments in Eastern Navajo Agency must also be considered. Should further development of lease allotments occur and prove production, it is likely that lessees would pursue additional development in the agency. For purposes of cumulative impact analyses, the density of active and permitted oil and gas wells and associated facilities is expected to increase steadily within the Eastern Navajo Agency over the next decade. Oil and gas development is expected to have a minor cumulative effect on land use patterns and the human and natural environment, due to the dispersed and passive nature of the development.

Appendix C outlines a list of lease stipulations that will be applied to the appropriate allotments to minimize cumulative impacts.

4.1 Air Resources

The following analysis of cumulative impacts of the proposed action on air quality would be limited to the Four Corners area of New Mexico. The cumulative impacts of GHG emissions and their relationship to climate change are evaluated at the national and global levels in the Air Resources Technical Report (U.S. Department of Interior Bureau of Land Management, 2016).

Even though the Proposed Action of leasing would not contribute to cumulative effects on air resources, future foreseeable development could contribute to cumulative GHG emissions. The primary sources of emissions include the following:

- Fossil fuel combustion for construction and operation of oil and gas facilities – vehicles driving to and from production sites, engines that drive drill rigs, etc. These produce CO₂ in quantities that vary depending on the age, types, and conditions of the equipment as well as the targeted formation, locations of wells with respect to processing facilities and pipelines, and other site-specific factors.
- Fugitive CH₄ – CH₄ that escapes from wells (both gas and oil), oil storage, and various types of processing equipment. This is a major source of global CH₄ emissions. These emissions have been estimated for various aspects of the energy sector, and starting in 2011, producers are required under 40 CFR § 98, to estimate and report their CH₄ emissions to the USEPA.
- Combustion of produced oil and gas – it is expected that operations will produce marketable quantities of oil and/or gas. Combustion of the oil and/or gas would release CO₂ into the atmosphere. Fossil fuel combustion is the largest source of global CO₂.

Increases in GHGs are thought to be related to climate change, which may affect various resources and contribute to changes such as earlier “greening” of vegetation in the spring and longer thermal growing seasons (IPCC, 2007). Climate change may combine with other human-induced stress to further increase the vulnerability of ecosystems to other pests, invasive species, and loss of native species. Climate change may also affect breeding patterns, water and food supply, and habitat availability to some degree. Sensitive species could experience additional stressors as a result of climate change.

The assessment of GHG emissions, their relationship to global climatic patterns, and the resulting impacts, however, is still an ongoing scientific process. It is not known with certainty the net impacts that

reasonably foreseeable mineral development could have on climate – that is, while FIMO actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science.

FIMO does not have the ability to directly associate a FIMO action’s contribution to climate change with effects in any particular area. Inconsistencies in the results of scientific models designed to predict climate change on regional or local scales limits the ability to completely quantify potential future effects of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing science. When further information on the effect to climate change is known, such information would be incorporated in the BIA’s planning and NEPA documents as appropriate.

In recent years, many states, tribes, and other organizations have initiated GHG inventories, tallying GHG emissions by economic sector. The USEPA provides links to statewide GHG emissions inventories (USEPA, 2015c). Guidelines for estimating project-specific GHG emissions are available (URS Corporation, 2010), but some additional data, including the volume of oil produced and the number of wells, are not available for the Proposed Action. Uncertainties regarding the numbers of wells and other factors result in a moderate to high degree of uncertainty and speculation with regard to GHG estimates at the leasing stage. At the APD stage, more site-specific information on oil and gas activities resulting in GHG impacts would be described in detail. Also at the APD stage, the FIMO would review and evaluate operations, require mitigation measures, and encourage operators to participate in the voluntary STAR program.

Although the Proposed Action of leasing, in itself, would not result in any air quality or climate change effects, potential reasonably foreseeable mineral development could increase GHGs that may influence climate change within the region and result in cumulative effects when combined with other past, present, and future actions in the area. For instance, as previously acknowledged in this EA, it is possible that there could be additional oil and gas development on private surface and private minerals in the future. These activities could result in additional air emissions.

Reclamation and other stipulations and best management practices, as described earlier in this EA, would help to minimize the potential for significant adverse cumulative effects.

4.1.1 Air Quality

The primary activities that contribute to levels of air pollutant and GHG emissions in the Four Corners area are electricity generation stations, fossil fuel industries and vehicle travel. The Air Resources Technical Report includes a description of the varied sources of national and regional emissions that are incorporated here to represent the past, present and reasonably foreseeable impacts to air resources. It includes a summary of emissions on the national and regional scale by industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally) and transportation.

4.1.2 Climate Change

The very small increase in GHG emissions that could result from approval of the Proposed Action Alternative would not produce climate change impacts that differ from the No Action Alternative. This is because climate change is a global process that is impacted by the sum total of GHGs in the Earth’s atmosphere. The incremental contribution to global GHGs from the proposed action cannot be translated into effects on climate change globally or in the area of this site-specific action. It is currently not feasible to predict with certainty the net impacts from the proposed action on global or regional climate.

The Air Resources Technical Report discusses the relationship of past, present and future predicted emissions to climate change and the limitations in predicting local and regional impacts related to

emissions. It is currently not feasible to know with certainty the net impacts from particular emissions associated with activities on public lands (USEPA, 2017b).

4.2 Water Resources

The Air Resources Technical Report discusses the relationship of past, present and future predicted emissions to climate change and the limitations. The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. Past, present, and reasonably foreseeable future actions within the Ah-shi-sle-pah, Blanco, Black lake, De-Na-Zin, and Escavada Wash watershed may have impacts to water resources mainly resulting from surface disturbance associated with oil and gas development. For the proposed action there will be no cumulative impact to waters of the US, as there will be no surface disturbance at the leasing level.

4.3 Heritage/Archaeological Resources

The Proposed Action Alternative APE lies within four generalized cultural resources analysis units, based on natural Hydrologic Unit Code (HUC) 8 watershed boundaries, other major natural boundaries with strong, known implications for patterned historic settlement and behavior (e.g., the San Juan River), and available data, with Navajo Nation, Jicarilla Apache Nation, and Ute Mountain Ute Tribal lands generally underrepresented or unrepresented in the New Mexico Cultural Resource Information System (NMCRIS) database.

The four analysis units encompass 1,518,793 acres. Based on New Mexico Cultural Resource Information System data (NMCRIS; July 2017), there are 110,830 recorded sites and approximately 18.4 percent of all analysis units (278,999 acres) has been inventoried for cultural resources at the Class III level since 1977. This is an overall site density of 1:17.6 acres although site density varies between 1:16.6 acres to 1:21.4 acres across the analysis units. Approximately 84.9 percent of the sites (n≈1414 of 9360 with detailed eligibility data) are historic properties or potentially eligible for the NRHP. The 108 SR and/or NRHP-listed properties and other significant properties identified across the analysis units represent a variety of important cultural resources bearing special designations, including Chaco Canyon National Historic Park, Chaco Protection Sites, portions of the Chaco Culture UNESCO World Heritage property, and the Old Spanish National Historic Trail.

Risks of impacting unknown (i.e., buried) historic properties is normally negligible as cultural resources “discoveries” during surface disturbing components of a proposed action are infrequent in the Eastern Navajo Agency. Between FY2000 and FY2016, BLM has reported 28 discoveries have occurred in association with 21,290 actions (e.g. road, well, pipeline, etc.), or 1:760. During that period 153,626 acres of land were inspected for cultural resources, with an average of 7.2 acres per action and one discovery per 5,472 acres. Where the risk of discoveries can be reasonably expected (e.g., ≤ 100' of a known historic property, or in environmental settings known or suspected to be conducive to buried sites), archaeological monitoring by a qualified and permitted archaeologist during initial disturbance (e.g., blading, trenching) is normally required. If buried historic properties are discovered, collaborative steps are taken to protect them in place or recover their important information.

There would likely be no negative cumulative impact on known historic properties, as estimated site densities and known site locations do not preclude the full avoidance of adverse effects to historic properties and other cultural resources, including NRHP-listed properties, UNESCO World Heritage properties, and Chaco Protection Sites. A positive cumulative effect is the additional scientific information yielded by the archaeological survey both in terms of site-specific information and the amount of the landscape inventoried for cultural resources. Potential impacts to specific properties will be identified and addressed during site-specific analyses for future associated developments.

4.4 Socioeconomics and Environmental Justice

There are previously existing oil and gas facilities in the area of the allotments, in addition to the ROWs resulting from resource extraction. Allotments 131, 233 and 234 are occupied by residential leases. The neighboring Navajo Chapter Houses include Counselor, Huerfano and Nageezi.

Continued oil and gas development has the potential to increase road traffic, affecting traffic safety, water quality, visual resources and air quality. FIMO and BIA received comments both from individual allottee(s) and non allottee(s) in favor of the proposed lease sale for economic reasons. The Chapter House officials stated that the issues they experienced were in communications, roads, air, traffic, flaring and dust. Chapter officials expressed the need in addressing these impacts.

Stipulations, BMPs and COAs are tools that will be used to minimize impacts. There will be no surface disturbance at the leasing level. Additional mitigation measure may be considered at the site-specific (APD) application level for development.

4.5 Visual Resources

The cumulative impact area considered for visual resources is the applicable inventory units of the FFO VRI (March 2009). The rationale for this boundary is that the visual resource inventory serves as the baseline information for assessing potential effects to visual resources within the proposed projects. Cumulative impacts are incorporated by reference to Section 4.2 of the FFO Visual Resource Management Plan Amendment (BLM, 2013d). The past, current and future activities in the inventory unit would cumulatively increase the cultural modification done to the landscape. This is viewed as negative impact when assessing the scenic quality of an area. The proposed action would contribute to these cumulative impacts by moving forward with the lease sale for the twenty-two (22) allotments. Visual contrast analysis would be conducted to determine if development is in compliance with VRM standards when the project proponents begin the work of developing any infrastructure on BLM lands classified as VRM III. When a site-specific project is proposed, VRM analysis would be conducted. Cumulatively these developments could change the overall character of the VRM classification. The No Action alternative would not contribute any cumulative impacts.

5 Supporting Information

This section includes individuals or organizations from the public, external agencies, and the FIMO staff (Table 14) contacted during the development of this document.

Table 14: List of Preparers and Reviewers

Name	Title	Organization
Cassandra Gould	Realty Specialist	FIMO
Maureen Joe	FIMO Director	FIMO
Harrilene Yazzie	Supervisory Environmental Protection Specialist	Navajo Regional BIA
Robert Begay	Regional Archaeologist	Navajo Regional BIA
Pamela Kyselka	Wildlife Biologist	Navajo Nation Department of Fish and Wildlife
Tamara Billie	Senior Archaeologist	Navajo Nation Historic Preservation Department

6 References

- Birnbaum, Charles A. 1994. Preservation Brief 36. Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes. U.S. Department of the Interior. National Park Service.
- Birnbaum, Charles A. and Christine Capelle Peters. 1996. Guidelines for the Treatment of Cultural Landscapes. U.S. Department of the Interior. National Park Service.
- BLM-SHPO. 2014. State Protocol Agreement between New Mexico BLM and New Mexico State Historic Preservation Officer.
http://www.blm.gov/nm/st/en/prog/more/cultural_resources/need_to_know.html
- Boden, T. A., Marland, G., and Andres, R. J. Global, regional, and national fossil-fuel CO₂ emissions. U.S. Department of Energy. Oak Ridge, TN: Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory. doi:10.3334/CDIAC/00001_V2013.
- Brugge, David M. 1986. Tsegai: An Archaeological Ethnohistory of the Chaco Region. U.S. Department of the Interior.
- Brugge, David M. 1993. An Investigation of AIRFA Concerns Relating to the Fruitland Coal Gas Development Area. Office of Contract Archaeology, University of New Mexico. Ms. on file, Bureau of Land Management, Farmington, New Mexico.
- Bureau of Indian Affairs (BIA). 59 Indian Affairs Manual 3-H, National Environmental Policy Act Guidebook. Available online at
<http://www.bia.gov/WhatWeDo/Knowledge/Directives/Handbooks/>. Accessed September 2017.
- Bureau of Land Management (BLM). 2003a. Farmington Proposed Resource Management Plan and Final Environmental Impact Statement (PRMP/FEIS). Farmington, New Mexico: BLM-FFO.
- _____. 2003b. Farmington Resource Management Plan with Record of Decision. (RMP and ROD). Farmington, New Mexico: BLM-FFO.
- _____. 2005. Procedures for Performing Cultural Resource Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities.
http://www.blm.gov/pgdata/etc/medialib/blm/nm/programs/more/cultural_resources/cultural_docs.Par.77051.File.dat/H-8100-1_manual_final_V_8-21_.pdf
- _____. 2010. Climate Change Supplementary Information Report for Montana, North Dakota, and South Dakota, Bureau of Land Management. Report on Greenhouse Gas Emissions and Climate Change for Montana, North Dakota, and South Dakota. Technical report prepared for the Montana/Dakotas BLM by URS Corporation. URS Project 22241790.
- _____. 2011d. Roads Design Handbook. H-9113-1
- _____. 2011e. BLM Roads National Inventory and Condition Assessment Guidance and Instructions. H-9113-2.
- _____. 2013d. Farmington Field Office Visual Resource Management Resource Management Plan Amendment (DOI-BLM-NM-F010-2013-0047-EA).
- _____. 2015. FFO_TRANSPORT_BLM_roads_12-14-2015 (Shapefile of recorded BLM roads). Available at:
http://www.blm.gov/nm/st/en/prog/more/geographic_sciences/spatial_data_metadata/farmington_spatial.html.
- CCSP, 2008: *Climate Models: An Assessment of Strengths and Limitations*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Bader D.C., C. Covey, W.J. Gutowski Jr., I.M. Held, K.E. Kunkel, R.L. Miller, R.T. Tokmakian and

- Clement, Dorene. 1999. General Guidelines for Identifying and Evaluating Historic Landscapes. Environmental Program, California Department of Transportation, Sacramento.
- Condie, Carol J. and Ruthan Knudson (editors). 1982. The Cultural Resources of the Proposed New Mexico Generating Station Study Area, San Juan Basin, New Mexico. Quivira Research Center Publication 39. Albuquerque.
- Copeland, James M. 2015. Ranches, Springs, and Old Stone Towers: The General Land Office Surveys In and Near Dinétah. In, The Multifaceted Forester, Papers in Honor of John S. Hayden. Papers of the Archaeological Society of New Mexico 41:57-67.
- Council on Environmental Quality. 1997. Environmental Justice Guidance under the National 1281 Environmental Policy Act. December 10, 1997.
- de la Torre, Marta, Margaret G. H. MacLean, and David Myers. 2003. Chaco Culture National Historical Park, U.S. National Park Service: A Case Study. The Getty Conservation Institute. Los Angeles, CA.
- Enquist, Carolyn and Gori, Dave. Implications of Recent Climate Change on Conservation Priorities in New Mexico. April 2008.
- Fransted, Dennis and Oswald Werner. 1975. Ethnogeography of the Chaco Canyon Navajo. Unpublished manuscript, Northwestern University. On file at Division of Chaco Research, Albuquerque.
- Fransted, Dennis. 1979. An Introduction to the Navajo Oral History of Anasazi Sites in the San Juan Basin Area. Unpublished manuscript, Navajo Aging Services, Fort Defiance, Arizona.
- Freimund, Wayne and Douglas Dalenberg. Chaco Culture National Historical Park: 2009 Visitor Survey. The University of Montana. January 1, 2010.
- Goddard Institute for Space Studies. 2007. Annual Mean Temperature Change for Three Latitude Bands. Datasets and Images. GISS Surface Temperature Analysis, Analysis Graphs and Plots. New York, New York. (Available on the Internet https://data.giss.nasa.gov/gistemp/graphs_v3/)
- Hebblewhite, M. 2008. A literature review of the effects of energy development on ungulates: implications for central and eastern Montana, Montana Fish, Wildlife and Parks, Miles City, USA.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Basis (Summary for Policymakers). Cambridge University Press. Cambridge, England and New York, New York. Available on the Internet: <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf>
- _____. 2014. IPCC Fifth Assessment Report: Synthesis Report. Available on the Internet: https://www.ipcc.ch/news_and_events/docs/COP20/LCAHLD.pdf
- Karl, Thomas L., Jerry M. Melillo, and Thomas C. Peterson, (eds.). Global Climate Change Impacts in the United States, Cambridge University Press, 2009.
- Kelly, Klara, Rena Martin, Richard Begay, Ted Neff, and Clifford Werito. 2006. "We Will Help You With What We Know": Diné Traditional Cultural Places In Dinétah. Museum of Northern

- Arizona Environmental Solutions, Inc, Flagstaff. Ms. on file, Bureau of Land Management, Farmington, New Mexico.
- M.H. Zhang (Authors). Department of Energy, Office of Biological and Environmental Research, Washington, D.C., USA, 124 pp.
- National Academy of Sciences. 2006. Understanding and Responding to Climate Change: Highlights of National Academies Reports. Division on Earth and Life Studies. National Academy of Sciences. Washington, D.C.
- National Aeronautics and Space Administration Goddard Institute for Space Studies. (2007). GISS surface temperature analysis. Retrieved from <http://data.giss.nasa.gov/gistemp/2007/>.
- National Park Service. 1997. How to Apply the National Register Criteria for Evaluation. National Register Bulletin 15. Washington.
- _____. 1999. Guidelines for Evaluating and Documenting Rural Historic Landscapes. National Register Bulletin 30. Washington.
- Natural Resource Conservation Service. 2013.
<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/watersheds/dataset/>. Accessed July 30, 2013.
- New Mexico Environment Department (NMED). 2010. Inventory of New Mexico Greenhouse Gas Emissions: 2000-2007. Santa Fe: New Mexico Environment Department.
- Parker, Patricia L. and Thomas F. King. 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties. National Park Service, National Register Bulletin 38. Washington.
- Pursley, Bilek, Ruhl, Earthquake catalogs for New Mexico and bordering areas: 2005-2009. *N.M. Geol.* 35, 3–12 (2013).
- Ramanathan, V., Carmichael, G., 2008. Global and regional climate changes due to black carbon. *Nat. Geosci.* 1 (4), 221e227.
- U.S. Census Bureau. 2012a. Poverty threshold by size of family. Internet Web site:
<https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html>. Accessed on February 20, 2014.
- _____. 2012b. American Community Survey, 2012 American Community Survey 5-Year Estimates, Tables DP-02, DP-03, DP-04, DP-05; generated by Lauren Zielinski; using American FactFinder; <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t> . Accessed February 17, 2014.
- _____. 2013. Small Area Estimates Branch 2002 and 2012 Poverty and Median Income Estimates - Release date December 2013. Accessed on February 20, 2014.
- _____. 2015. US Census Bureau GIS data. Tiger Products. Internet Web Site:
<https://www.census.gov/geo/maps-data/data/tiger.html> Accessed on July 2015.
- U.S. Department of Interior Bureau of Land Management. (2016). *Air Resources Technical Report for Oil and Gas Development*. Santa Fe: U.S. Department of Interior Bureau of Land Management.

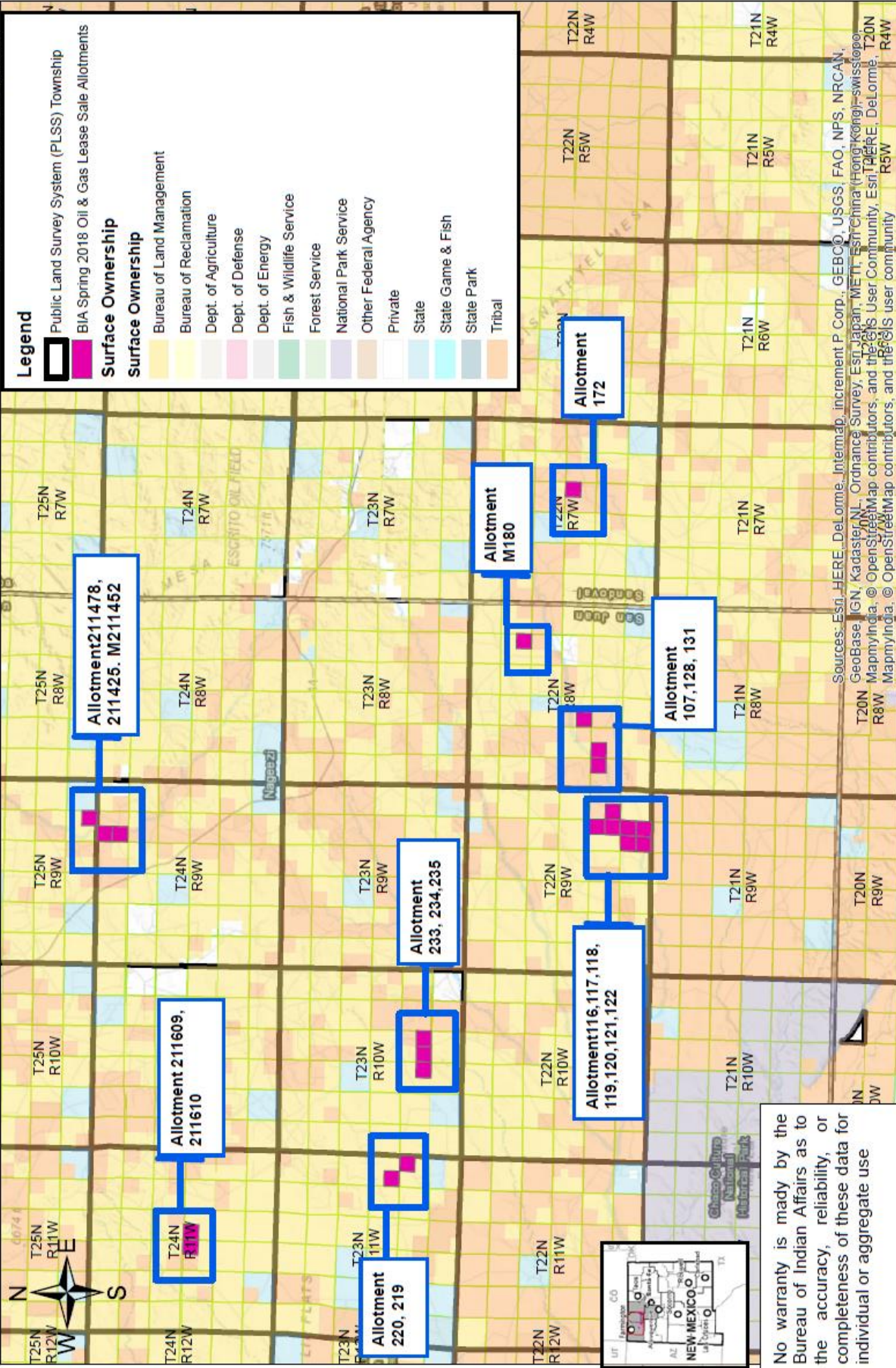
- U.S. Environmental Protection Agency (USEPA). 2004. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reserves. Office of Ground Water and Drinking Water (4606M). EPA 816-R-04-003.
- _____. (2012, May 21). 2005 National-Scale Air Toxics Assessment. Retrieved February 27, 2014, from U.S. Environmental Protection Agency: <https://www.epa.gov/national-air-toxics-assessment/2005-national-air-toxics-assessment>
- _____. (2013, December 5). The Green Book Nonattainment Areas for Criteria Pollutants. Retrieved February 25, 2014, from U.S. Environmental Protection Agency: <https://www.epa.gov/green-book>
- _____. (2014, February 7). Air Trends: Design Values. Retrieved February 25, 2014, from U.S. Environmental Protection Agency: <https://www.epa.gov/air-trends>
- _____. (2014, February 3). *The 2011 National Emissions Inventory*. Retrieved February 27, 2014, from U.S. Environmental Protection Agency: <https://www.epa.gov/air-emissions-inventories>
- _____. (2016, September 14). Air Quality Index Report. Retrieved October 6, 2016, from U.S. Environmental Protection Agency: <https://www.epa.gov/outdoor-air-quality-data>
- _____. (2016b, May 11). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014 – Executive Summary*. Retrieved September 20, 2017, from U.S. Environmental Protection Agency: <https://www.epa.gov/sites/production/files/2017-04/documents/us-ghg-inventory-2016-chapter-executive-summary.pdf>
- _____. (2016c). *Inventory of the U.S. Greenhouse Gas Emissions and Sinks: 1990-2014*. Tables 3-36, 3-38, 3-47, and 3-49.
- _____. (2017, February 14). *Understanding Global Warming Potentials*. Retrieved September 20, 2017, from U.S. Environmental Protection Agency: <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>
- _____. (2017b, April 14). *Overview of Greenhouse Gases*. Retrieved September 20, 2017, from U.S. Environmental Protection Agency: <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>

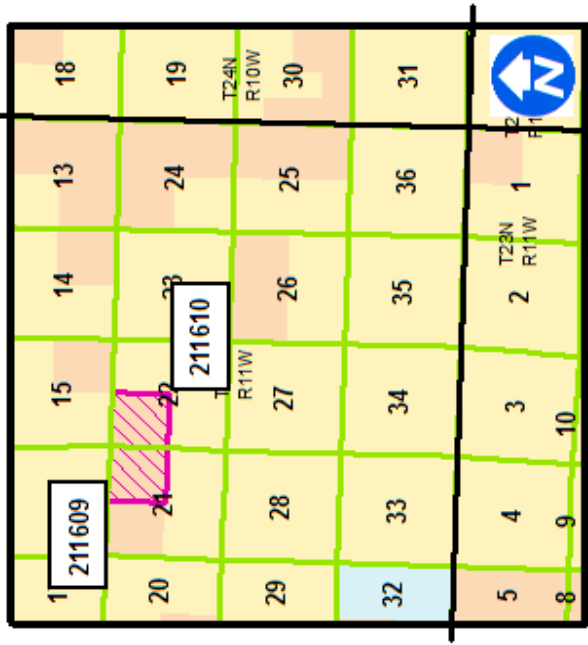
Appendix A. Maps



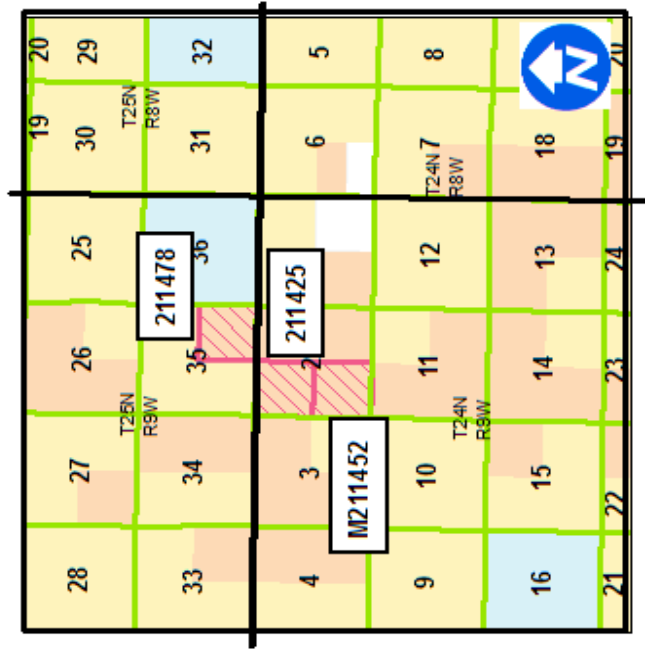
Bureau of Indian Affairs Draft Spring 2018 Oil & Gas Lease Sale Allotments

NAD83 UTM Zone 13 Projection

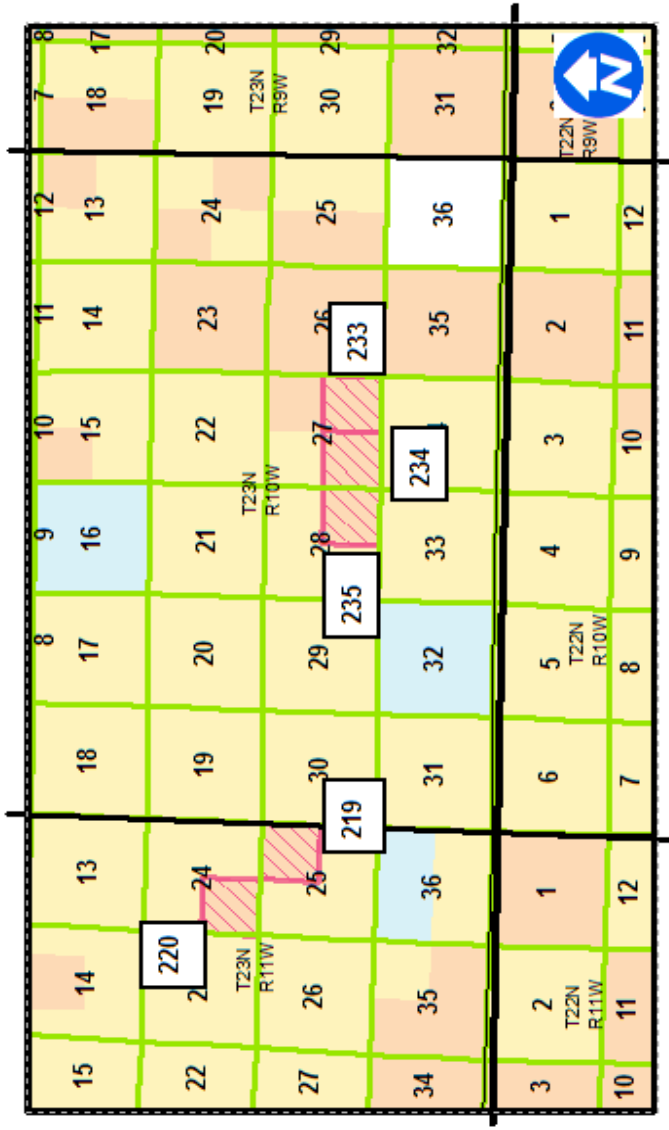




Allotment 211609 & 211610



Allotment 211425, M211452 & 211478



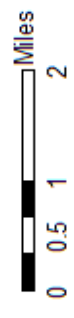
Allotment 219-220 & 233-235

Legend

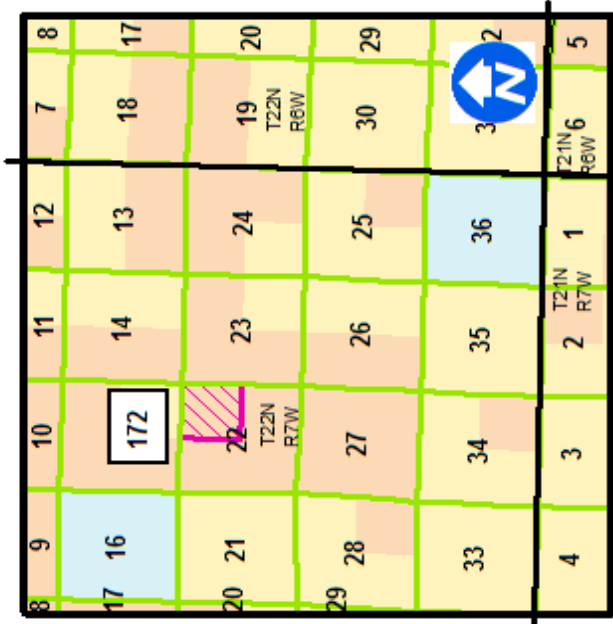
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- FLSSFrstDivision
- BIA January 2018 Oil & Gas Lease Sale Allotments

Surface Ownership

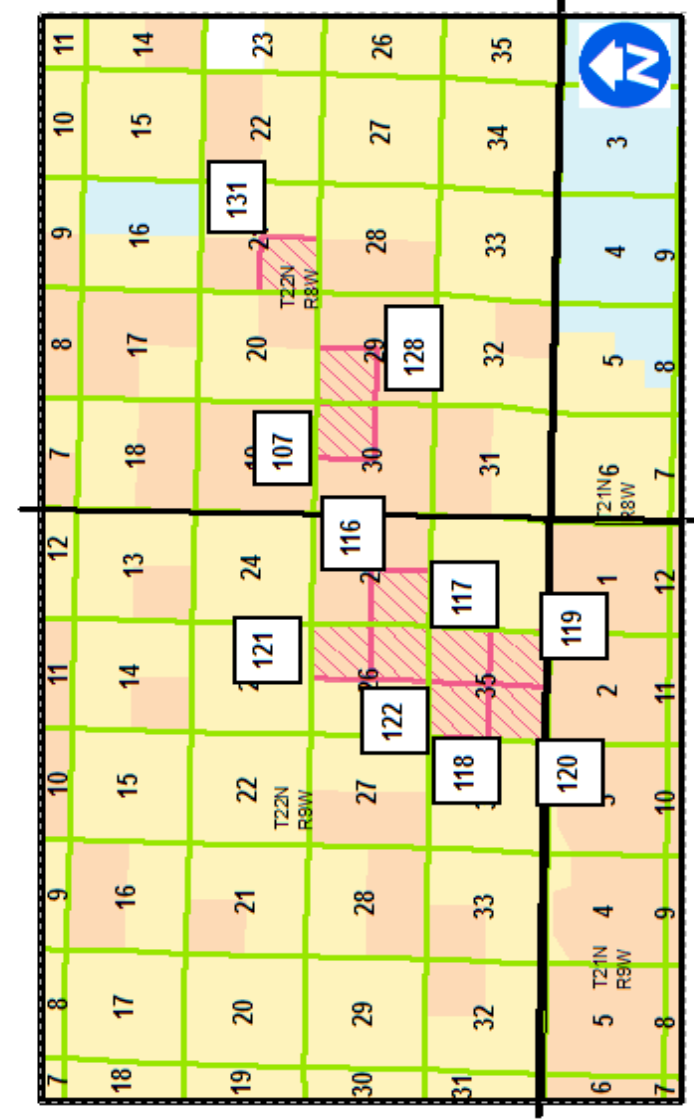
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- Bureau of Reclamation
- Dept. of Agriculture
- Dept. of Defense
- Dept. of Energy
- Fish & Wildlife Service
- Forest Service
- National Park Service
- Other Federal Agency
- Private
- State
- State Game & Fish
- State Park
- Tribal



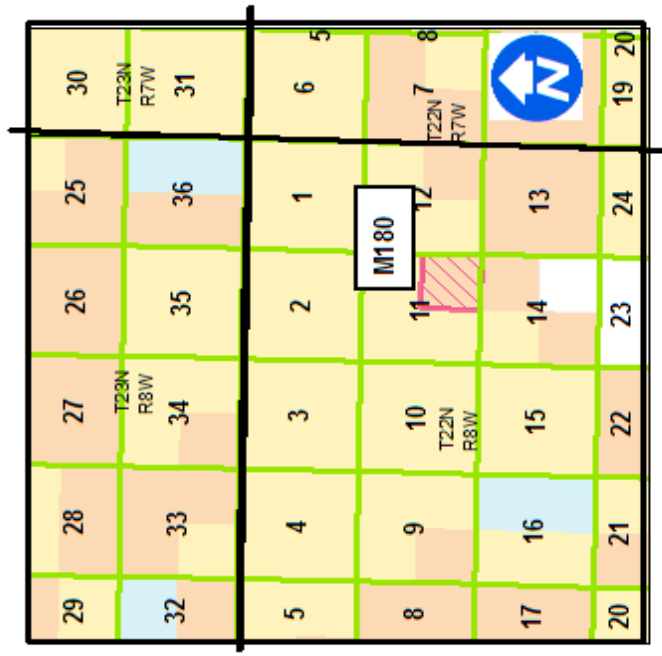
NAD83 UTM Zone 13 Projection



Allotment 172



Allotment 107, 116-122 & 128



Allotment M 180

Legend

- PLSS Township
- PLSS First Division
- BIA January 2018 Oil & Gas Lease Sale Allotments

Surface Ownership

- Bureau of Land Management
- Bureau of Reclamation
- Dept. of Agriculture
- Dept. of Defense
- Dept. of Energy
- Fish & Wildlife Service
- Forest Service
- National Park Service
- Other Federal Agency
- Private
- State
- State Game & Fish
- State Park
- Tribal

Surface Ownership

0 0.5 1 2 Miles

NAD83 UTM Zone 13 P Projection

Appendix B. Phases of Oil and Gas Development

Construction Activities

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

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

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

Drilling Operations

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

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

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

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

Completion Operations

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

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

Hydraulic Fracturing

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

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

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

This process increases the flow rate and volume of reservoir fluids that move from the producing formation into the wellbore. The fracturing fluid is typically more than 99 percent water and sand, with small amounts of readily available chemical additives used to control the chemical and mechanical properties of the water and sand mixture (see discussion about Hazardous and Solid Wastes below).

Because the fluid is composed mostly of water, large volumes of water are usually needed to perform hydraulic fracturing. However, in some cases, water is recycled or produced water is used.

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

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

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

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

Production Operations

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

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

Hazardous or Solid Wastes Associated with Oil and Gas Development

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

Appendix B: Table 1. Common wastes produced during oil and gas development.

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

Hydraulic Fracturing

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

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

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

NORM

Some soils and geologic formations contain low levels of radioactive material. This naturally occurring radioactive material (NORM) emits low levels of radiation, to which everyone is exposed on a daily basis. When NORM is associated with oil and natural gas production, it begins as small amounts of uranium and thorium within the rock. These elements, along with some of their decay elements, notably 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.

Appendix C. Lease Stipulation for Indian Allotment Lands Summary

Code	BIA Surface Management Stipulations for Allotments
FIMO-1	If so required by the Regional Director or his authorized representative, the lessee shall condition, under the direction of BLM, any well drilled which does not produce oil or gas in paying quantities as determined by said BLM but which is capable of producing water satisfactorily for domestic, agricultural, or livestock use by the lessor. The lessee may remove all pumping equipment installed by lessee at any well within <u>ninety (90) days</u> after expiration or termination of the lease, otherwise such equipment shall become the property of the lessor, except where such well is left for usage by the lessor or other surface owners in which case all water pumping equipment and storage tanks shall be left on the premises and shall become the property of the lessor.
FIMO-2	Improvements: notwithstanding the provisions of subparagraph 3(1), shall be defined for the purpose of this lease as any house, bam or other buildings or structure, any improved land being used for farm or agricultural purposes and any other improvements to the land such as a lake, farm plot, monument, fence, historical, etc. Where an "improvement" is present within 200 feet of a proposed oil and gas operation, the lessee, prior to entering the premises to begin any operation whatsoever, shall secure from the lessor (resident) written consent to conduct such operations. The lessee shall present a plan specifying the exact location and description of the operation that is to take place and shall agree with the lessor as to anticipated damages to any improvements. In the case of any dispute as to the amount of damages, the matter may be submitted to arbitration in the field between the lessee and lessor and an independent arbitrator to be selected by the two.
FIMO-3	Navajo Grazing rights to the surface of the lands so leased shall be protected, and lessor's rights respecting ~ the use of water shall be unimpaired. Compensation as determined by the superintendent will be required for all surface damages. The lessee shall submit a development plan for surface use for the entire leased area to the Federal Indian Minerals Office, 6251 College Blvd., Suite B, Farmington, NM 87402.
FIMO-4	<p>Compliance with Surface and Environmental Protection Stipulations of the National Environmental Policy Act (NEPA) of 1969.</p> <ul style="list-style-type: none"> • Notwithstanding any provision of this lease to the contrary, any drilling, construction or other operation on the leased lands that will disturb the surface thereof or otherwise affect the environment (hereinafter called "surface disturbing operation") conducted by lessee shall be subject, as set forth in this stipulation, to the prior approval of such operation by the BLM in consultation with the appropriate surface management agency and to such reasonable conditions as may be required to protect the surface of the leased lands and the environment. • Prior to entry upon the leased land or the disturbance of the surface, the lessee shall submit a development plan for surface use and a full Environmental Assessment for the entire leased area to the Federal Indian Minerals Office, 6251 College Blvd., Ste B, Farmington, NM 87402. An analysis will be determined by FIMO for the purpose of insuring that the surface, natural resources, the environment and existing improvements are properly protected and timely reclamation of the disturbed areas. Upon completion of the environmental analysis, the FIMO shall notify the lessee of the stipulations and the conditions to which the proposed surface disturbance operations will be subject.
FIMO-5	The Navajo Nation Historic Preservation Officer (THPO) will be consulted to determine the appropriate avoidance/mitigation strategy for any historic properties located in the corridors.
FIMO-6	The Navajo Nation Historic Preservation Officer (THPO) will be consulted to determine the appropriate avoidance/mitigation strategy for any historic properties located in the APE.

Appendix D. Map 1: General Location Map of the Planning Area

