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Farmington Oil and Gas Lease Sale, March 2018

Environmental Assessment

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CHAPTER 1. INTRODUCTION

1.1. Background

It is the policy of the Bureau of Land Management (BLM) to make mineral resources available for use and to encourage their orderly development to meet national, regional, and local needs. This policy is derived from various laws, including the Mineral Leasing Act of 1920 (MLA), as amended [30 USC. 181 et seq.] and the Federal Land Policy and Management Act of 1976 (FLPMA), as amended. The Federal Onshore Oil and Gas Leasing Reform Act of 1987 (Sec. 5102(a)(b)(1)(A)) directs the BLM to conduct quarterly oil and gas sales in each state whenever eligible lands are available for leasing. The BLM New Mexico State Office (NMSO) conducts a quarterly competitive lease sale to offer available oil and gas lease parcels in New Mexico, Oklahoma, Texas, and Kansas.

Expressions of Interest (EOI) to nominate parcels for leasing by the BLM are submitted by the public (43 Code of Federal Regulations [CFR] 3203.10(a)) or are included by BLM (43 CFR 3203.10(e)). From these EOIs, the NMSO sends a draft parcel list to any Field Offices in which parcels are located for review and processing. Field Office staff then review the parcels to determine if they are in areas open to leasing; if new information has become available which might change any analysis conducted during the planning process; if appropriate consultations have been conducted; what appropriate lease stipulations should be included; and if there are special resource conditions of which potential bidders should be made aware. In order to meet the requirements of BLM H-3120-1 Competitive Leases Handbook (H-3120-1), an Environmental Assessment (EA) is initiated for the nominated parcels.

The decision as to which public lands and minerals are open for leasing and what leasing stipulations are necessary, based on information available at the time, is made during the land use planning process. Surface management of non-BLM administered land overlaying federal minerals is determined by the BLM in consultation with the appropriate surface management agency or the private surface owner.

After the EA is prepared, the EA and unsigned Finding of No Significant Impact (FONSI) will be made available to the public along with the list of available lease parcels and stipulations and notices for a 30-day public comment period. The documents will be available on the BLM National Register for National Environmental Policy Act (NEPA) documents (ePlanning) at https://eplanning.blm.gov and the BLM New Mexico website at https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/regional-lease-sales/new-mexico, with project-specific documents at https://go.usa.gov/xRuMT. After the end of the public comment period, the BLM analyzes and incorporates the comments, where appropriate, and updates the documents or parcel list, if necessary.

The final parcel list with stipulations and notices are then made available through a Notice of Competitive Lease Sale (NCLS) at least 90 days before the auction is held, which starts the protest period (30 days) with a copy of the EA and an unsigned FONSI. The protest period ends 30 days after the NCLS is posted. The NMSO resolves any protests within the 60 days between the end of the protest period and the lease sale, whenever possible. If any changes are needed to the parcels or stipulations/notices, an erratum is posted to the BLM website to notify the public of the change. On rare occasions, additional information obtained after the publication of the NCLS may result in deferral of certain parcels prior to the lease sale.

The parcels analyzed in this document would be available for sale at an auction held by the NMSO tentatively scheduled for March 8, 2018. If a parcel is not purchased at the lease sale by competitive bidding, it may still be leased within two years after the initial offering. A lease may be held for ten years, after which the lease expires unless oil or gas is produced in paying quantities. A producing lease can be held indefinitely by economic production.

A lessee must submit an Application for Permit to Drill (APD) (Form 3160-3) to the BLM for approval and must possess an approved APD, which include site-specific conditions of approval (COA) prior to

any surface disturbance in preparation for drilling. Examples of COAs and Standard Terms and Conditions are provided in Appendix G of the 2003 Farmington Resource Management Plan (RMP) and Appendix E of this EA. Each COA may vary in its detail according to site requirements and the findings of environmental and cultural surveys during the approval process. COAs may change over time to comply with changes in policy, laws, and regulations. Additional information regarding the BLM's oil and gas management program can be accessed online at: https://www.blm.gov/programs/energy-and-minerals/oil-and-gas. Any stipulations attached to the standard lease form must be complied with before an APD may be approved. Following BLM approval of an APD, a lessee may produce oil and gas from the well in a manner approved by BLM in the APD or in subsequent sundry notices.

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 Form 3100-11, Offer to Lease and Lease for Oil and Gas, US Department of the Interior (USDI), BLM, October 2008 or later edition). After a lease has been issued, the lessee has the right to use as much of the leased land as necessary to explore (or drill) for, extract, remove, and dispose of oil and gas deposits located under the leased lands with exceptions for restrictions that may be imposed consistent with the standard lease terms and the stipulations and notices attached to the lease. 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 or users. Compliance with valid, nondiscretionary statutes and laws is 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 BLM's requirements under federal environmental protection laws, such as the Clean Water Act, Clean Air Act, Endangered Species Act, National Historic Preservation Act (NHPA), and FLMPA, which are applicable to all actions on federal 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 H-3120-1.

This EA documents the BLM Farmington Field Office (FFO) review of 35 parcels (6,792.440 acres) nominated for the March 8, 2018, Competitive Oil and Gas Lease Sale. Thirteen parcels are located on surface administered by the BLM (2,515.730 acres); ten parcels are located on surface administered by the Bureau of Indian Affairs (BIA) above federal minerals (2,203.370 acres); and twelve parcels are located on surface owned by private landowners above federal minerals (2,073.340 acres). Nine of these parcels are located within boundaries of existing oil and gas units. December 2016, NMSO mailed letters to BIA Navajo Regional Office (NRO) regarding the split-estate lease parcel nominations (tribal surface, BLM minerals). The BIA NRO responded in January and March of 2017 with stipulations to be applied to tribal surface.

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 Federal government. Regulations found at 43 CFR 3162.2-2 outline the BLM's authority to protect leased and unleased public domain, 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.

This EA will assess the conformance of the proposed action with the approved land use plan, identify and substantiate a rationale for deferring or dropping specific parcels, if any, from the lease sale, and determine the need for and character of additional stipulations to be attached to specific parcels.

1.2. Purpose and Need for the Proposed Action

The BLM's purpose of the action is to provide opportunities for private individuals or companies to explore for and develop oil and gas resources on public lands through a competitive leasing process. The

need of the action is established by the BLM's responsibility under the MLA, as amended, to promote the exploration and development of oil and gas on the public domain.

The BLM will decide whether or not to lease the nominated parcels and, if so, under what terms and conditions.

1.3. Conformance with Applicable Land Use Plan(s)

The applicable land use plan for the proposed action is the 2003 Farmington RMP and Record of Decision (ROD), as amended and the 2014 FFO Visual Resource Management, Resource Management Plan Amendment (VRM-RMPA). The RMP designated approximately 2.59 million acres of federal minerals open for continued oil and gas development and leasing under Standard Terms and Conditions. The surface ownership of the 25 nominated parcels include private ownership, BLM managed, and tribal trust managed. The BLM has trust responsibilities for tribal lands and issues oil and gas leases where federal minerals underlie the Indian-owned surface. The tribal surface owner (BIA or tribe) is contacted for concurrence and to identify specific surface protection stipulations, if any, before the lease is issued. The RMP, along with the 2002 Biological Assessment, also describes specific stipulations that would be attached to new leases offered in certain areas. The action alternatives considered conform to fluid mineral leasing decisions in the RMP and are consistent with the RMP goals and objectives for natural and cultural resources.

The BLM uses a Visual Resource Management (VRM) system to inventory and manage visual resources on public lands. The primary objective of VRM is to manage visual resources so that the quality of scenic (visual) values is protected. A Visual Resource Inventory (VRI) was performed in 2009. Based on this VRI the VRM-RMPA was completed in 2014 which established VRM classes.

The RMP also identifies the potential stipulations that could be attached to split-estate tracts that are proposed for leasing and requires that all new leases and all re-issued expired leases include surface resource protection stipulations. Mandatory stipulations would be incorporated into each lease where those stipulations apply. In addition, the BLM may include optional stipulations where resource values exist that warrant special protections. These special stipulations could include lease notices (LN), seasonal timing limitations (TLS), no surface occupancy (NSO) and other controlled surface use (CSU) stipulations which are designed to minimize or alleviate potential impacts to special resource values. Leasing the split-estate parcels would also be consistent with the RMP goals and objectives for natural and cultural resources.

Pursuant to 40 CFR 1508.28 and 1502.21, this EA is tiered to and incorporates by reference the information and analysis contained in the RMP and associated Final Environmental Impact Statement (FEIS) 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, special status species (SSS), wildlife, rangeland, lands and access, visual resources, cultural resources, paleontology, noise, social and economic conditions, and environmental justice.

It is unknown when, where, or to what extent any subsequent well sites, roads, and associated infrastructure would be proposed. Analysis of projected surface disturbance impacts from lease development is based on potential current well densities of five horizontal wells per 640 acres as listed in the Reasonable Foreseeable Development (RFD) Scenario developed for the RMP, and the 2002 Biological Assessment. The RFD was updated to include horizontal drilling in 2014 and 2015. An appropriate level of site-specific analysis of individual wells or roads would occur when a leaseholder submits an APD. Assumptions based on the updated RFD scenario are used in the analysis of impacts in this EA.

This EA will assist the BLM in project planning and decision-making in compliance with the NEPA, as amended (Public Law [PL] 91-90, 42 United States Code [USC] 4321 et seq.).

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

The MLA establishes that deposits of oil and gas owned by the US are subject to disposition in the form and manner provided by the MLA under the rules and regulations prescribed by the Secretary of the Interior, where consistent with the FLPMA, the NEPA, as amended (PL 91-90, 42 USC 4321 et seq.), and other applicable laws, regulations, and policies.

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 federal, state, and local laws and regulations, including obtaining all necessary permits prior to any lease development activities.

BLM FFO biologists have reviewed the proposed action and determined it would comply with threatened and endangered species management guidelines outlined in the 2002 Biological Assessment for the RMP (Consultation #2-22-01-I-389). One species has been listed since 2003 with proposed Critical Habitat, the yellow-billed cuckoo (threatened, 2014). The proposed action analysis in this EA would have a “no effect” determination for this species due to lack of nesting habitat within 30 miles of the analysis area. For federally-listed fish species, a separate “effects determination” would be made at the site-specific project level to insure that water used for drilling operations are permitted from an existing legal source (no new water depletion) and to comply with the Endangered Species Act (ESA). Any new water depletion will likely require Section 7 consultation under ESA. No further consultation with the US Fish and Wildlife Service (USFWS) is required at this stage of the proposed lease sale.

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

Compliance with Section 106 responsibilities of the NHPA is adhered to per 36 CFR Part 800. Native American consultation is initiated by mail regarding each lease sale activity. A second request for information will be sent to the same recipients if there is no response to the first inquiry. If no response to the second letter is received and no other substantial conflicts or issues are identified, the proposed leasing of parcels may go forward. If any responses are received, BLM cultural resources staff would discuss the information or issues of concern with the respondent to determine if all or portions of a parcel are to be withdrawn from the sale, or if additional terms and conditions will be developed and attached as lease stipulations.

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

In 2007, the Legislature of the State of New Mexico passed the Surface Owners Protection Act. This Act requires operators to provide the surface owner at least five business days’ notice prior to initial entry

upon the land for activities that do not disturb the surface; and at least 30 days' notice prior to conducting actual oil and gas operations. Included in this policy is the implementation of a Notice to Lessees (NTL), a requirement of lessees and operators of onshore federal oil and gas leases within the State of New Mexico to provide the BLM with the names and addresses of the surface owners of those lands where the Federal Government is not the surface owner, not including lands where another federal agency manages the surface.

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

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

1.5. Public Involvement

Letters were mailed to 39 Tribes and Pueblos on August 16, 2017. Corrected maps were sent to Tribes and Pueblos on August 31, 2017. The following consultation and outreach meetings were held with Tribes, Pueblos, and Chapter House Officials and residents to discuss concerns about further development.

1. September 20, 2017 at Pueblo of Acoma;
2. September 28, 2017 at Ojo Encino for the chapters of Ojo Encino, Torreon, and Counselor;
3. October 10, 2017 at Ojo Encino for the chapters of Ojo Encino, Torreon, and Counselor;
4. October 13, 2017 at Pueblo of San Felipe;
5. October 16, 2017 at White Rock Chapter House;
6. November 27, 2017 at Torreon Chapter House.

The attendees expressed concerns about increased traffic, road conditions, safety, flaring, venting, a need for ethnographic surveys, and the protection of cultural sites.

These 25 parcels are being considered for sale, and the EA was made available for public review and comment for 30 days beginning September 21, 2017 and ending on October 20, 2017. Several unique comments were received and were addressed throughout the EA analysis.

The BLM received approximately 17,600 public comments during the comment period, of which the majority were form letters. The concerns presented by the public have been summarized into four broad categories. Similar concerns within each category have been grouped together for brevity.

1. Procedural (NEPA and other) Concerns:
    a. Oil and gas leasing should be deferred until the BLM/BIA Mancos-Gallup Farmington RMP Amendment (M-G RMPA) is complete so as to avoid limiting the decision space.
    b. The impacts are likely to be significant and should be analyzed through the Environmental Impact Statement (EIS) process.
    c. Government-to-government consultation has been insufficient or ineffective.

d. Oil and gas development appears to have been prioritized over all other potential uses of public land, in violation of FLPMA.

2. Cultural Concerns:
    a. The land around Chaco Canyon must be withdrawn from leasing or deferred in order to protect the archaeological and cultural resources; in particular, some of the proposed lease parcels are too close to the North Road and Great Houses.
    b. Traditional cultural properties (TCP) and other cultural resources have not been adequately identified throughout the San Juan Basin: the BLM relies too heavily on New Mexico Cultural Resources Information System (NMCRIS) and other outdated inventories, and should instead collaborate closely with Pueblo and tribal experts to identify cultural resources before offering parcels for lease/before approving APDs; inadequate Section 106 NHPA evaluation/consultation.
    c. The cultural impact of leasing must be evaluated within the context of the entire San Juan Basin; even on parcels where surface disturbance is prohibited, cultural resources might be impacted by horizontal drilling.
    d. Audio/visual impacts and degradation of night-sky quality around Chaco Canyon has not been adequately analyzed.
    e. The existing stipulation to avoid placement of oil and gas development sites near dwellings requires that the structure be inhabited, which does not adequately protect seasonally or irregularly-inhabited tribal dwellings. Oil and gas development is fragmenting tribal-owned surface lands, diminishing suitable locations for future tribal homesites.

3. Socio-economic Concerns:
    a. Rural communities have been inappropriately lumped together with urban communities, leading to inadequate environmental-justice analysis.
    b. Insufficient consideration of how negative impacts from oil and gas development will damage cultural tourism and general, dispersed recreation in the region.
    c. Development of (subsurface) federal mineral estate may reduce the solace of a private, split-estate (surface) landowner.
    d. Insufficient analysis of impacts to subsistence gathering (firewood, hunting, etc.) by tribal members.
    e. Current oil and gas revenue-sharing system is not equitable for tribal communities, particularly at the local level.

4. Health and Other Environmental Concerns:
    a. Leakage of volatile organic compounds (VOC) has not been adequately analyzed for potential contribution to regional smog and other health risks. Methane leaks have not been adequately analyzed for their potential global contribution to greenhouse gases (GHG).
    b. Hydraulic fracturing may contaminate drinking water supplies or cause other environmental damage; impacts from horizontal drilling have not been fully analyzed.
    c. The BLM has not adequately considered recent climate science and the impact of reasonably foreseeable development on climate change in this analysis.
    d. Consider additional stipulations to protect water features and fragile soils, particularly on steep slopes.
    e. BLM should develop a long-term plan to limit impacts to big-game species, apply additional wildlife timing stipulations, maintain large existing blocks of undeveloped habitat, and limit amount of projects under simultaneous active development.

A 30 day Protest Period will begin on December 6, 2017 and will end on January 4, 2018. The NMSO will resolve any protest within the 60 days between the end of the protest period and the lease sale, whenever possible. If any changes are needed to the parcels or stipulations/notices, an erratum would be posted to the BLM website to notify the public of the change.

1.6. Identification of Issues and Scoping

1.6.1. Scoping

On May 22, 2017, the BLM New Mexico State Director, Farmington District Manager, and FFO personnel met via teleconference to discuss the 35 nominated parcels (Appendix A). The State Director identified three whole and one partial parcels on tribal trust lands (673.370 acres) and five parcels on BLM lands (1,364.700 acres) that were to be deferred. These parcels are discussed in Section 2.3, Alternatives Considered and Dismissed.

On July 6, 2017 an internal review of the Proposed Action, along with the appropriate stipulations from the RMP and BIA, was conducted by an interdisciplinary team (IDT) of FFO resource specialists to identify and consider potentially affected resources and issues of concern. During the review the IDT subsequently addressed the identified issues or conflicts related to the Proposed Action

One nominated parcel (016), located within the Carracas Mesa Recreation/Wildlife Area (120.000 acres), will not be offered for leasing because the current land use plan (RMP) has explicitly closed that area to new oil and gas leasing. This parcel cannot be offered for lease. The Carracas Mesa nominated parcel is discussed further in Section 2.3, Alternatives Considered and Dismissed.

During a meeting held on August 31, 2017, the State Director identified that nominated parcel 015 (160.000 acres) could not be offered. Parcel 015 was selected by the State of New Mexico for exchange and has been segregated, making the parcel unavailable for leasing. The State Director also reduced parcel 035 by 40.000 acres to eliminate overlap with an active coal mine lease.

1.6.2. Issues

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.” Significant issues directly influence the initiation, development, and technical design of the proposal; are disclosed in the analysis; and were used to develop alternatives to the proposed action. Issues are significant because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict (BLM 2008).

Non-significant issues are identified as those:

1) outside the scope of the proposed action;

2) already decided by law, regulation, or other higher level decision;

3) unrelated to the decision to be made; or

4) conjectural and not supported by scientific or factual evidence

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)…”

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

- What effects would the leasing of oil and gas parcels have on air quality and climate?
- What effects would the leasing of oil and gas parcels have on cultural resources, including historic properties, properties listed on the National Register of Historic Places (NRHP) or New Mexico State Register of Cultural Properties (SR), Chaco Protection Sites, World Heritage Sites, or other places of traditional religious and cultural importance?
- What effects would the leasing of oil and gas parcels have on socioeconomics and environmental justice?
- How would the leasing of oil and gas parcels effect mineral resources drained from wells on adjacent lands?
- What effects would the leasing of oil and gas parcels have on night sky resources?
- What effects would the leasing of oil and gas parcels have on visual resources?
- What effects would the leasing of oil and gas parcels have on SSS, raptors, and migratory birds?
- What effects would the leasing of oil and gas parcels have on wildlife habitat and migration corridors?
- What effects would the leasing of oil and gas parcels have on water resources?

1.6.3. Issues Considered and Not Carried Forward For Analysis:

The FEIS analyzed in detail the resources in the FFO. The following descriptions include information that has not changed since the FEIS was written, no new circumstances have arisen, and/or no new data has become available.

What effects could leasing have on soils? Parcels 002, 003, 005, 006, 008, 009, 013, 014, 018, 020 are located within areas found to have fragile soil resources, which are typically slow to develop, prone to erosion, typically have low restoration potential, and have very low organic matter. Soil resources for oil and gas development were analyzed on pages 3-15 to 3-24 and 4-106 to 4-107 of the FEIS, which states that impacts to soils would be an increase in soil erosion, but the amount of increase would be determined by the location of the construction on the landscape and the mitigation measures and BMPs used. Soil types would be analyzed at the APD stage in a future EA.

Parcels 003, 004, 005, 006, 008, 009, 011, 018, 020, and 029 each contain steep terrain. Lease stipulation F-46-CSU Topography was developed by the FFO to maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, and to avoid areas subject to slope failure, mass wasting, piping, and excessive reclamation challenges. Predicting future well locations on these parcels would be difficult and inaccurate; therefore, steep slopes, siting, and construction would be analyzed at the APD stage on a site-specific basis.

What effects could leasing have on other water resources? Parcels 001, 002, 004 through 010, 012, 013, 014, 017 through 021, 029, 030, 033, 034, and 035 are located in areas containing known water features. Water resources (water, riparian, floodplains, streams, wetlands) were analyzed in the FEIS pages 3-24 through 3-30, and 3-35 to 3-39, 4-107 which generally state that potential impacts could be a result of erosion creating sedimentation increases or infiltration from unlined pits, but could be mitigated by placement, mitigation measures and BMPs at the site specific level. Water, riparian, floodplains, streams, and wetlands would be analyzed at the APD stage in a future EA.

What effects could leasing have on the Beechatuda Tongue Geologic Formation? Parcel 032 encompasses the entire 100 acres of the Beechatuda Tongue Geologic Formation Specially Designated Area (SDA). The Beechatuda Tongue Geologic Formation of the Cliff House Sandstone is a rock stratigraphic unit mapped in, and named for, Beechatuda Draw in T.30N, R.15W, Section 5, W/4. This area is the type locality for the unit; as such, it is of interest to scientists and educators as a site for comparison and study and for possible further refinement of the stratigraphic nomenclature. It is

important that the unit be preserved to allow these studies and comparisons. The Beechatuda Tongue Geological Formation, all of which is BLM-managed land and all of which contains federal minerals. The Beechatuda Tongue Geologic Formation SDA was analyzed in the RMP/FEIS which required protection through lease stipulation F-23-NSO.

What effects could leasing have on forestry? Parcels 003, 005, 008, and 009 include forested areas containing ponderosa pine. The RMP provides certain protection to ponderosa pines including restoration. Forestry was analyzed in the RMP; however, mitigation measures for wildlife (pg. 2-25 of the ROD) states that no hardwood tree with a diameter of 10 inches or more at the base or any ponderosa pine, Douglas fir, or aspen tree is to be removed or damaged without approval from the Authorized Officer. Removal of trees would be determined on a site-specific basis at the APD stage in a future EA.

What effects could leasing have on paleontological resources? There is a high potential for paleontological resources exist on parcels 001, 003, 006, 009, 021, and 031. There are no direct impacts to paleontological or geological resources through the administrative action of leasing. Indirect effects from leasing may occur to paleontological or geological resources if development were to occur, such as damage or destruction of surficial and buried paleontological resources. At the time of a site-specific application, such as an APD, paleontological or geological resources would be identified and conditions of approval to mitigate adverse impacts to paleontological or geological resources may be imposed at that time, which may include pre-work paleontological resource surveys prior to approval of surface disturbing activities and/or paleontological monitoring during construction of roads, well pads, and other proposed activities. Lease stipulation F-9-CSU would be applied to these parcels as required in the ROD page B-3.

What effects could leasing have on designated corridors? Parcel 020 is partially within the West Wide Energy Corridor, which is provided protections through the RMP (p. 2-11). The RMP states, Specific proposals would require site-specific environmental analysis and compliance with established permitting processes. Activities generally excluded from right-of-way (ROW) corridors include mineral material sales, range and wildlife habitat improvements involving surface disturbance and facility construction, campgrounds and public recreational facilities, and other facilities that would attract public use. New oil and gas wells will be sited outside these designated ROW corridors.

Parcel 014 is partially within the Navajo-Indian Irrigation Project, which is provided protections through the RMP/ROD page B-6 with Lease Stipulation F-28-CSU which provides operating constraints to ensure that no oil or gas facilities would be placed where it could interfere with construction or operation of the irrigation project.

1.7. Resources Considered and Eliminated from Further Analysis

The BLM FFO IDT conducted internal scoping by reviewing the proposed project and locations to identify potentially affected resources and land uses. The IDT Checklist in Appendix B provides the rationale for issues considered but not analyzed further.

Issues determined to not be present within the leasing area were given a determination of not present (NP) in the IDT Checklist.

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVE(S)

2.1. Alternative A: No Action

The BLM NEPA Handbook H-1790-1 (BLM 2008b) 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 (parcel nomination) would be deferred, and the 25 parcels

would not be offered for lease during the March 8, 2018, Competitive Oil and Gas Lease Sale. Surface management and any ongoing oil and gas development on surrounding federal, private, and state leases would continue under current guidelines and practices.

Drainage of the federal mineral estate by producing wells adjacent to the federal mineral estate lands would result in the establishment of a Compensatory Royalty Agreement (CRA) to collect royalties. Selection of the No Action alternative would not prevent these parcels from nomination for a future lease sale.

2.2. Alternative B: Proposed Action

The Proposed Action would offer for lease 25 nominated parcels of federal minerals administered by the BLM FFO, covering 4,434.370 acres. The surface ownership of the proposed 25 parcels includes private (2033.340 acres), BLM (1031.030 acres), and tribal trust (1370.000 acres). Standard terms and conditions, lease stipulations listed in the RMP and BIA stipulations per Navajo Area BIA Surface Management Agency Lease Stipulations for Federal Oil and Gas Lease Offerings would apply. The lease purchaser would have the exclusive right to use as much of the leased mineral estate as is necessary to explore and drill for oil and gas, subject to the stipulations attached to the lease (43 CFR 3101.1-2).

Oil and gas leases are issued for a 10-year period and continue for as long thereafter as oil or gas is 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 is not permitted until the lease owner or operator submits a complete APD package following the requirements specified under Onshore Oil and Gas Orders listed in 43 CFR 3162, and the APD is approved. An APD would not be approved until site-specific NEPA analysis is 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 parcels recommended for leasing under Alternative B: Proposed Action are presented below in Table 1.

Standard terms and conditions, and lease stipulations from the RMP, Navajo Area BIA Surface Management Agency Lease Stipulations for Federal Oil and Gas Offerings, and Lease Notices developed through the parcel 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. The Competitive Leasing Handbook (H-3120-1) requires that the WO-NHPA and WO-ESA-7 lease stipulations be added to every lease.

Table 1. Alternative B: Proposed Action

Lease Parcel #	Surface Ownership	Legal Description	Acres	Lease Stipulations*
NM-201803-001	Private	T.24N, R.1E, 23 PM, NM Sec. 05 LOTS 1; 05 SENE,SE; 08 E2; Rio Arriba County Farmington FO	558.830	F-1-TLS F-4-TLS F-9-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-002	Private	T.24N, R.1E, 23 PM, NM Sec. 05 LOTS 4; 05 SWNW,W2SW; Rio Arriba County	159.150	F-1-TLS F-9-CSU NM-11-LN WO-ESA-7

Lease Parcel #	Surface Ownership	Legal Description	Acres	Lease Stipulations*
		Farmington FO		WO-NHPA
NM-201803-003	Private	T.25N, R.1E, 23 PM, NM Sec. 28 N2NW,SENW,NESW; Rio Arriba County Farmington FO	160.000	F-4-TLS F-9-CSU F-40-CSU F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-004	Private	T.25N, R.1E, 23 PM, NM Sec. 33 S2NE,N2SE,SESE; Rio Arriba County Farmington FO	200.000	F-9-CSU F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-005	BLM	T.22N, R.1W, 23 PM, NM Sec. 18 S2NE,N2SE; Sandoval County Farmington FO	160.000	F-9-CSU F-40-CSU F-41-LN F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-006	BLM	T.22N, R.1W, 23 PM, NM Sec. 30 NENE; Sandoval County Farmington FO	40.000	F-9-CSU F-40-CSU F-41-LN F-44-NSO F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-007	BLM	T.22N, R.1W, 23 PM, NM Sec. 31 LOTS 2,3; Sandoval County Farmington FO	71.030	F-9-CSU F-41-LN NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-008	Private	T.23N, R.1W, 23 PM, NM Sec. 20 S2SW; Sandoval County Farmington FO	80.000	F-6-VRM F-9-CSU F-40-CSU F-44-NSO F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA

Lease Parcel #	Surface Ownership	Legal Description	Acres	Lease Stipulations*
NM-201803-009	Private	T.23N, R.1W, 23 PM, NM Sec. 30 LOTS 3,4; 30 E2SW,SE; Sandoval County Farmington FO	315.360	F-6-VRM F-9-CSU F-40-CSU F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-010	Private	T.24N, R.1W, 23 PM, NM Sec. 25 SESE; Rio Arriba County Farmington FO	40.000	F-6-VRM F-9-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-011	Private	T.24N, R.1W, 23 PM, NM Sec. 25 N2NE; Rio Arriba County Farmington FO	80.000	F-6-VRM F-9-CSU F-40-CSU F-44-NSO F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-012	Private	T.24N, R.1W, 23 PM, NM Sec. 25 SWNW,W2SW; Rio Arriba County Farmington FO	120.000	F-6-VRM F-9-CSU F-40-CSU F-44-NSO NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-013	Tribal Trust	T.22N, R.6W, 23 PM, NM Sec. 15 SE; 22 NENE; Sandoval County Farmington FO Bureau of Indian Affairs	200.000	BIA-1 BIA-3 F-6-VRM F-40-CSU F-44-NSO NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-014	Tribal Trust	T.22N, R.6W, 23 PM, NM Sec. 23 E2; 24 NW; Sandoval County Farmington FO Bureau of Indian Affairs	480.000	BIA-1 BIA-3 F-6-VRM F-28-CSU F-40-CSU F-44-NSO NM-11-LN WO-ESA-7 WO-NHPA

Lease Parcel #	Surface Ownership	Legal Description	Acres	Lease Stipulations*
NM-201803-017	Tribal Trust	T.22N, R.7W, 23 PM, NM Sec. 26 SW; Sandoval County Farmington FO Bureau of Indian Affairs	160.000	BIA-1 BIA-3 F-6-VRM F-40-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-018	Tribal Trust	T.24N, R.7W, 23 PM, NM Sec. 30 E2SW; Rio Arriba County Farmington FO Bureau of Indian Affairs	80.000	BIA-1 BIA-3 F-1-TLS F-6-VRM F-46-CSU NM-10-LN NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-020	BLM	T.23N, R.8W, 23 PM, NM Sec. 29 S2; San Juan County Farmington FO	320.000	F-6-VRM F-9-CSU F-40-CSU F-41-LN F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-021	BLM	T.23N, R.8W, 23 PM, NM Sec. 33 SW; San Juan County Farmington FO	160.000	F-6-VRM F-9-CSU F-41-LN NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-029	Tribal Trust	T.23N, R.9W, 23 PM, NM Sec. 35 E2SE,NWSE,NESWSE; San Juan County Farmington FO Bureau of Indian Affairs	130.000	BIA-1 BIA-3 F-7-VRM F-9-CSU F-44-NSO F-46-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-030	Tribal Trust	T.24N, R.11W, 23 PM, NM Sec. 26 N2; San Juan County Farmington FO Bureau of Indian Affairs	320.000	BIA-1 BIA-3 F-6-VRM F-44-NSO NM-11-LN WO-ESA-7 WO-NHPA

Lease Parcel #	Surface Ownership	Legal Description	Acres	Lease Stipulations*
NM-201803-031	BLM	T.30N, R.15W, 23 PM, NM Sec. 01 NWNE,N2NW; San Juan County Farmington FO	120.000	F-6-VRM F-41-LN NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-032	BLM	T.30N, R.15W, 23 PM, NM Sec. 05 NW; San Juan County Farmington FO	160.000	F-6-VRM F-9-CSU F-23-NSO F-41-LN NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-033	Private	T.30N, R.15W, 23 PM, NM Sec. 11 SESE; San Juan County Farmington FO	40.000	F-7-VRM F-9-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-034	Private	T.30N, R.15W, 23 PM, NM Sec. 12 SENW,SW; San Juan County Farmington FO	200.000	F-7-VRM F-9-CSU NM-11-LN WO-ESA-7 WO-NHPA
NM-201803-035	Private	T.30N, R.15W, 23 PM, NM Sec. 14 E2NE; San Juan County Farmington FO	80.000	F-7-VRM F-9-CSU NM-11-LN WO-ESA-7 WO-NHPA

*See Appendix D for a summary of stipulations

2.3. Reasonably Foreseeable Development

Oil and gas development may include constructing a well pad, access road, pipeline, and facilities, drilling a well using a conventional pit system or closed-loop system, hydraulically fracturing the well, installing pipelines and/or hauling produced fluids, regularly monitoring the well, and completing work-over tasks throughout the life of the well. In the FFO, typically, all of these actions are undertaken during development of an oil or gas well; it is reasonably foreseeable that they may occur around the leased parcels. See Appendix C for a complete description of the phases of oil and gas development.

Drilling of wells is not permitted until the lease owner or operator submits a complete APD package following the requirements specified under Onshore Oil and Gas Orders listed in 43 CFR 3162, and the APD is approved. An APD would not be approved until site-specific NEPA analysis is conducted.

Standard terms and conditions, stipulations listed in the RMP, and any new stipulations would apply as appropriate to each lease. In addition, site-specific mitigation measures and BMPs would be attached as COAs for each proposed exploration and development activity authorized for a lease. See Appendix E for sample Standard Design Features and BMPs including select examples from the RMP.

2.4. Parcels Considered but Eliminated from Detailed Study

Parcel 015 was segregated for a land exchange with the State of New Mexico and is not available for leasing.

Parcel 016 is located within the Carracas Mesa Recreation/Wildlife Area (120.000 acres). The RMP prescribes that the Carracas Mesa Recreation/Wildlife Area is closed to new oil and gas leasing. Therefore, leasing this parcel for oil and gas development is not in conformance with the RMP. Offering this parcel for oil and gas development would require a land use plan amendment. The FFO is currently working on a land use plan amendment which may affect future leasing outcomes.

Parcels 019 and 022 through 028 and a portion of 029 are being deferred to allow time for additional impact analysis and tribal consultation, as required by Executive Order (E.O.) 13175 and other applicable laws and policies.

A portion of parcel 035 is located over an existing coalmine lease. Due to coal mining operations, a portion (40.000 acres) is deferred from the lease sale.

Locations and acreage of deferred parcels are shown below in Table 2.

Table 2. Parcels Considered and Eliminated

Lease Parcel #	Legal Description	Acres
NM-201803-015	T.22N, R.6W, 23 PM, NM Sec. 26 NW; Sandoval County Farmington FO	160.000
NM-201803-016	T.0320N, R.0060W, 23 PM, NM Sec. 012 NESE,S2SE; Rio Arriba County Farmington FO	120.000
NM-201803-019	T.0220N, R.0080W, 23 PM, NM Sec. 032 SE; San Juan County Farmington FO Bureau of Indian Affairs	160.000
NM-201803-022	T.0220N, R.0090W, 23 PM, NM Sec. 003 LOTS 1-4; 003 S2N2; San Juan County Farmington FO Bureau of Indian Affairs	323.370
NM-201803-023	T.0220N, R.0090W, 23 PM, NM Sec. 004 LOTS 1,2; 004 S2NE; San Juan County Farmington FO	161.830
NM-201803-024	T.0220N, R.0090W, 23 PM, NM Sec. 005 LOTS 1-4; 005 S2N2,SW; San Juan County Farmington FO	482.870

Lease Parcel #	Legal Description	Acres
NM-201803-025	T.0220N, R.0090W, 23 PM, NM Sec. 008 N2,N2SW; San Juan County Farmington FO	400.000
NM-201803-026	T.0220N, R.0090W, 23 PM, NM Sec. 009 SW; San Juan County Farmington FO	160.000
NM-201803-027	T.0220N, R.0090W, 23 PM, NM Sec. 009 NE; San Juan County Farmington FO	160.000
NM-201803-028	T.0230N, R.0090W, 23 PM, NM Sec. 034 SW; San Juan County Farmington FO Bureau of Indian Affairs	160.000
NM-201803-029	T.0230N, R.0090W, 23 PM, NM Sec. 035 W2SWSE,SESWSE; San Juan County Farmington FO Bureau of Indian Affairs	30.000
NM-201803-035	T.30N, R.15W, 23 PM, NM Sec. 14 NESE; San Juan County Farmington FO	40.000

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the environment that would be affected by implementation of the proposed alternatives. Elements of the affected environment described in this section focus on the relevant resources and issues.

3.1. 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. Such development requires additional analysis and decision making although the BLM's subsequent decisions could not conflict with the valid rights afforded by the lease. The level of development that might occur as an outcome leasing is unknown. A more precise description of environmental effects would be possible if the exact level of development were known. The BLM has determined that any estimate of development at this time is too speculative to be analyzed as part of this EA. The BLM determined that the RMP resource protections provide adequate consideration of resource values and potential for adverse impacts during evaluation at the leasing stage. Existing data are used to determine resource presence on each parcel. 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.

The FEIS analyzed in detail the resources in the FFO. The following descriptions and subsequent analysis include information that has changed since the FEIS was written, new circumstances that have arisen, and/or new data that has become available.

3.2. Air Resources

Air quality and climate are components of air resources, which may be affected by BLM applications, activities, and resource management. Therefore, the BLM considers and analyzes the potential effects of BLM and BLM-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 RMP/FEIS (BLM 2003) which this analysis tiers to and incorporates by reference. Much of the information referenced in this section is incorporated by reference from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as Air Resources Technical Report; BLM 2017). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

3.2.1. 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 ambient air standards. The US Environmental Protection Agency (EPA) Green Book web page (EPA 2017) reports that all counties in the FFO area 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 FFO are described below.

"Design Values" are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2016 design values for criteria pollutants are listed below in Table 3. 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. PM_{10} design concentrations are not available for San Juan County.

Table 3. 2016 Criteria Pollutant Monitored Values in San Juan County (EPA 2016)

Pollutant	Averaging Time	2016 Design Concentration	NAAQS	NMAAQS
O_3	8-hour	0.066 ppm	[1]0.070 ppm	[8]
NO_2	Annual	10 ppb	[2]53 ppb	50 ppb
NO_2	1-hour	35 ppb	[3]100 ppb	
$PM_{2.5}$	Annual	[7]4.5 µg/m^3	[4]12 µg/m^3	[6]60 µg/m^3
$PM_{2.5}$	24 -hour	[7]12 µg/m^3	[3]35 µg/m^3	[6]150 µg/m^3
SO_2	1-hour	8 ppb	[5]75 ppb	

[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): TSPs refer to mass concentrations of particulate matter contained in air and can include $PM_{2.5}$. $PM_{2.5}$ is reserved as fine inhalable particulate matter with a diameter of less than 2. 5 microns.
[7] $PM_{2.5}$ Latest Design Criteria 2014

[8] NMAAQS O_3 is the same as NAAQS

Table 4 shows total human caused emissions for each of the counties located in the FFO based on EPA's 2014 emissions inventory (EPA 2014). Human caused emissions Include; Crops and Livestock Dust, Fertilizer Application, Livestock Waste, Paved Road Dust, Unpaved Road Dust, Agricultural Field Burning, Prescribed Fires, Fuel Combustion (Comm/Institutional-Biomass, Coal, Natural Gas, Oil and Other), (Electric Generation - Biomass, Coal, Natural Gas, Oil, and Other), (Industrial Boilers, Internal Combustion Engines - Biomass, Coal, Natural Gas, Oil, and Other), (Residential - Natural Gas, Oil, Other, and Wood), Cement Manufacturing, Chemical Manufacturing, Ferrous Metals, Mining, Non-Ferrous Metals, Oil and Gas Production, Petroleum Refineries, Pulp and Paper, Storage and Transfer, Non-industrial Emissions Sources, Aircraft, Commercial Marine Vessels, Locomotives, (Non-Road Equipment - Diesel, Gasoline, and Other), On-Road Diesel Heavy Duty Vehicles, On-Road Diesel Light Duty Vehicles, On-Road Gasoline Heavy Duty Vehicles, On-Road Gasoline Light Duty Vehicles, Consumer and Commercial Solvent Use, Degreasing, Dry Cleaning, Graphic Arts, Industrial Surface Coating and Solvent Use, Non-Industrial Surface Coating, Bulk Gasoline Terminals, Commercial Cooking, Gas Stations, and Waste Disposal.

Table 4. Analysis Area Emissions in Tons/Year, 2014

County	NO_X (1)	CO (2)	VOC (3)	PM_{10} (4)	$PM_{2.5}$ (5)	SO_2 (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) NO_X – nitrogen oxides
(2) CO – carbon monoxide
(3) VOC – volatile organic compounds
(4) PM_{10} – particulate matter with an aerodynamic diameter equal to or less than 10 microns
(5) $PM_{2.5}$ – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
(6) SO_2 – 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 2016, EPA promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of VOCs leaks and methane during gas well completions.

In 2005, the EPA 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 (EPA 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 (EPA 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" (EPA 2016).

Although the AQI in the region has reached the level considered unhealthy for sensitive groups on several days almost every year in the last decade. The number of days classified for the past 10 years is illustrated in table 5. There are no patterns or trends to the occurrences. The number of days has decreased from the beginning of the decade to present. On seven days in the past decade, air quality has reached the level of "unhealthy," and on two days air quality reached the level of "very unhealthy." Days in which air quality has reached the level of "unhealthy for sensitive groups" has varied over the past decade. In 2009 and 2014, there were no days that were "unhealthy for sensitive groups" or worse in air quality. In 2006 and 2013, there was one day that was "unhealthy" during each year. In 2010, there were five "unhealthy" days and two "very unhealthy days." The number of days classified as unhealthy are summarized in Table 5.

Table 5. Number of Days classified as "unhealthy for sensitive groups" (AQI 101-150) or worse (EPA 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

3.2.2. 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 (BLM 2017). The EPA 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 (EPA 2012).

3.2.3. 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.

Secretarial Order (S.O.) 3289, issued on September 14, 2009, established a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes, and on the land, water, ocean, fish and wildlife, and cultural heritage resources the Department manages. The S.O. states that one must "consider and analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research

and investigations, and/or when making major decisions affecting DOI resources." BLM does recognize the importance of climate change and the potential effects it could have on natural and socioeconomic environments. Since the assessment of GHG emissions and climate change is in its formative phase it is currently not feasible to predict the exact impacts the Proposed Action would have on climate. However, for the purpose of NEPA analysis, this EA includes a qualitative and quantitative analysis of possible GHG emissions that could occur as a result of reasonably foreseeable oil and gas development. More detailed emissions would be available and calculated at a site specific level of analysis such as those that occur at an APD stage.

It is accepted within the scientific community that global temperatures have risen at an increased rate and the likely cause is gases that trap heat in the atmosphere, referred to as greenhouse gases (GHG), for more information refer to the Air Resources Technical Report (BLM, 2017).

GHGs are composed mostly of carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), water vapor, and ozone. 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 Unites States comes from mobile sources (diesel engines and vehicle use) or biomass burning (wildfires, residential heating, and industry) (EPA 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 a negative direction depending upon location and site-specific factors.

As defined by the EPA, the global warming potential (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. GWPs for each GHG pollutant is included in Table 6.

Table 6. GHG Regulated by EPA and GWPs (EPA 2016b, 2017b)

Air Pollutant	Chemical Symbol / Acronym	GWP
Carbon Dioxide	CO_2	1
Methane	CH_4	21-25
Nitrous Oxide	N_2O	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 degrees Celsius 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 US 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 (EPA 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 (BLM 2010).

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 (EPA 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 2016, EPA promulgated air quality regulations controlling VOC and methane emissions at gas wells. These rules require air pollution mitigation measures that reduce the emissions of VOCs. 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.

3.3. Heritage/Archaeological Resources

3.3.1. Cultural Resources

The Proposed Action is located within the archaeologically rich San Juan Basin of northwestern New Mexico. In the prehistory of the San Juan Basin can be divided into five major periods: PaleoIndian (ca. 10000 B.C. to 5500 B.C.), Archaic (ca. 5500 B.C. to A.D. 400), Basketmaker II-III and Pueblo I-IV periods (A.D. 1-1540), and the Historic (A.D. 1540 to present), which includes Native American as well

as later Hispanic and Euro-American settlers. Detailed description of these periods is provided in the RMP. An associated document contains additional information (SAIC 2002).

BLM Manual 8100, The Foundations for Managing Cultural Resources (2004) defines a cultural resource as "a definite location of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups (see also “traditional cultural property”). Cultural resources are concrete, material places and things that are located, classified, ranked, and managed through the system of identifying, protecting, and utilizing for public benefit described in this Manual series. They may be but are not necessarily eligible for the NRHP (i.e., a "historic property”).

Cultural resources vary considerably and may include, but are not limited to, simple artifact scatters, domiciles of various types with a myriad of associated features, rock art and inscriptions, ceremonial and religious features, and roads and trails. In the broadest sense, cultural resources include sites, buildings, structures, objects, and districts or landscapes (NPS 1997). These terms are defined at 36 CFR Part 60.3.

Although the Navajo Nation has their own operational definitions regarding cultural resources on their lands as set forth by the Navajo Nation Cultural Resources Protection Act (NNCRPA), the preceding Federal definitions are generally applicable. On the Navajo Nation cultural resources are managed for the benefit of the Navajo Nation and its people.

Section 106 of the NHPA requires federal agencies to consider what effect their licensing, permitting, or other authorization of an undertaking, such as mineral leasing, may have on properties eligible for the National Register. Pursuant to 36 CFR 800.16 (i), “Effect means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register.” At the same time, NEPA requires the analysis and disclosure of impacts from undertakings, with impacts possessing only partial equivalency with effects. For example, a finding of no adverse effect under NHPA, or even an adverse effect that has been duly mitigated through the Section 106 process, generally equates to no significant impact to cultural resources.

The NRHP (36 CFR Part 60) and the parallel registers kept semi-independently by most states form the basic benchmark by which the significance of cultural resources are evaluated by a Federal agency when considering what effects its actions may have on cultural resources. To summarize, to be considered eligible for the National Register and considered a historic property per 36 CFR Part 800, a cultural resource must possess integrity, potentially including integrity of location, design, setting, materials, workmanship, feeling, and association, and:

> A) be associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B) be associated with the lives of persons significant in our past; or
>
> C) embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> D) have yielded, or be likely to yield, information important in prehistory or history.

Because of the general equivalency in analysis and the substantial overlap in agency responsibilities under both NEPA and NHPA, the NEPA process is often utilized to fulfill certain requirements of the Section 106 process, including public notification and involvement. However, it is important to recognize the two processes differ somewhat in terms of procedures and goals. For this reason, the following discussion should not be read as an exhaustive report of identification efforts and determination of effects pursuant to

NHPA Section 106, but a synopsis of salient points, especially those expected to generate substantial public interest. A Class I existing records review is currently under development, through consultation with the New Mexico State Historic Preservation Officer (SHPO), the Navajo Nation Tribal Historic Preservation Officer (THPO), potentially affected Native American tribes, and various other consulting parties. This overview will offer a more expansive and detailed analysis of this undertaking's potential to affect historic properties and may ultimately differ in its specific conclusions. However, a determination of adverse effect in the absence of appropriate mitigation, or any other substantial discrepancy between the preliminary analysis offered below and the conclusions of the Section 106 process, would result in an ultimate finding of significant impact. Conversely, if detailed consideration of effects through the Section 106 process finds the undertaking has no effect to historic properties, no adverse effect, or only such adverse effects as have been properly addressed by mitigations developed through consultation, it would support the preliminary finding of no significant impact to cultural resources documented below and not preclude an overall finding of no significant impact.

3.3.2. Area of Potential Effect and Cultural Resource Identification

As previously noted, pursuant to Section 106 of the NHPA and its implementing regulations (36 CFR Part 800) a federal agency is required to consider the effects of its actions or 'undertakings', such as leasing, on properties that are listed or eligible for the NRHP. This consideration of effects significantly informs the agency's ultimate assessment of impacts to cultural resources, pursuant to NEPA, and its subsequent decision to approve or deny the undertaking. For instance, an unmitigated adverse effect to historic properties, as determined through the Section 106 process, generally yields a finding of significant impact for the undertaking as a whole. It is completed by a process of collaborative identification, often including field surveys or reconnaissance, with subsequent evaluations of significance for any districts, sites, buildings, structures, and objects that have been identified within the Area of Potential Effect (APE).

In a letter dated September 27, 2017, the SHPO tentatively withheld concurrence with the agency's determination of no adverse effect to historic properties and executed its right to conduct Section 106 consultation for this undertaking under the 36 CFR Part 800 regulations, outside the streamlined review process outlined in the Programmatic Agreement and tiered Protocol between BLM and the SHPO. Based on preliminary discussions, the Section 106 process will continue through the development of a Class I existing records review, which expands upon the analysis offered below and will develop in consultation with the SHPO, the Navajo Nation THPO, affected Native American tribes, and other consulting parties including the National Trust for Historic Preservation and Archaeology Southwest and likely including the National Park Service (NPS) and BIA. While public review components of the Section 106 process and the NEPA review process are executed in tandem, important issues and interested parties identified through this early level of review will be considered or involved throughout the remainder of the Section 106 process. Please note that the final APE developed through consultation may differ from the preliminary APE implemented below. While the final APE for direct effects would be similar to and inclusive of the one used for this preliminary analysis, the APE for indirect effects may be substantially smaller or larger, depending on the results of more in-depth analysis of the potential for visual and auditory impacts to have adverse effects (potential significant impacts) on cultural resources.

Previous cultural resource studies and surveys from 1977 to 2017 in the areas of the parcels have been generally limited to inventories related to land use authorizations that include various public and industrial infrastructure, ranching, fluid minerals extraction, and home sites. The figures may be slightly higher because many surveys on tribal lands are not represented in a Geographic Information System (GIS) environment.

Table 7. Survey coverage and site counts by parcel.

Parcel #	Parcel Acreage	Previous Survey Acreage	Parcel Survey Coverage (Percent)	Known Sites
001	559	< 1 (about 0.5)	0.1	3
002	159	2	1.3	1
003	160	< 1 (about 0.2)	0.1	8
004	200	0	0	2
005	160	14	8.8	4, & 1 historic structure
006	40	< 1 (about 0.6)	1.5	0
007	71	1	1.4	0
008	80	0	0	0
009	315	0	0	0
010	40	< 1 (about 0.9)	2.3	0
011	80	2	2.5	6
012	120	9	7.5	3
013	200	21.5	10.8	4
014	480	49	10.2	12
017	160	0	0	0
018	80	5	6.3	0
020	320	47	14.7	2
021	160	159	99.4	12
029	130	0	0	0
030	320	33	10.3	3
031	120	38	31.7	1
032	160	8	5.0	1
033	40	0	0	0
034	200	< 1 (about 0.2)	0.1	0
035	80	17.6	22.0	1

Because prior inventory coverage correlates strongly with Class III (intensive field survey) inventories for oil and gas and associated right-of-way development, some undeveloped parcels are underrepresented by existing cultural resources data. For this reason, and because certain classes of cultural resources are susceptible to indirect adverse effects originating distant from their physical boundaries or immediate vicinity, the analysis of the affected environment relies on NMCRIS data representing known cultural resources in broad geographic areas surrounding the direct-effect APE. 36 CFR Part 800 and the

Secretary of the Interior's Guidelines for Identification explicitly support the practice of using existing cultural resource inventory data and sampling in the cultural resources identification effort. Pursuant to these authorities, BLM Manual 8110, Identifying and Evaluating Cultural Resources, identifies the Class I, or Existing Information Inventory, as a valid means for achieving identification in certain circumstances. Because the FFO possesses extensive existing Class III inventory data for all major culture-regions, because parcels lacking significant survey coverage represent only small lacunae within broader, well-sampled cultural environments, and because ensuing ground-disturbing developments would require site-specific and recent Class III inventory coverage, BLM deems a review of these existing data adequate for determining the impacts of the proposed leases on cultural resources.

The parcels under analysis fall into four generalized cultural resources analysis units, based on natural Hydrologic Unit Code (HUC) 8 watershed boundaries, other major natural boundaries with known, significant 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 NMCRIS database. The **Middle San Juan Unit** (**MSJ**) includes the eastern portion of the Middle San Juan HUC 8 watershed in New Mexico and excluding tribal lands. The **West Blanco Canyon Unit** (**WBC**) includes the half of the Blanco Canyon HUC 8 watershed that lies west of the Jicarilla Apache Reservation. The **East Chaco Unit** (**ECU**) includes dispersed parcels of non-tribal surface among the "checkerboard" lands in the east half of the Chaco HUC 8 watershed, including Chaco Canyon National Historic Park. The **Gallina Unit** (**GU**) includes portions of the Blanco Canyon, Rio Chama, and Rio Puerco HUC 8 watersheds falling north of Cuba, New Mexico and between the Jicarilla Apache Nation and the Santa Fe National Forest. Straddling the Continental Divide and united by broad passes containing the historic towns of La Jara, Regina, Llaves, Ojito, Gavilan, and Lindrith, this area represents the northwestern frontier of pre-US Territorial Period Hispanic settlement in New Mexico and the heartland of the prehistoric Gallina Anasazi archaeological culture. The cultural unity of the region in multiple significant past eras of occupation justify the analysis unit's definition by terms other than watershed boundaries.

Table 8. Critical statistics of prior regional inventory coverage and site recording.

Analysis Unit (& Total Acres)	Parcels	Class III Inventory, Total (& Percent of Analysis Unit)	Class III Inventory Since 2004, Total (& Percent)	Archaeological and Historic Sites Recorded, Total [& Class III acres per site]	NRHP-Eligible; Undetermined; and Not Eligible*	NRHP-Listed and/or SR-Listed Sites
MSJ (185,007)	031, 032, 033, 034, 035	44,257 (23.9%)	9,978 (5.4%)	2142 [20.7 ac]	381 E (51.3%) 142 U (19.1%) 220 NE (29.6%)	9
WBC (538,071)	013, 014	69,723 (13.0%)	32,657 (6.1%)	5418 [12.9 ac]	2203 E (76.3%) 314 U (10.9%) 372 NE (12.9%)	37
ECU (521,261)	017, 020, 021, 029, 030	125,632 (24.1%)	16,525 (3.2%)	5883 [21.4 ac]	410 E (50.6%) 218 U (26.9%) 182 NE (22.5%)	45
GU (274,454)	001, 002, 003,	39,387 (14.4%)	9,141 (3.3%)	2375 [16.6 ac]	232 E (80.0%) 33 U (11.4%) 25 NE (8.6%)	2

Analysis Unit (& Total Acres)	Parcels	Class III Inventory, Total (& Percent of Analysis Unit)	Class III Inventory Since 2004, Total (& Percent)	Archaeological and Historic Sites Recorded, Total [& Class III acres per site]	NRHP-Eligible; Undetermined; and Not Eligible*	NRHP-Listed and/or SR-Listed Sites
	004, 005, 006, 007, 008, 009, 010, 011, 012					
Total (1,518,793)		278,999(18.4%)	68,301 (4.5%)	15,818 [17.6 ac]	3226 E (68.2%) 707 U (14.9%) 799 NE (16.9%)	93

* As several sites have no readily available determination of eligibility in NMCRIS, the total number of sites is substantially greater than the sum of Eligible, Undetermined, and Not Eligible sites. Tallied determinations of eligibility from initial recordings only.

Critical statistics derived from July 2017 NMCRIS data suggest there are sufficient existing data to satisfactorily quantify the potential for significant archaeological or historic sites within the proposed parcels and that development of these parcels does not preclude the avoidance of direct effects to such resources. In aggregate, about 18.4% of the four regional analysis units surrounding the proposed parcels has been inventoried to Class III standards, with a well-distributed 4.5 % of this coverage dating since 2004, at which time FFO began requiring the use of Global Positioning Systems (GPS) in fieldwork. This time also post-dates the 2000 disabling of selective availability which previously reduced the accuracy of civilian GPS use. Within the aggregate analysis area, researchers have documented 15,818 archaeological sites and historic structures, approximately 83.1% (13,148) of which are potentially eligible for NRHP listing. 93 sites within the five analysis units have been formally listed on the NRHP, the SR, or both. For the most part, these register-listed properties represent Chacoan sites directly or indirectly associated with Chaco Culture National Historic Park (CCNHP) within the ECU and 16th-18th century Navajo defensive sites in the Dinétah, or ancestral Navajo homeland, within the WBC.

Based on the available data, developers of the parcels under analysis would be able to achieve avoidance of direct effects to potential historic properties through careful placement of facilities, following site-specific analyses including Class III cultural resource inventories. As stated above in the Proposed Action (Section 2.2), the average twinned well pad measures 500 feet by 500 feet and, with its subsidiary facilities, occupies a total of 6.68 acres. The standard APE for direct effects, as defined in the revised (2014) Protocol between the New Mexico BLM and the New Mexico SHPO, includes a 100-foot buffer around well pads and a 50-foot buffer around associated roads, pipelines, and other linear structures. This buffer represents approximately 185,300 additional square feet, or 4.25 acres, for a total area requirement of 10.93 acres for a large well pad and associated facilities. It should be noted that developers are often able to avoid direct effects even to sites within the cultural buffer area by adherence to special stipulations, most often including temporary barriers and archaeological monitoring, that the calculated site density is likely an overestimate resulting from the "edge effect" of networks of linear Class III inventories in contrast with the more accurate results of large block inventories, and that not all sites (84.9% overall, and 91.4% in the culturally significant GU; see Table 8 above) potentially meet the

criteria of historic properties or significant resources requiring further protection or consideration under the Section 106 process or other authorities.

3.3.3. Landscape-level Cultural Resources and Register-listed Properties

As noted above, certain classes of cultural resources are susceptible to indirect effects from development. In general, such resources are listed or eligible for listing on the SR or NRHP under Criteria A, B, or C and possess integrity of location, design, setting, feeling, and/or association. Frequently, these properties associate within broader cultural landscape settings. Some landscapes are themselves NRHP-listed entities, such as the Navajo/Refugee Pueblo Thematic Group or Crow Canyon Archaeological District, which account for the majority of listed properties in the West Blanco Canyon analysis unit. Others, such as the greater Chacoan landscape dominating the ECU and MSJ, defy formalization and are represented by individually listed constituent sites and districts. However, other resources within this broad category are sometimes inconsistent with the concept of historic properties, taking their definitions from authorities other than NHPA. For example, sacred sites, as defined in E.O. 13007, may or may not coincide with historic properties.

Scholars, tribes, and the interested public have identified three cultural landscapes, in the broadest sense of the term, of special interest across the analysis units. These are the Chaco landscape, the Gallina Culture area, and the Dinétah (ancestral Navajo homeland). These should not be confused or equated with formally-identified and documented landscapes, such as Rural Historic Landscapes (see NPS National Register Bulletin 30).

The greater Chacoan landscape includes areas of intensive, concentrated prehistoric Anasazi settlement in the area of CCNHP, which sits at the heart of the East Chaco analysis unit, and the Totah area where the Animas and La Plata Rivers join the San Juan, including the MSJ and extreme western Northern Upper San Juan analysis units. Major Chacoan sites near proposed lease parcels are discussed in detail below.

Various sites contributing to the greater Chacoan landscape have received special designations with implications for site management. Chaco Culture National Historical Park (CCNHP), Aztec Ruins National Monument, and the BLM managed Chaco outlier sites of Pierre's Site, Halfway House, Twin Angels, Casamero, and Kin Nizhoni were named as part of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage property, Chaco Culture, on December 8, 1987. The World Heritage listing includes the 34,000 acres in CCNHP, 318 acres in Aztec Ruins National Monument, and 518 acres within the four sites managed by the BLM. Pursuant to PL 96-550 (1980), as amended by PL 104 -11 (1995), 39 sites in New Mexico, Arizona, and Colorado are designated Chaco Culture Archeological Protection Sites. They were designated to recognize the unique archaeological resources associated with the prehistoric Chacoan Anasazi in the San Juan Basin and surrounding areas, provide for the preservation and interpretation of these resources, and to facilitate research activities associated with these resources. No activities upon the upper surface of the sites (surface to 20 meters below ground level) are permitted that would endanger the cultural values. Nothing in the Act is deemed to prevent exploration and development of subsurface oil and gas, mineral, and coal resources from without the sites which does not infringe upon the upper surface of the sites. The prescriptions and goals of this act are implemented and augmented through FFO’s management of Chacoan and other preeminent cultural sites as Areas of Critical Environmental Concern (ACECs), applying NSO and CSU stipulations to ensure development avoids important sites and their immediate environs. See the RMP/FEIS, Appendix N for a full enumeration of management prescriptions for cultural sites, including NSO protections for Pierre’s Site, Halfway House, Twin Angels, and the Chaco North Road.

The Gallina Culture area, directly associated with the GU and its immediate environs, was home to a unique, high-altitude Anasazi adaptation. Though contemporary with Chacoan Anasazi (11th to 14th century), the Gallina Culture retained traits of the earlier, pre-Chacoan Rosa Anasazi, who built major

settlements along the Animas and upper San Juan Rivers in the 8th to 10th centuries. It remains an important focus for specialized academic investigations in the prehistoric Southwest.

The Dinétah may be defined in many ways, but a useful approach for archaeologists roughly equates it with the densest distribution of 16th to 18th century Navajo defensive sites, a large fraction of which are collectively listed on the NRHP and SR as the Navajo/Refugee Pueblo Thematic Group. For the most part, large landforms including Crow Mesa separate the Dinétah from the nearest parcels currently under consideration.

Sites contributing to these generalized cultural landscapes or possessing unique significance under NRHP Criteria A, B, or C may be susceptible to indirect impacts from oil and gas development. Auditory and visual intrusions, especially, have the potential to undermine sites' integrity of location, design, setting, feeling, and/or association. As visual impacts most often persist for greater distances than auditory intrusions, the viewshed analysis is an important touchstone for the consideration of the potential for all indirect effects.

Appendix C of the Wyoming Protocol between BLM and SHPO offers methodology bridging BLM's existing Visual Resources Management (VRM) program and NHPA Section 106 that has been successfully implemented as interim guidance for projects in New Mexico and elsewhere. In essence, VRM guidance breaks the viewshed into three zones: foreground-middle ground (out to 3 to 5 miles), background (5 miles to 15 miles), and seldom seen zones (more than 15 miles distant or hidden from view). These zones, along with the specific details of a proposed project's nature and setting, inform the determination of visual contrast. Appendix C equates a determination of no contrast with a Section 106 determination of no effect to historic properties, a weak contrast with no adverse effect, and a moderate or strong contrast with an adverse effect. Generally, FFO considers routine, dispersed oil and gas developments outside the foreground-middleground zone to have a negligible potential for indirect impacts other than visual contrast with the existing landscape, and such projects outside the background zone to have a negligible potential for visual contrast. The table below identifies potential, foreseeable effects to known properties sensitive to indirect effects within the analysis areas. There is also a higher general potential for indirect impacts to sites not yet discovered from parcels in analysis units containing these cultural landscapes or a greater than average number of important, register-listed properties, e.g., the WBC and ECU. Where development occurs in proximity to sites sensitive to indirect impacts, special best management practices (BMPs) or mitigations formulated through consultation between the BLM, SHPO, tribes, and consulting parties may be necessary to reduce visual contrast or other indirect impacts and achieve no effect or no adverse effect to historic properties and no significant impact to other important cultural resources. Final determinations of effect for associated developments and any necessary mitigations will be developed during future, site-specific analyses and Section 106 consultations for individual development projects, as outlined in universal stipulations WO-NHPA and NM-11-LN, and as implied by stipulation BIA-1 for developments on Navajo Nation Tribal Trust or Indian Allotted surface.

Table 9. Parcels near Chacoan outliers and other cultural properties sensitive to indirect impacts.

Property	Type	Parcel Nos.	Approximate Distance	Within Viewshed?	Foreseeable Potential Effects and Further Work
Chaco Culture	National Historic Park; UNESCO World Heritage	020, 021, 029, 030, 031	10 to 14 miles.	Parcel 030: mostly. Others: partially or not.	Parcels potentially within the background zone also contain substantial areas in the seldom seen zone. Usable surfaces in Parcel 030 appear to be in the background zone. Dispersed oil and gas developments in the background zone are unlikely to result in more than a weak contrast

Property	Type	Parcel Nos.	Approximate Distance	Within Viewshed?	Foreseeable Potential Effects and Further Work
					and no adverse effect. Large facilities and/or clusters of facilities may require special BMPs or mitigations to reduce visual contrast.
Pueblo Pintado	National Historic Park, detached unit; UNESCO World Heritage	017, 020, 021, 029	11 to 16 miles.	Partially or not.	Parcel 020 appears to fall mostly outside the background zone. Other parcels contain mixed areas of background and seldom seen zones. Large facilities and/or clusters of facilities may require special BMPs or mitigations to reduce visual contrast.
East Community / Kin Bulldozer	Chacoan outlier	Similar to Pueblo Pintado, above.	Similar to Pueblo Pintado, above.	Similar to Pueblo Pintado, above.	Similar to Pueblo Pintado, above.
Raton Well	Chaco Protection Site	017	13 to 15 miles.	Not.	View obstructed by Pot Mesa and north rim of Arroyo Pueblo Alto.
Bis sa'ani	ACEC; Chaco Protection Site	017, 020, 021, 029	6 to 14 miles.	Not.	Though near enough to be within the background zone, majority or entirety of each parcel in seldom seen zone: the view is obstructed by north rim of Escavada Wash and Betonnie Tsosie Wash to north and tablelands south of Escavada Wash to the east.
Pierre's Site	UNESCO World Heritage; ACEC; Chaco Protection Site	020, 021, 029, 030	3 to 15 miles.	Not.	Parcel 030 is near enough to be within the foreground-middleground zone, but is outside the modeled viewshed. Other parcels outside the viewshed. Though the landform obstructing visibility between Parcel 030 and Pierre's Site will also lessen the potential for auditory or other indirect impacts, there is a minor potential that BMPs or mitigations (e.g., muffler) could be necessary to achieve *no adverse effect* to the site. This potential should be investigated further during site-specific analyses for future proposed facilities.
Halfway House	UNESCO World	030	7 to 8 miles.	Not.	Parcel 030 is close enough to be

Property	Type	Parcel Nos.	Approximate Distance	Within Viewshed?	Foreseeable Potential Effects and Further Work
	Heritage; ACEC; Chaco Protection Site				within the background zone, but outside the modeled viewshed. Parcel 030 is likely too distant for future proposed facilities to create substantial auditory or other indirect effects to the site.
Eagle Nest; LA2520; LA8620; Morris 40 / Squaw Springs	Chacoan outliers	031, 032, 033, 034, 035	Parcel 031: 2 to 4 miles. Others: 4 to 9 miles.	Not.	Parcel 031 is near enough to LA2520 and Morris 40 to be within the foreground-middleground zone. Modeling indicates a significant potential for facilities to impact the viewshed of LA2520 and little to no potential to impact Morris 40. Other sites surrounding Kirtland, Fruitland, and The Meadows are generally in the background zone of all parcels. Development in Parcel 031 will require further site-specific analysis of the potential for indirect effects to LA2520, and may require special BMPs or mitigations to achieve no adverse effect. The potential for indirect effects other than visual intrusion to Morris 40 from developments in Parcel 031 is minor but extant. Large facilities and/or clusters of facilities in other parcels may require special BMPs or mitigations to reduce visual contrast.
Hogback; Holmes Group; Jackson Lake; La Plata; Morris' Old Fort; Morris 39; Morris 41; Point Pueblo; Sterling; Tse Taak'a	Chacoan outliers; Hogback & Morris 41: Chaco Protection Sites	031, 032, 033, 034, 035	8 to 20 miles.	Not.	Several major landforms including The Hogback, Barker Dome, and Pinon Mesa preclude the potential for significant visual or other indirect impacts to sites outside of the general area of Kirtland, Fruitland, and The Meadows.
Nogales Cliff House / SR-252	Gallina Anasazi architecture: SR & NRHP Property	003, 004	2 to 5 miles.	Parcel 003: partially. Parcel 004: not.	Higher elevations, unsuitable for constructing most facilities, are visible in the foreground-middleground of the site's viewshed. Distance and complex topography both in the vicinity of the historic property and within the parcel restricts visibility and reduces the

Property	Type	Parcel Nos.	Approximate Distance	Within Viewshed?	Foreseeable Potential Effects and Further Work
					potential for other indirect effects to negligible levels.
Rincon Largo District	Navajo/Refugee Pueblo Thematic Group, SR & NRHP District: ACEC	018	4 to 6 miles.	Not.	Though the easternmost edge of the parcel is near enough to potentially fall within the register district's foreground/middleground zone, the district is screened from visual and other indirect impacts by Crow Mesa.
Farmer 18	16th-18th Century Navajo Pueblito (unrecorded)	018	0 miles (located within).	Wholly.	Parcel 018 is wholly within the viewshed of Farmer 18 pueblito. Farmer 18 is potentially similar to listed properties in the Navajo/Refugee Pueblo Thematic Group and likely Eligible for the NRHP. As no recent, detailed information about the site is available, development of Parcel 018 may require evaluation or re-evaluation of Farmer 18 Pueblito as part of the site-specific analysis, even if the site falls outside the direct-effect APE of proposed facilities. Depending on the results of this work, special BMPs or mitigations may be necessary to achieve no adverse effect to the site.

3.3.4. Native American Religious Concerns

There are several pieces of legislation or E.O.s 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, PL 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, PL 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, PL 96-95). Protection or archaeological resources on Federal and Indian lands.

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 NRHP 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 place's National Register eligibility or lack thereof. For this reason, FFO 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 parcels 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. Gilpin 2013; 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 (cultural resources management technical reports of limited distribution) the known places of traditional religious and cultural importance in the San Juan Basin are 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 were identified (Fransted and Werner 1975) suggesting that occupancy is an important factor in the retention of specific knowledge.

In the same area reported by Brugge (1993) there was only one specific geographical location identified through extensive and generally unproductive efforts to engage 20 pueblos in identifying and documenting places of traditional religious and cultural importance. Places like Mesa Verde, Chaco Canyon, and Aztec Ruin were often mentioned, and the precise location of a number of other named places generally attributed to northwest New Mexico remains uncertain (Brugge 1993:111). Whether or not these results indicate an absence of information, a lack of interest in the area, or a polite way of safeguarding sensitive information is unknown. Without a doubt, the pre-Columbian archaeological sites of the San Juan Basin and elsewhere are culturally affiliated with pueblos. Recent statements from representatives of those pueblos have clearly reiterated that these sites and their environment are of traditional religious and cultural importance to them and suggest future ethnographic studies may be more fruitful (e.g., the All Pueblo Council of Governors' Resolution No. APCG 2017-12).

A recent ethnographic overview for the Navajo-Gallup Water Supply Project (NGWSP), which spans the western and eastern margins of the San Juan Basin, reiterates the importance of Chaco Canyon and Aztec Ruin to several northern and southern Tiwa, Tewa, and Keresan pueblos, Jemez Pueblo, Zuni Pueblo, and Hopi Pueblo. It further cites several known TCPs on the periphery of the San Juan Basin (e.g., Chimney Rock, Mount Taylor, and Mesa Verdean sites in the Montezuma Valley) and few within the basin as evidence for the potential for other, unidentified TCPs in the region (Gilpin 2013).

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 BLM tribal consultation efforts with tribes and local Navajo chapters and communities.

Four of the 25 proposed parcels (Parcels 013, 014, 017, and 020) overlap or contain known sites of traditional cultural significance, an additional 8 (Parcels 018, 021, 029, 030, 031, 033, 034, 035) are potentially within the foreground-middleground zone (i.e., within 5 miles), and one more (Parcel 032) is potentially within the background zone (within 15 miles). 12 parcels, all within the GU (Parcels 001-012),

are more than 15 miles from any known TCP, sacred site, or similar property disclosed to FFO, though such sites may be identified through further inventory and Section 106 consultation for specific proposed developments.

Parcels 013 and 014 are located on a large landform variously known as Sis Naateel, Sisnathyel Mesa, or Wide Belt Mesa. It is reported to be the home of several Navajo holy individuals important in the Blessingway ceremony and to be the location where the Navajo acquired sheep and horses. However, there is some ambiguity on the identification of this mesa. It is clearly described by Van Valkenburgh (1941:171) as a "large quasi-rectangular mesa standing isolated in the southwestern township of the Jicarilla Apache Indian reservation… 10 miles east of Counselors trading post." See also Van Valkenburgh (1974:32-37). Brugge (1993:18) encountered the problems of Navajo toponymy and correlating names recorded on recent US Geological Survey (USGS) maps. Brugge (1993:18) went on to state that "the work of Van Valkenburgh has been of value. His descriptions are usually more detailed than those of other students of Navajo culture…" The mesa shown on the current USGS map as Sisnathyel Mesa does not seem to conform to Van Valkenburgh's description.

The NGWSP Ethnographic Overview cited past ethnographies and personal communications noting Jemez and Zuni shrines and significant locations in the San Juan Basin, though the only ones specifically identified and within 20 miles of the undertaking area, excepting Chaco Canyon, are shared by the Navajo and addressed in Kelley et al. 2006 (Gilpin 2013). One cited study found Hopi clan symbols within rock art sites along the San Juan River in the vicinity of Farmington, perhaps within 10 miles of proposed parcels north of Kirtland, Fruitland, and Waterflow, New Mexico (Parcels 031, 032, 033, 034, and 035).

Where development occurs in proximity to sites sensitive to indirect impacts, special BMPs or mitigations formulated through consultation between the FFO 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. Final determinations of effect and any necessary mitigations would be developed during future, site-specific analyses, Section 106 consultations, and government-to-government consultations for individual development projects.

3.4. Socioeconomics and Environmental Justice

The approved RMP balances the need for development of renewable and non-renewable energy resources with resource protections. The decisions in the RMP would facilitate development and provide for socioeconomic benefits to the planning area and the State of New Mexico.

The study area for this lease sale is home to a wide variety of cultural, ethnic, and tribal communities. The Native American populations in the study area are considered indigenous groups, and many Hispanic residents can trace their family's history of settlement of northern New Mexico for hundreds of years. These traditional and indigenous communities are intermingled with more recent Euroamerican groups and immigrants. Ranchers, miners, farmers, oil and gas workers, and service industry providers are all part of the socioeconomic mixture of people in the study area.

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 Native American 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 10).

Table 10. Total Population, Age-Gender Distribution, and Trends.

	Sandoval County	San Juan County	Rio Arriba County	McKinley County	New Mexico
Total Population	136,638	125,133	39,949	73,998	2,084,117
Under 5 years	8,155	9,358	2,780	6,344	137,989
5 to 9 years	9,822	10,243	2,641	6,008	142,552
10 to 14 years	10,335	9,308	2,551	6,555	141,844
15 to 19 years	9,425	8,635	2,780	6,131	142,996
20 to 24 years	7,713	8,734	2,388	5,945	150,914
25 to 29 years	8,017	8,799	2,415	5,293	140,875
30 to 34 years	8,525	8,633	2,252	4,683	135,777
35 to 39 years	8,217	7,726	2,132	4,577	122,918
40 to 44 years	9,477	6,926	2,508	4,154	122,583
45 to 49 years	8,881	7,416	2,524	4,310	127,315
50 to 54 years	10,093	8,580	2,917	4,761	143,539
55 to 59 years	9,819	8,842	2,899	4,018	140,333
60 to 64 years	8,570	6,407	2,808	3,651	128,004
65 to 69 years	7,203	5,153	2,313	2,482	102,832
70 to 74 years	5,082	3,634	1,478	1,946	75,610
75 to 79 years	3,010	2,779	1,005	1,375	54,890
80 to 84 years	2,405	1,985	840	940	37,943
85 years and over	1,889	1,975	718	825	35,203
Total Female	69,497	63,109	20,324	38,317	1,051,703
Total Male	67,141	62,024	19,625	35,681	1,032,414
Change in Median Age, 2010-2015					
Median Age (2015*)	39.1	34.2	40.1	30.8	37.0

	Sandoval County	San Juan County	Rio Arriba County	McKinley County	New Mexico
Median Age (2010)	37.4	32.3	38.6	29.9	36.4
Median Age % Change	4.5%	5.9%	3.9%	3.0%	1.6%

* ACS 5-year estimates used. 2015 represents average characteristics from 2011-2015; 2010 represents 2006-2010.
Source: EPS 2017

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 study area, the BLM considers how agency authorized, permitted, or funded actions may affect minority, low-income, and American Indian communities.

E.O. 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 CEQ (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 (HHS 2015). 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

3.4.1. 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 (21.8 percent and 21.0 percent), but it is much higher than the national average of 15.5 percent. Poverty levels ranged from 37.5 percent in McKinley County to 14.2 percent in Sandoval County. Sandoval County and San Juan County were below the state average (Table 11).

Table 11. Study Area County Population in Poverty.

	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	7,165	19,934	22,152	71,017	421,123	34,569,951
	30.2%	17.7%	11.1%	18.2%	21.3%	20.6%	12.1%
Percent of Population in Poverty 2015	27,493	9,413	19,305	24,755	80,966	429,361	48,760,123
	37.5%	23.7%	14.2%	20.1%	21.8%	21.0%	15.5%
Median Household Income 2002	$25,197	$30,557	$45,213	$34,329	N/A	$34,827	$45,409
Median Household Income 2015	$28,772	$36,098	$58,982	$48,671	N/ A	$44,963	$53,889
Classified as Low Income Population in 2015 based on CEQ guidelines?	No	No	No	No	No	NA	NA

Sources: EPS 2017, US Census Bureau 2012

Similarly, estimates from 2015 indicate that Sandoval and San Juan Counties had household median incomes ($58,982 and $48,671) that were above the state level of $44,963. McKinley County ($28,772) and Rio Arriba County ($36,098) were below that of the state in 2015. 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 Gallup (25.5 percent) and Espanola (28.8 percent) (Table 12).

Table 12. 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	31.9%	N	15.2%	N
Bernalillo	78.1%	Y	18.9%	N
Bloomfield	52.8%	Y	18.0%	N

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?
Espanola	90.4%	Y	28.8%	N
Farmington	45.8%	N	16.5%	N
Gallup	68.2%	Y	25.5%	N
Rio Rancho	49.2%	N	11.4%	N

Source: EPS 2017

Note: The data in this table is calculated by American Community Survey using annual surveys conducted during 2011-2015 and are representative of average characteristics during this period.

3.4.2. Minority Populations

Based on 2011 to 2015 data, minorities made up 60.8 percent of the population in New Mexico, compared to 37.7 percent in the US as a whole. The proportion of minorities in the socioeconomic study area (66.4 percent) substantially exceeded the US average and is higher than the state average. At the county level, the population ranged from 90.1 percent minority in McKinley County to 54.5 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 13).

Table 13. Study Area County Population by Race/Ethnicity.

Population	McKinley County	Rio Arriba County	Sandoval County	San Juan County	Study Area	New Mexico	US	Jicarilla Apache Nation	Navajo Nation	Ute Mountain Ute Tribe
Total Population	73,998	39,949	136,638	125,133	375,718	2,084,117	316,515,021	2995	173,822	1,439
Hispanic or Latino	10,303	28,544	50,357	24,504	113,708	986,972	54,232,205	280	3,003	124
ethnicity of any race	13.9%	71.5%	36.9%	19.6%	30.3%	47.4%	17.1%	9.3%	1.7%	8.6%
White alone	7,320	5,238	62,189	51,317	126,064	817,048	197,258,278	61	3,169	161
	9.9%	13.1%	45.5%	41.0%	33.6%	39.2%	62.3%	2.0%	1.8%	11.2%
Black or African	572	159	2,631	604	3,966	38,081	38,785,726	17	715	11
American alone	0.8%	0.4%	1.9%	0.5%	1.1%	1.8%	12.3%	0.6%	0.4%	0.8%
American Indian or	53,497	5,574	16,233	45,398	120,702	177,257	2,078,613	2,715	163,724	1,102
Alaskan Native alone	72.3%	14.0%	11.9%	36.3%	32.1%	8.5%	0.7%	90.7%	94.2%	76.6%
Asian alone	657	144	1,791	623	3,215	27,225	16,054,074	42	1,091	11
	0.9%	0.4%	1.3%	0.5%	0.9%	1.3%	5.1%	1.4%	0.6%	0.8%
Native Hawaiian and	20	3	49	64	136	883	499,531	0	144	0
Other Pacific Islander alone	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	0.0%	0.1%	0.0%
Some Other	12	47	479	71	609	3,811	638,429	4	39	0
Race	0.0%	0.1%	0.4%	0.1%	0.2%	0.2%	0.2%	0.1%	0.0%	0.0%
Two or more	1,617	240	2,909	2,552	7,318	32,840	6,968,165	71	1,937	30
Races	2.2%	0.6%	2.1%	2.0%	1.9%	1.6%	2.2%	2.4%	1.1%	2.1%
Classified as										

Population	McKinley County	Rio Arriba County	Sandoval County	San Juan County	Study Area	New Mexico	US	Jicarilla Apache Nation	Navajo Nation	Ute Mountain Ute Tribe
Minority Population based on CEQ guidelines?	Yes	Yes	Yes	Yes		Yes	NA	Yes	Yes	Yes

Sources: EPS 2017, US Census Bureau 2012

Note: The data in this table is calculated by ACS using annual surveys conducted during 2011-2015 and are representative of average characteristics during this period.

3.4.3. Native American Populations

Study Area County Population by Race/Ethnicity (2011 to 2015) account for a substantial portion of the study area population in some areas, notably McKinley and San Juan Counties, where the population is 72.3 and 36.3 percent Native American respectively. Three tribal governments have reservations within the planning area: the Jicarilla Apache Nation, the Navajo Nation, and the Ute Mountain Ute Tribe. The Southern Ute Indian Tribe 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 (Table 14).

In addition, the Navajo Nation Chapter Houses of Counselor, Ojo Encino, and Torreon are in the general area of the proposed leases. 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. The BLM received comments both from individual allottees in favor of the proposed lease sale for economic reasons, and from the Chapter Houses asking that no more lease sales be held due to potential negative impacts.

Policies established in 2006 by the BLM and US Forest Service, in coordination with federally recognized tribes, ensure access by traditional native practitioners to area plants. The policy also ensures that management of these plants promotes ecosystem health for public lands. The BLM is encouraged to support and incorporate into their planning traditional native and native practitioner plant- gathering for traditional use (Boshell 2010).

Table 14. Tribal Nations in the Planning Area.

Tribe	Acres in Planning Area	General Location
Jicarilla Apache Nation	739,600	The majority of the Jicarilla Apache Nation is located in western Rio Arriba County, but within the eastern portion of the planning area
Navajo Nation	860,900	A portion of the Navajo Nation extends into western San Juan County and into the western portion of the planning area
Ute Mountain Ute Tribe	103,500	A portion of the Ute Mountain Ute Tribe extends into the northern portion of San Juan County, just east of the Navajo Nation, and into the northern portion of the planning area

Tribe	Acres in Planning Area	General Location
Unknown	196,300	Lands located in the southern portion of the planning area whose tribal affiliation is uncertain due to inconsistencies between US Census Bureau tribal areas dataset and BLM land status dataset.

Source: BLM GIS 2014, US Census Bureau 2015

3.5. Night Skies

There is a long history of stargazing in the Four Corners region, starting with the Ancestral Puebloan culture that inhabited the Chaco area. There has been substantial research in cultural astronomy, and there are 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 a background in archeoastronomy.

In addition, CCNHP built a public observatory in 1998 to accommodate the multitude of thousands of visitors who come to experience the night sky. The park was designated as an International Dark-Sky Association Gold-tier Dark Sky Park in 2013. The night sky observation is a substantial cultural, spiritual and recreational interest and a way for the public to connect and better understand the ancient culture that once thrived in the Chaco Canyon area.

3.6. Visual Resources

The BLM uses a Visual Resource Management (VRM) system to inventory and manage visual resources on public lands. 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 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 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 provides 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 special management areas 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 FFO completed a VRI in 2009. FFO inventory classes reflect the findings in regards to scenic quality, sensitivity level, and distance-zone. These findings are referenced in Table 15 for VRI class for each proposed lease.

Table 15. Visual Resource Inventory Class of Lease Parcels

VRI Class	Proposed Lease Parcels
Class I	None
Class II	032
Class III	018, 030
Class IV	001-018, 020-021, 029, 031, 032-035

Visual resources are managed by assigning a VRM Class. The FFO completed a VRM, Resource Management Plan Amendment in 2014 VRM-RMPA) that established VRM Classes. The objective for each VRM Class describes how that area should be managed, as shown in Table 16. The proposed lease parcels are either in or near BLM lands with VRM Class II, III and IV areas. Table 17 indicates the VRM Class of the nine proposed leases that are on BLM administered surface. The BLM does not assign VRM Classes to non-BLM administered surface. The eighteen parcels that are on non-BLM administered surface are all near or adjacent to VRM Class IV BLM administered surface. Parcel 018 is also near VRM Class III BLM administered surface.

Table 16. 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.

Table 17. Lease Parcels ID and associated VRM Classes.

VRM Class	Parcel ID

VRM Class	Parcel ID
Class I	None
Class II	032
Class III	020, 021
Class IV	005, 006, 007, 031, 032

3.7. Special Status Species

The BLM manages certain species which are not federally listed as threatened or endangered under the Endangered Species Act (ESA) in order to prevent or reduce the need to list these species under the ESA in the future. BLM SSS are: 1) species listed or proposed for listing under the ESA, and 2) species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA, which are designated as Bureau sensitive by the State Director. All Federal candidate species, proposed species, and delisted species in the 5 years following delisting will also be conserved as Bureau sensitive species. BLM SSS include BLM sensitive species and BLM FFO special management species. The New Mexico BLM State Director has designated a list of BLM sensitive species for the State of New Mexico. In accordance with BLM Manual 6840 (BLM 2008a), the BLM FFO has prepared a list of special management species to focus species management efforts toward for maintaining habitats under a multiple-use mandate. BLM FFO special management species include some BLM sensitive species and other species for which the BLM FFO has determined special management is appropriate (Table 18) (BLM 2008c). The authority for this policy and guidance is established by the ESA, Title II of the Sikes Act, as amended (16 USC 670a–670o, 74 statute 1052), BLM FFO SSS Management Policy (BLM 2008c), BLM Manual 6840, FLPMA, and USDI Manual 235.1.1A.

Each SSS listed in Table 18 has suitable habitat that is mapped based on known nesting (birds), breeding (mammals), and occupation (plants). Data from past and current survey efforts within potential habitat continually refine suitable habitat for each species. Suitable habitat maps may change annually, depending on the species, as new data is collected. Other SSS with habitat within the proposed lease parcels, not listed below, may be added in the future. New management measure may be required to protect any new SSS list to minimize or eliminate impacts to the species and habitat.

Table 18. List of non-federally-listed Special Status Species with potential to be impacted by proposed activities with conservation status and habitat requirements.

Common Name (Scientific Name)	Conservation Status	Range or Habitat Requirements	Potential for Occurrence in Project Area
Plants			
Brack's fishhook cactus (Sclerocactus cloveriae ssp. brackii)	State E BLM S	Occurs in salt desert shrublands/badlands on soils derived from the Nacimiento Formation.	The proposed parcel areas contains known suitable habitat for this species.
Birds			

Common Name (Scientific Name)	Conservation Status	Range or Habitat Requirements	Potential for Occurrence in Project Area
Burrowing owl (Athene cunicularia)	BLM S	Found in grasslands especially in association with prairie dog colonies, in desert-scrub, and in agricultural and semi-urban environments. Depends on prairie dogs, rock squirrels, and other fossorial mammals for the availability of burrows. Known to occur in BLM FFO planning area.	The proposed parcel areas contains nesting habitat for this species. This species is likely to occur within or in close proximity to proposed parcel areas.
Ferruginous hawk (*Buteo regalis*)	FFO SMS	During the breeding season it is present in grasslands and badlands and along the ecotone between grasslands and piñon- juniper woodlands, especially in the vicinity of prairie dog colonies. Known to occur in the BLM FFO planning area as a permanent resident.	The proposed parcel areas contains foraging and some nesting habitat for this species. No documented nesting in proposed parcel areas.
Golden eagle (Aquila chrysaetos)	BLM SMS	In New Mexico, nests along steep-walled mountain/desert canyons. During the winter, forages in open grassland or shrubland habitat (NMPIF 2015). Known to occur in the BLM FFO planning area as a permanent resident.	The proposed parcel areas contains nesting habitat for this species. This species may nest and forage within or in close proximity to proposed parcel areas.
Peregrine falcon (*Falco peregrinus*)	State T FFO SMS	A year-round resident and local breeder throughout New Mexico. Usually observed along mountain ridges, near cliffs and canyons, and around bodies of water. All nests in New Mexico are found on cliffs. Known to occur in the BLM FFO planning area as a permanent resident.	Foraging and nesting habitat within and near proposed parcel areas. No known nesting documented within proposed parcel areas.
Prairie falcon (*Falco mexicanus*)	FFO SMS	Occurs in arid plains and steppes at all elevations. Preferred nesting sites consist of cliff ledges or crevices, but it may nest in trees, on power poles and buildings, and along steep sides of arroyos. Known to occur in the BLM FFO planning area as a permanent resident.	Foraging and nesting habitat within and near proposed parcel areas. No known nesting documented within proposed parcel areas.
Mammals			

Common Name (Scientific Name)	Conservation Status	Range or Habitat Requirements	Potential for Occurrence in Project Area
Gunnison's prairie dog (Cynomys gunnisoni)	BLM S	These populations inhabit montane shrublands and high mountain valleys and plateaus in the southern Rocky Mountains at 6,000–12,000 ft. Known to occur in the BLM FFO planning area as a permanent resident.	Known to occur within or near proposed parcel areas.

Sources: Except where otherwise noted, range or habitat information for wildlife species is taken from the BLM (2003:3-43–3-44), the BISON- M website (BISON-M 2015), NatureServe (2015), and the USFWS New Mexico Southwest Region Ecological Services Field Office IPaC System (USFWS 2015).
FFO SMS – FFO Special Management Species
BLM - S – BLM Sensitive Species of FFO
State of New Mexico status definitions:
E = Endangered. Any species that is considered by the state (NMDGF) as being in jeopardy of extinction or extirpation from New Mexico. T = Threatened. Any species that, in the view of the state, is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico.
S = Sensitive. Any species tracked by the state due to conservation concern.

3.7.1. Migratory Birds

A Memorandum of Understanding (MOU) between the BLM and USFWS dated April 12, 2010 calls for increased efforts to fully implement the Migratory Bird Treaty Act of 1918 (BLM 2010a). In keeping with this mandate, the BLM FFO issued an interim policy to minimize unintentional take and to better optimize migratory bird efforts related to BLM FFO activities (BLM 2010b). The BLM FFO 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.

3.8. Wildlife

The FFO contains varying densities of residential and seasonal big game populations. The northern part of the FFO provide habitat for herds of wintering and resident populations of mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*). The landscape encompassing the proposed parcel areas are dominated by residential (i.e. non-migratory) big game species. As such, these animals depend on habitats that provide summer and winter resources. The parcels being considered for leasing occur near the Crow Mesa Wildlife SDA and include excellent habitat for big game, especially mule deer. Mule deer and elk densities north of US Highway 550 tend to be higher, providing robust opportunities for sportsmen. Although populations do extend well beyond US Highway 550 to the south, densities tend to be lower. Little is known about the mule deer populations south of US Highway 550 or why they are lower, as these lands are predominantly administered by tribal authorities—thus limiting hunter access (and data provided by hunter surveys) and New Mexico Department of Game and Fish's (NMDGF) ability to monitor populations.

Several small populations of pronghorn antelope (*Antilocapra americana*) reside in the area north and east of US Highway 550 and are less common south of the highway.

Detailed information on other wildlife species and habitats in the FFO is contained on pages 3-39 to 3-42 of the RMP/FEIS and the background biological resources analysis (SAIC 2002) prepared for the RMP.

3.9. Water Resources

3.9.1. Surface Water

The analysis area for impacts to surface water includes the five watersheds in which the parcels are located. These watersheds include the Middle San Juan, Chaco, Blanco Canyon, Rio Puerco, and Rio Chama. The impact indicator for analysis is acres of disturbance in the waterways and water quality in relation to sedimentation. Jurisdictional Waters of the U.S. are regulated by the United States 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. The BLM FFO 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. Surface water types within the parcels would be limited to seeps, springs, sumps, and ephemeral washes that occasionally flood. Surface flows and intensity of flooding within the ephemeral washes would be depended on precipitation events. The parcels may also contain developed stock ponds and developed wildlife waters.

3.9.2. Groundwater

Aquifers in the San Juan Basin are generally considered to be confined and artesian due to the overlying low hydraulic conductivity formations and the regional geologic structure (Stone et al. 1983). Groundwater recharge occurs along the topographic high outcrops along the basin margins. Discharge from groundwater aquifers generally occurs in topographic low areas such as the San Juan River in the northwestern part of the basin and the Rio Puerco in the southeast. Vertical leakage (interaquifer movement) across fine-grained formations is also a source of recharge and discharge due to variations in hydraulic head. Regionally, vertical leakage is assumed to be low; however, fracturing, in particular around structural features in the basin, could result in higher rates of vertical permeability (Stone et al. 1983).

Groundwater is generally available in most of the BLM FFO and is of poor to fair quality. Primary aquifers in the BLM FFO contain thick sandstone intervals and include the sandstone based San Jose, Ojo Alamo, Mesaverde, and Dakota formations. Groundwater is also present within the Fruitland formation.

Hydraulic fracturing (a.k.a. "fracking") is an operation designed to increase the flow of hydrocarbons from reservoir rock formations to a wellbore through modifying the permeability of the formation. By applying fluids under pressure to fracture the production formation, fracking creates pathways in the target intervals that increase the rate at which fluids can be produced from the reservoir. Well stimulation techniques such as fracking have been used in the San Juan Basin since the 1950s. Approximately 95 percent of all new wells nationwide are hydraulically fracked in order to enhance production.

The New Mexico Oil Conservation Division (NMOCD) regulates state oil and gas operations in New Mexico. The NMOCD has the responsibility to gather oil and gas production data, permit new wells, establish pool rules and oil and gas allowables, issue discharge permits, enforce rules and regulations of the division, monitor underground injection wells, and ensure that abandoned wells are properly plugged and the land is responsibly restored. The New Mexico Environment Department (NMED) administers the major environmental protection laws. The Water Quality Control Commission (WQCC), which is administratively attached to the NMED, assigns responsibility for administering its regulations to constituent agencies, including the NMOCD. The NMOCD administers, through delegation by the WQCC, all Water Quality Act regulations pertaining to surface and groundwater (except sewage not present in a combined waste stream).

CHAPTER 4. ENVIRONMENTAL IMPACTS

4.1. Alternative A: No Action

Under the No Action alternative, all of the proposed parcels would be deferred and not offered for sale in the March 8, 2018, Competitive Oil and Gas 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.

4.1.1. Fluid Minerals

There would be no new impacts from oil and gas production on the proposed parcel land. Oil and gas development of Federal, State, private, and Indian minerals would continue on the land surrounding the proposed parcels. No additional natural gas or crude oil from the proposed parcels would enter the public markets and no royalties would accrue to Federal or State treasuries.

These 25 parcels are surrounded by leased Federal, Allotted, private and State lands. There has been active drilling around these lands targeting the Mancos/Gallup, Fruitland Coal, Dakota NW, or Pictured Cliff/Dakota geologic horizons and a Potential Drainage Situation (PDS) analysis has been performed by a BLM FFO Geologist and Physical Science Technician. There is one PDS well identified as draining one of the 25 unleased parcel (018). The ROD stipulates that any parcel having the potential for drainage be subject to lease notice NM-10 for federal lands.

Oil and gas consumption is driven by a variety of complex interacting factors including energy costs, energy efficiency, availability of other energy sources, economics, demography, and weather or climate. If the BLM were to forego leasing and potential development of the proposed parcels, the assumption is that the public's demand for the resource would not be expected to change. Instead, the mineral resource foregone would be replaced in the short- and long-term by other sources that may include a combination of imports, using alternative energy sources (e.g. wind, solar), and other domestic production. This offset in supply would result in a no net gain for oil and gas domestic production.

4.1.2. Socioeconomics and Environmental Justice

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

4.1.3. All Other Resources

No other resources (solid minerals, soils, vegetation, wildlife, air quality, etc.) would be affected under the No Action Alternative as there would be no potential surface disturbance that could detrimentally affect these resources. The No Action Alternative would result in the continuation of the current land and resource uses around the parcels; however, the selection of the no action alternative would not preclude these parcels from being nominated and considered in a future lease sale, which would result in impacts as described under the Proposed Action Alternative.

4.2. Alternative B: Proposed Action

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

If the lease parcels were developed, short-term impacts would be stabilized or mitigated within five years and long-term impacts are those that would substantially remain for more than five years. Potential indirect impacts and mitigation measures of the Proposed Action are described below.

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

The RFD for Northern New Mexico (2014) forecasts that the most likely oil and gas development in the area of the 25 unleased parcels would be horizontal drilling of the Mancos/Gallup play. These parcels are within the high potential area delineated by the RFD, where up to 1,600 potential new Mancos/Gallup wells are projected to be drilled (Engler et al., 2014). The anticipated indirect impacts of horizontal drilling and multi-stage fracking are consistent with the impacts considered in the RMP (pages 2-2 to 2-8).

Table 19 displays the number of wells that may be required to develop the parcels based on typical spacing and potential formation development considerations.

Table 19. Development Scenario by Lease Parcel.

Lease Parcel #	Acres	Horizontal Wells (estimated development)	Vertical Wells (estimated development)
NM-201803-001	558.830	4	3
NM-201803-002	159.150	1	1
NM-201803-003	160.000	1	1
NM-201803-004	200.000	2	1
NM-201803-005	160.000	1	1
NM-201803-006	40.000	1	1
NM-201803-007	71.030	1	1
NM-201803-008	80.000	1	1
NM-201803-009	315.360	2	2
NM-201803-010	40.000	1	1
NM-201803-011	80.000	1	1
NM-201803-012	120.000	1	1
NM-201803-013	200.000	2	1
NM-201803-014	480.000	4	3
NM-201803-017	160.000	1	1
NM-201803-018	80.000	1	1
NM-201803-020	320.000	2	2
NM-201803-021	160.000	1	1
NM-201803-029	130.000	1	1
NM-201803-030	320.000	2	2
NM-201803-031	120.000	1	1
NM-201803-032	160.000	1	1
NM-201803-033	40.000	1	1
NM-201803-034	200.000	2	1
NM-201803-035	80.000	1	1
Total:	4,434.370	37	32

The proposed action could result in a maximum of 37 horizontal and 32 vertical wells, totaling 63 potential wells. These could occur as twinned well pads or single well pads. For this analysis, we will assume that each horizontal well pad is a twinned and each vertical well pad is a single well pad.

Horizontal drilling reduces the overall footprint of oil and gas development because of the ability to place more than one well on a well pad. While the size of a twinned well pad is larger than a single well pad, twinning decreases the total number of well pads required for a given amount of wells thus reducing overall disturbance acreage.

The average well pad size for a twinned well pad was assumed to be 500 feet by 530 feet, or 6.08 acres. An additional 0.6 acres was added to account for any associated road or pipeline development, resulting in 6.68 acres of short-term disturbance per twinned well pad. Following completion of the well, interim reclamation of the well pad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The average well pad size for a single well pad was assumed to be 500 feet by 500 feet, or 5.74 acres. Again, an additional 0.6 acres was added to account for associated road or pipeline development, resulting in 6.34 acres of short-term disturbance per single well pad. Following completion of the well, interim reclamation of the well pad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The well pad sizes and acreages are derived from observed averages of recent development in the surrounding area of the proposed lease parcel areas. The sizes and acreages are used to estimate possible disturbance caused by developing the 25 proposed parcels.

If development proceeds with 18 twinned well pads, the well pads and associated pipelines and roads could result in an estimated 6.68 acres of short-term surface disturbance and 1.5 acres of long-term disturbance per well; this would result in 114.12 acres of short-term surface disturbance and 27 acres of long-term surface disturbance.

If development proceeds with 32 single well pads, the well pads and associated pipelines and roads could result in an estimated 6.34 acres of short-term surface disturbance and 1.5 acres of long-term disturbance per well; this would result in 202.88 acres of short-term surface disturbance and 48 acres of long-term surface disturbance. Accounting for both twinned and single-well pads, the total estimated disturbance is 242 acres of short-term disturbance and 75 acres of long-term disturbance.

4.2.1. 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 FFO used in developing the inputs for the calculator (BLM 2017).

Hydraulic fracturing is not a new process in the San Juan Basin or within the oil and gas industry in general -- in fact, unfractured producing wells are very uncommon in the region. Over time, improvements in hydraulic fracturing techniques have further increased the production potential of individual wells. Those same improvements may also lead to incrementally higher emissions of VOCs during the relatively brief completion phase of new wells. Additionally, modern fracturing techniques may indirectly increase the quantity of roadbed dust temporarily suspended in the atmosphere simply due to an increase (relative to older fracturing techniques) in vehicular traffic involved in transporting mobile equipment and supplies. However, once the hydraulic fracturing is complete, these effects largely disappear.

4.2.2. Air Quality

Under the Proposed Action Alternative, leasing the subject tracts would have no direct impacts to air quality. Any potential effects to air quality from the sale of a lease parcel 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 VOCs 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 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.

4.2.3. Greenhouse Gases

Information about GHGs and their effects on national and global climate is presented in the Air Resources Technical Report (BLM 2017). Analysis of the impacts of the proposed action on GHG emissions are reported below.

Leasing the subject tracts under the Proposed Action Alternative would have no direct impacts to climate change as a result of GHG emissions. Any potential effects to air quality from sale of a lease parcel would occur when the lease is developed. Impacts to air quality as a result of lease development would be considered at the time of application for specific projects.

The two primary GHGs associated with the oil and gas industry are carbon dioxide (CO2) and methane (CH4). Because methane has a GWP that is 21-25 times greater than the warming potential of CO2, the EPA uses measures of CO2 equivalent (CO2e) which takes the difference in warming potential into account for reporting greenhouse gas emissions. Emissions will be expressed in metric tons of CO2 equivalent in this document.

4.2.3.1. *Estimated Oil and Gas Production Volumes*

Estimates of the oil and gas production volumes that may ultimately be produced from the 25 parcels are needed to quantify any potential GHG emissions associated with lease development. Based on the analysis provided in the RFD for Northern New Mexico (2014) and the subsequent update to the RFD for Northern New Mexico (2015) (hereafter referred to as the 2014 RFD and 2015 RFD update, respectively) oil and gas production estimates were generated for the 25 parcels using the following criteria:

1. Since 2011, the Mancos/Gallup shale play in the San Juan Basin has been developed by horizontal drilling and any future development is anticipated to be primarily horizontal drilling of the Mancos/Gallup and shallow (less than 3,500 ft) development of coalbed methane from the Fruitland Coal formation. This conclusion is reflected in the number of APDs and type of formations currently being developed by these approved APDs.
2. Eight of the 25 parcels numbered 013 & 014, and 017 through 021 lie within the high, medium and low Mancos oil development potential area, delineated in the 2015 RFD update analysis. Most of the leased parcels (parcels 1 through 12) are located on the east side of the San Juan Basin in area of exploratory Mancos oil development not discussed in either RFD. Five of the

parcels (31 through 35) are located on the west side of the basin in an area of Mancos/Gallup and Fruitland Coal potential.

3. Wells drilled in the high potential area are projected to have an Estimated Ultimate Recovery (EUR) of 140,000 barrels (bbls) of oil per well and 630,000 thousand cubic feet (Mcf) of gas per well based on the decline curve analysis of the 41 study wells.
4. The 2014 RFD and the 2015 RFD update projects that 1,600 new Mancos/Gallup horizontal wells would be drilled in the high potential area over the next 20 years, at a density of five wells per section (1 section = 640 acres).

Using these data, the potential oil and gas production volumes (EURs) per parcel were estimated. These volume estimates assume that the majority of future activity would be horizontal development of the Mancos/Gallup play and that EURs of recent Mancos/Gallup wells would be similar to the EUR of future Mancos/Gallup wells. In addition, these calculations only present estimated volumes for oil and gas. Produced hydrocarbons for wells in New Mexico are reported in terms of oil and gas. In official production reports, all liquid volumes are accounted for in the oil category and consequently any condensate volumes produced from the well are considered oil volumes for reporting purposes. Therefore, oil and gas volumes estimated for these parcels include any potential condensate volumes in the oil category.

The estimated volumes presented here are not estimates of total well production or total wells that would be drilled; these values estimate only the potential oil and gas volumes attributable to each parcel. The values were derived by first determining the number of wells that may intersect each parcel (wells/parcel) based on the well density of five wells/section forecast in the 2014 RFD and 2015 RFD update. This estimated wells/parcel value was then multiplied by the EUR of 140,000 bbls of oil per well and 630,000 Mcf of gas per well projected in the 2015 RFD update to determine the EUR per parcel (EUR/parcel). The estimated oil and gas production volumes are presented in Table 20.

Table 20. Estimated Oil and Gas Production Volumes per Parcel

		Horizontal Wells			Conventional Vertical Wells		
Parcel	Acres	Oil (BBL)	Gas (Mcf)	Num. Horiz. Wells	Oil (BBL)	Gas (Mcf)	Num. Vert. Wells
Parcels below are located on eastside of San Juan Basin							
NM-201803-001	558.83	180,000[3]	720,000[3]	4	30,000[6]	1,800,000[6]	3
NM-201803-002	159.15	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
NM-201803-003	160.00	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
NM-201803-004	200.00	90,000[3]	360,000[3]	2	10,000[6]	600,000[6]	1
NM-201803-005	160.00	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
NM-201803-006	40.00	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
NM-201803-007	71.03	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
NM-201803-008	80.00	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
NM-201803-009	315.36	90,000[3]	360,000[3]	2	20,000[6]	1,200,000[6]	2
NM-201803-010	40.00	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
NM-201803-011	80.00	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
NM-201803-012	120.00	45,000[3]	180,000[3]	1	10,000[6]	600,000[6]	1
Parcels below are located in Lybrook/Nageezi area of high Mancos/Gallup potential							
NM-201803-013	200.00	280,000[1]	1,260,000[1]	2		300,000[4]	1
NM-201803-014	480.00	560,000[1]	2,520,000[1]	4		900,000[4]	3
NM-201803-017	160.00	140,000[1]	630,000[1]	1		300,000[4]	1
NM-201803-018	80.00	140,000[1]	630,000[1]	1		300,000[4]	1
NM-201803-020	320.00	280,000[1]	1,260,000[1]	2		600,000[4]	2
NM-201803-021	160.00	140,000[1]	630,000[1]	1		300,000[4]	1
Parcels below are located in NW portion of San Juan basin							
NM-201803-029	130.00	45,000[2]	180,000[2]	1	5,000[5]	100,000[5]	1
NM-201803-030	320.00	90,000[2]	360,000[2]	2	10,000[5]	200,000[5]	2
NM-201803-031	120.00	45,000[2]	180,000[2]	1	5,000[5]	100,000[5]	1
NM-201803-032	160.00	45,000[2]	180,000[2]	1	5,000[5]	100,000[5]	1
NM-201803-033	40.00	45,000[2]	180,000[2]	1	5,000[5]	100,000[5]	1
NM-201803-034	200.00	90,000[2]	360,000[2]	2	5,000[5]	100,000[5]	1
NM-201803-035	80.00	45,000[2]	180,000[2]	1	5,000[5]	100,000[5]	1
Subtotals	4,434.37	2,710,000	11,610,000	37	190,000	12,500,000	32

Total Number of Wells: 69

[1] EUR 140,000 BBL + 630,000 Mcf for high potential Mancos area from 2015 RFD
[2] EUR 45,000 BBL + 180,000 Mcf for fractured Mancos NW portion SJB from fig. 16 RFD
[3] EUR 45,000 BBL +180,000 Mcf for naturally fractured Mancos east side SJB from fig. 16 RFD
[4] EUR 300,000 Mcf for Fruitland Coal south end SJB in Lybrook area
[5] EUR 5,000 BBL + 100,000 Mcf for Fruitland Coal/Dakota NW portion SJB
[6] EUR 600,000 Mcf for Pictured Cliff/Dakota east side SJB

4.2.3.2. *Estimated Direct Greenhouse Gas Emissions*

Table 21 shows an estimate of direct greenhouse gas emissions for oil and gas field production for New Mexico and Federal leases by basin based on the assumption that greenhouse gas emissions are proportional to production.

Table 21. 2014 Oil and Gas Field Production Emissions (EPA 2016c*)

Source	Oil		Gas		Total Oil and Gas Production
Location	CO_2	CH_4 (as mT CO_2e)	CO_2	CH_4 (as mT CO_2e)	(metric Tons CO_2e)
New Mexico	23,000	2,583,691	864,579	5,066,619	8,537,889
Federal leases in New Mexico	12,314	1,383,222	525,557	3,079,878	5,000,970
San Juan Basin (16,289 wells)	853	95,816	357,665	2,095,992	2,550,325
Permian Basin (17,798 wells)	11,461	1,287,406	167,892	983,886	2,450,645

*Most recent inventory data year available, 2014 data.
Sources: Petroleum Recovery Research Center, 2015; USDI Office of Natural Resources Revenue, 2015; US Energy Information Administration, 2015; EPA "Inventory of the US Greenhouse Gas Emissions and Sinks: 1990-2014," Tables 3-36, 3-38, 3-47, and 3-49.

To estimate the potential emissions from the proposed lease sale, an estimate of emissions per well is useful. To establish the exact number of federal wells in the San Juan Basin is problematic due to the ongoing development of new wells, the abandonment of unproductive wells, land sales and exchanges, and incomplete or inaccurate data bases; however, the number of active federal wells in the New Mexico portion of the San Juan Basin has been estimated to be 16,289. This number was arrived at by BLM FFO through utilizing the BLM New MexicoGIS and the New Mexico Conservation Division ONGARD Data Search. ONGARD was searched for all active, new, and temporarily abandoned wells in New Mexico.

Table 22 shows estimated annual direct emissions from San Juan Basin federal leases at 2,550,325 metric tons CO2e. Therefore, the estimate of direct emissions per well in the San Juan Basin is 156.6 metric tons CO2e annually. The maximum number of wells to be producing from the 25 parcels is estimated to be 69. In the event that 69 separate wells were completed on the proposed leases, the maximum direct emissions resulting from the lease sale would be 10,803 metric tons CO2e per year.

Table 22. Potential Direct Greenhouse Gas Emissions Resulting from Proposed Lease Sale

GHG Emissions	Metric Tons (CO_2e)
Total New Mexico Emissions From Oil and Gas Field Production	8,537,889
Total Federal Mineral Estate San Juan Basin Emissions from Oil and Gas Field Production (16,289 wells)	2,550,325
Total Federal Mineral Estate Permian Basin Emissions from Oil and Gas Field Production (17,798 wells)	2,450,645
Total Potential GHG Emissions from Oil and Gas Field Production at Full Development (69 wells)	10,803

Referenced to latest available estimates from Table 21

4.2.3.3. *Estimated Indirect Greenhouse Gas Emissions*

Table 23 shows estimated indirect GHG emissions based on the EUR estimates contained in Table 20. Indirect GHG emissions are typically associated with combustion of either the oil or gas, either as direct fuel or produced fuel (e.g. gasoline from oil). EPA has developed indirect emissions calculators that can provide gross estimates based on established assumptions. With respect to the rough estimate of indirect CO2 emissions, it should be noted that it is difficult to discern with certainty what end uses for the fuels extracted from particular leaseholds might be reasonably foreseeable. For instance, end uses of fossil fuels extracted from Federal leases could include, but are not limited to: combustion of transportation fuels, fuel oils for heating and electricity generation, as well as production of asphalt and road oil, and the feedstocks used to make chemicals, plastics, and synthetic materials. Table 23 is based on an approximation of these end uses on a national basis using the reference cited. While the BLM based these estimates on national data about typical end use of produced oil and gas, it is important to note that the BLM does not exercise control over the specific end use of the oil and gas produced from any individual federal lease.

Table 23. Estimated indirect GHG emissions based on the Estimated Ultimate Recovery estimates, referenced to Latest Available Estimates from 2014 (EPA 2016c)

Product Category	Estimated Product Quantity	Emissions Factor	CH4 emissions Metric Tons CO2e	N2O emissions Metric Tons CO2e	CO2 Emissions (Metric Tons)	Total Emissions Metric Tons CO2e
Crude Oil (bbl)	2,754,637	0.43 MT CO_2/bbl	0.0012	0.0029	1,184,494	1,184,494
Natural Gas (Mcf)		0.055 MT CO_2/Mcf	564.31	672.65	1,197,077	1,198,314
Total						2,382,808

Source: Environmental Protection Agency Greenhouse Gas Equivalencies Calculator, May 2016

As it is not possible to assign an impact value to these numbers, the emissions estimates themselves are presented as a proxy for impact.

Uncertainties of GHG Calculations

Although this EA presents a quantified estimate of potential GHG emissions associated with reasonably foreseeable oil and gas development, there is uncertainty in GHG emission estimates due to uncertainties with regard to eventual production volumes and variability in flaring, construction, and transportation.

In addition, there is uncertainty with regard to the net effects of reasonably foreseeable oil and gas development on climate – that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. Inconsistencies in the results of scientific models designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing science at the present time. More site-specific information on oil and gas activities resulting in GHG impacts would be described in detail at the APD stage. At the APD stage, the BLM would evaluate operations, require mitigation measures, and encourage operators to participate in the voluntary STAR program.

End Uses

The estimates above provide a complete GHG lifecycle of a well from site inspection to possible indirect emissions through combustion. A rough estimate was possible using publicly available information and using estimates from future production for reasonably foreseeable development. With respect to the rough estimates of indirect CO2 emissions, it should be noted that it is difficult to discern with certainty what end uses for the fuels extracted from a particular leasehold might be reasonably foreseeable. For instance, end uses of fossil fuels extracted from Federal leases could include, but are not limited to: combustion of transportation fuels, fuel oils for heating and electricity generation, as well as production of asphalt and road oil, and the feedstocks used to make chemicals, plastics, and synthetic materials. At this time, there is uncertainty with regard to the actual development that may occur.

It is important to note that the BLM does not exercise control over the specific end use of the oil and gas produced from any individual federal lease. The BLM has no authority to direct or regulate the end use of the produced oil and/or gas. As a result, the BLM can only provide an estimate of potential GHG emissions using national approximations of where or how the end use may occur.

Availability of Input Data

In light of the difficulties in attributing specific climate impacts to individual projects, agencies use the projected GHG emissions as a proxy for assessing a Proposed Action's potential climate change impacts. Estimates were made based on readily available data and reasonable assumptions about potential future development. There are many factors that affect the potential for GHG emissions estimates at the leasing stage: a lease may not be purchased, so no GHG emissions would be expected; a lease may be purchased but never explored, so again there would be no GHG emissions; a lease may be purchased and an exploratory well drilled that showed no development potential, so minimal GHG emissions would occur; or a lease may be purchased, explored, and developed.

If developed there are notable differences in the potential for emissions related to a wide variety of variables, including the production potential of the well, economic considerations, regulatory considerations, and operator dynamics, to name a few. Further NEPA analysis would be conducted at the APD stage, when specific development details with which to analyze potential GHG emissions are known.

4.2.3.4. *Monetizing Costs and Benefits: Social Cost of Greenhouse Gases*

Tthe BLM finds that including monetary estimates of the social cost of GHGs (SC GHG) in its NEPA analysis for this Proposed Action would not be useful. There is no court case or existing guidance requiring the inclusion of SC GHG in the NEPA context.

Estimating SC GHG is challenging because it is intended to model effects at a global scale on the welfare of future generations caused by additional carbon emissions occurring in the present. The Interagency Working Group on the Social Cost of GHGs, convened by the US Office of Management and Budget, developed estimates of the social cost of carbon dioxide, methane and nitrous oxide emissions. BLM finds that including meaningful monetary estimates of the SCC would not provide additional pertinent information to the decision maker.

Given the global nature of climate change, estimating SC of an individual decision requires assessing the impact of the project on the global market for the commodity in question. While the BLM is able to estimate the GHG emissions associated with reasonably foreseeable oil and gas development, this EA does not estimate the net effect of this action on global GHG emissions or climate change. Depending on the global demand for oil and gas, the net effect of this project may be partially offset by changes in production in other locations. Accounting for this potential substitution effect is technically challenging.

4.2.3.5. *Potential Mitigation*

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

Between 2008 and 2012, methane and carbon dioxide emissions from oil production have increased nationally due to increases in domestic oil production. Between 2006 and 2012, methane emissions from natural gas production declined significantly due to improved practices and the use of green completions with hydraulic fracturing. However, during the same period, CO emissions from natural gas production increased significantly due to increases in flaring (EPA 2014). The FFO would work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy.

Due to the proximity of occupied buildings and residences to potential well sites to develop these proposed lease parcels, information about the air quality impacts at these locations needs to be determined and disclosed as part of the NEPA analysis prior to decision making on the APDs for wells on these parcels. Air dispersion modeling in accordance with EPA and state modeling guidelines can be used to determine "near- field" impacts. This modeling could not be completed at the time of the RMP because it requires very specific information about how leases are developed and locations of development. At the time of the lease sale, there is still not enough information available about how the lease would be developed to accurately determine the near-field air quality impacts. Due to the parcel's close proximity to occupied dwellings, air dispersion modeling may be required to determine the near-field impacts at the time of the APD when exact project locations and equipment specifications are known. Based off the modeling results, the lease operator may be required to relocate projects, delay certain operations, and apply other reasonable mitigation measures consistent with lease rights (43 CFR 3101.1-2 and Form 3100-11 Section 6) to minimize impacts to air quality and human health and safety.

Due to occupied residences located within or adjacent to eight of the 25 parcels, lease stipulation F-44-NSO would apply. Lease stipulation F-44-NSO states that no surface occupancy is allowed within 660 feet of any occupied residences of a community to reduce impacts to the community of drilling and production activities. The BLM would determine impacts from surface disturbances at the APD stage.

4.2.4. Heritage/Archaeological Resources

4.2.4.1. *Cultural Resources*

Because the act of leasing obligates the agency to allow access to leased minerals, and therefore some level of surface-disturbing activity, the act of leasing itself has a hypothetical potential to result in unavoidable adverse effects and significant impacts where factors such as lease parcel size and location preclude designs that fully avoid effects and impacts. Further, effects and impacts to cultural resources are foreseeable, potential consequences of lease development.

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 and impacts normally and most often include alterations to the physical integrity of a cultural resource. The greatest potential effect to

historic properties stems from the construction of facilities associated with leases 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 property's physical integrity, including location, design, materials, and workmanship. If a cultural resource is significant for reasons other than its scientific information and the historic property's aspects of integrity including setting, feeling, and association contribute to conveying its significance, effects may also include the introduction of audible, atmospheric, or visual elements that are out of character for the cultural site. Important cultural resources that are not historic properties per NHPA may be subject to impacts that are functionally equivalent to the aforementioned effects.

Conversely, cultural resource investigations associated with development add to an understanding of the prehistory and history of the area under investigation, and cultural resources that would otherwise remain undiscovered and unevaluated are identified. Most of the cultural resources identified within the proposed action and within the APEs were identified by investigations associated with the planning of proposed development. As of July 2017, approximately 448 acres had been inventoried for cultural resources to Class III standards within the parcels, or 9.4% of their combined area of 4,434.370 acres. With a projected site density of one site identified for every 17.6 acres of Class III inventory (1:17.6 acres) and 16.9% of sites evaluated for NRHP eligibility across all analysis units found not eligible, an estimated total of 278 additional unrecorded sites is projected to exist in the uninventoried areas of the proposed lease parcels, 236 of which are projected to be eligible for the National Register.

The BLM has applied the criteria of adverse effect as defined in 36 CFR 800.5(1) 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. BLM likewise does not foresee significant impacts that are functionally equivalent to such adverse effects to cultural resources other than historic properties.

The need for further Section 106 review at the APD level is highlighted in lease stipulations WO-NHPA and NM-11-LN, applied to all proposed lease parcels. Stipulation BIA-1, Part 1 similarly implies the need for further Section 106 review for parcels with Navajo Nation Tribal Trust or Indian Allotted surface.

In addition, special stipulations apply to certain parcels to ensure the avoidance of effects or adverse effects to cultural resources. Stipulations F-40-CSU and F-6-VRM are applied selectively to ensure BLM has the necessary tools to effectively avoid or mitigate adverse effects following site-specific analyses and consultations regarding individual development projects. F-40-CSU, a CSU stipulation, is applied in areas with site densities likely to require substantial relocations or reroutes of proposed facilities, pipelines, and access roads to avoid direct impacts to historic properties. It also applies to parcels within the viewshed of sensitive cultural resources, allowing BLM to require any of a number of potential design features or mitigations to avoid indirect effects, including those from auditory impacts. Similarly, stipulation F-6-VRM, a VRM stipulation, also applies to parcels within the viewshed of sensitive cultural resources. In such cases, this stipulation requires management to a VRM-II level, regardless of the area's VRM classification, to avoid potential adverse effects to cultural resources. Best management practices or design features to reduce auditory and visual impacts, or mitigations that may be applied pursuant to stipulations F-40-CSU and F-6-VRM, include the use of BLM standard environmental colors, low-profile tanks and other facilities, facility orientation to reduce visible profiles from key observation points, hospital-grade mufflers or other sound-dampening devices, and well pad, access road, and pipeline alignments that reduce visual contrast with the surrounding landscape. See Table 9 in Section 3.3.3,

above, for a list of potentially-sensitive cultural resources meriting VRM and CSU stipulations for nearby proposed lease parcels.

4.2.4.2. *Cultural Landscapes*

Special BMPs or mitigations may be necessary to achieve no effect or no adverse effect to historic properties or no significant impact to cultural resources, in general, that constitute cultural landscapes that are not in and of themselves NRHP-listed or NRHP-eligible properties. However, 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 (NPS 1999, NPS 1996), nor would it compound the inherent problems 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 and unavoidable significant impacts to portions of the Chaco Culture UNESCO World Heritage property, Chaco Protection Sites, or known similar sites.

4.2.4.3. *Native American Religious Concerns*

The Proposed Action Alternative is not known to physically threaten the integrity of any sacred places or 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 E.O. 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 would help ensure that new information is incorporated and taken into account during individual lease development analysis and authorizations.

4.2.5. Socioeconomics and Environmental Justice

While the act of leasing federal 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 parcels. 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 parcels considered in this sale, the social and economic effects on adjacent populations and users would be assessed relative to known impacts.

At the lease sale stage, there is often not enough information available about how the lease would 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 APD EA should assess whether there are disproportionately high and adverse impacts to identified environmental justice populations from the development of these leases.

Given that the surface of several lease parcels proposed for sale in this document are Navajo Nation tribal trust lands, it is reasonable to assume that the majority of current occupants of the residences in the lease parcels are Navajo Nation members and their families. Therefore, the current population of the lease parcels should be considered an environmental justice population of concern, and should be addressed accordingly in any additional environmental analyses undertaken at the APD stage. The current residents of the lease parcels proposed for sale in this action may be reasonably be defined as a discrete, though dispersed, Native American 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 lease parcels, residents should 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,

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.

The BLM must provide these affected environmental justice populations reasonable opportunities to identify such affects, and should collaborate with the affected populations to determine possible mitigation methods and measures. The BLM 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.

Creation of new access roads into an area could allow increased public access and exposure of private property to vandalism. For leases where the surface is privately owned and the subsurface is BLM managed, surface owner agreements, standard lease stipulations, and BMPs could address many of the concerns of private surface owners.

Due to occupied residences located within several parcels, lease stipulation F-44 would apply. F-44 states that no surface occupancy is allowed within 660 feet of any occupied residences of a community to reduce impacts to the community of drilling and production activities.

4.2.6. Night Skies

Table 24 lists the potential 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 for various reasons including during the flowback stage of a newly drilled well, if pipeline infrastructure is inoperable or not in place to transport natural gas, if compressors and/or other equipment are down for maintenance, and during emergency situations. The necessity for flaring and the duration of flaring varies widely from well to well and is difficult to predict.

Table 24. Potential light sources per well under the Proposed Action Alternative.

Light Source			Duration	
Location	Type	Number[1]	Days (average)	Hours[2]
Foreground/Middleground (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

Light Source			Duration	
Location	Type	Number[1]	Days (average)	Hours[2]
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

[1] The 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.

[2] This 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.

The Table provides the total number of light sources required for the development of a well; however, for parcels 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.

4.2.7. Visual Resources

The issuance of leases would not directly impact visual resource values. However, if issued, the proposed lease parcels 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 parcels. 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 VRM-RMPA.

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.

Management decisions made in order to manage visual resources are reflected in the VRM classification. These classes would be utilized to address potential effects to the visual resource for the remainder of this analysis. 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 include 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 BLM 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 tribal lands. However, those potential impacts cannot be analyzed until a site-specific application is submitted to the BLM.

Regardless of VRM classification, management prescriptions equivalent to those associated with VRM II or VRM III may be required to avoid adverse effects to nearby cultural resources sensitive to indirect effects or impacts.

4.2.8. Special Status Species

Direct and indirect impacts for Brack's fishhook cactus, burrowing owls, ferruginous hawk, golden eagle, prairie falcons, and peregrine falcon are described below.

4.2.8.1. *Brack's fishhook cactus*

The proposed lease sale has six proposed parcels that are within BLM FFO's mapped suitable habitat for this species. Of these six parcels, five parcels contain marginal to good habitat to support Brack's cactus. Approximately 215 acres (three parcels) of marginal to good habitat occurs on tribal trust lands. Approximately 190 acres (two parcels) of suitable habitat occurs on BLM FFO managed lands. The BLM FFO does not manage these tribal trust lands. Any proposed development on tribal trust lands would likely not have any protection measures (i.e. habitat avoidance).

Currently, the suitable habitat within the proposed parcel area is moderately fragmented, with no continuous habitat extending longer than 0.5 miles. The proposed action would undoubtedly increase the amount of habitat fragmentation, however, by proper planning and use of current technology, proposed well projects should be able to decrease fragmentation and other impacts to Brack's cactus habitat.

Further analysis would be conducted at the project level stage to further document potential impacts and apply the appropriate management to minimize or eliminate impacts. Overall, approximately 405 acres of suitable Brack's cactus habitat may be impacted by the proposed action. Of the 405 acres, approximately 190 acres would occur on BLM managed surface. Further analysis would be conducted at the project level stage to further document potential impacts and apply the appropriate management to minimize or eliminate impacts on BLM managed lands. Currently there is no management measures specific for Brack's cactus habitat on tribal trust lands.

Parcel 020 – This parcel area contains approximately 160 acres of good suitable Brack's cactus habitat on BLM administered lands. BLM GIS data show that the high habitat quality occurs in the east half of this proposed lease parcel. Approximately 23 acres within this parcel has been identified as an important conservation area by the Natural Heritage of New Mexico during their 2015 habitat survey. There is a likelihood that at least one well pad and associated pipeline, access road and power line are would constructed within this habitat area. Habitat loss and fragmentation would occur for any ground disturbing activity within the east half of this parcel. Loss of Brack's cactus habitat, including known individual cacti, would be the result by any proposed project activity in this habitat area. Project level biological surveys would be conducted to document any impacts to the habitat for this species.

Parcel 021 - This parcel area contains approximately 30 acres of marginal to good suitable Brack's cactus habitat on BLM administered lands. There is a likelihood that at least one well pad and associated pipeline, access road and power line would be constructed within this habitat area. Habitat loss and fragmentation would occur for any ground disturbing activity within the east half of this parcel. Loss of Brack's cactus habitat would be the result from any new ground-disturbing project activity in this habitat area. Project level biological surveys would be conducted to further document any impacts to the habitat for this species.

Parcel 018 - This parcel area contains approximately 50 acres of good suitable Brack's cactus habitat on IA lands. Habitat loss and fragmentation would occur for any ground disturbing activity within this proposed parcel. Loss of Brack's cactus habitat would be the result from any new ground-disturbing project activity in this habitat area. Project level biological surveys may be conducted to further document any impacts to the habitat for this species.

Parcel 029 - This parcel area contains approximately 115 acres of suitable Brack's cactus habitat (ranging from marginal to good habitat) on tribal trust lands. Habitat loss and fragmentation would occur for any ground disturbing activity within this proposed parcel. Loss of Brack's cactus habitat would be the result from any new ground-disturbing project activity in this habitat area. Project level biological surveys may be conducted to further document any impacts to the habitat for this species.

Parcel 030 - This parcel area contains approximately 50 acres of suitable Brack's cactus habitat (mostly marginal habitat) on IA lands. Habitat loss and fragmentation would occur for any ground disturbing activity within this proposed parcel. Loss of Brack's cactus habitat would be the result from any new ground-disturbing project activity in this habitat area. Project level biological surveys may be conducted to further document any impacts to the habitat for this species.

4.2.8.2. *Golden Eagles and Other Raptors*

The proposed analysis area contains nesting and foraging habitat for the golden eagle, peregrine falcon, prairie falcon, ferruginous hawk, and the burrowing owl. No known nests have been documented within the impact area of the proposed leases. There are no known nests for any other raptor within the proposed lease areas, however, nesting habitat exists. The BLM FFO has a policy that protects raptors from impacts from proposed projects. Due to the close proximity to the proposed lease and potential impacts from development, a 0.33- 0.5 mile protection buffer around raptors (depends on species and disturbance level) between Jan – July 31 to eliminate any impacts during the nesting season. Biological surveys and further analysis would be conducted at the project level stage to further document potential impacts and apply the appropriate management to minimize or eliminate impacts.

Due to the mobility of adult birds, it is unlikely that golden eagles would be directly harmed by the proposed project. Temporarily, noise and visual disturbances associated with proposed project construction could deter golden eagles from utilizing the proposed project area and immediate adjacent lands.

Parcels 031, 033, 034, 035– These four parcel areas are within three miles of an active golden eagle territory, the closest parcel being within 0.7 miles. Nesting habitat for ferruginous hawks and prairie falcons also exist within or in close proximity of the proposed lease parcels. Golden eagles, ferruginous hawks and prairie falcons commonly use these proposed parcel areas for foraging. There is a likelihood that several well pads and associated pipelines, access roads and power lines would be constructed within this foraging habitat area. Foraging habitat loss and fragmentation would occur for any ground disturbing activity within these parcels. Nesting stipulations would be applied to any proposed project to decrease any negative impacts to nesting raptor species. Biological surveys would determine the level of these management measures/stipulations, if any. Any stipulation(s) would be determined at the project level and would depend on the scope of the project, disturbance level, species type, timing of project, and nesting chronology.

Gunnison's prairie dog habitat is present within these proposed lease parcels. Burrowing owl nesting occurs within Gunnison's prairie dog burrows. Only one of these lease parcels (031) occurs on BLM FFO managed lands with the other three occurring on private surface. Burrowing owl timing stipulations (April 1 – August 15) would apply to any federal action that occurs within any of the proposed parcel. A biological survey would be required on BLM FFO managed lands. Management measures (if any) of any documented prairie dog colony and/or burrowing owl nest would be determined at the project level stage based on the biological survey.

Parcels 001, 002, 003, 004, 005, 006, 007– These seven parcel areas are within close proximity of cliffs, nesting and foraging habitat prairie and peregrine falcons, golden eagles and other raptors. There are no known nests that occur within or close to these parcels, however, surveys have not been conducted. There is a likelihood that several well pads and associated pipelines, access roads and power lines would constructed within these nesting/foraging habitat area. Foraging/nesting habitat loss and fragmentation would occur for any ground disturbing activity within these parcels. Nesting stipulations would be applied to any proposed project to decrease any negative impacts to nesting raptor species. Biological surveys would determine the level of these management measures/stipulations, if any. Any stipulation(s) would be determined at the project level and would depend on the scope of the project, disturbance level, species type, timing of project, and nesting chronology.

Gunnison's prairie dog habitat may present within these proposed lease parcels. Burrowing owl nesting occurs within Gunnison's prairie dog burrows. Three of these lease parcels (Parcels 005, 006, 007) occurs on BLM FFO managed lands with the other three occurring on private surface. Burrowing owl timing stipulations (April 1 – August 15) would apply to any federal action that occurs within any of the proposed parcel. A biological survey would be required on BLM FFO managed lands. Management measures (if any) of any documented prairie dog colony and/or burrowing owl nest would be determined at the project level stage based on the biological survey.

No other SSS are expected to be directly impacted by the action alternatives. Project specific analysis would be conducted on any new ground disturbing activity to eliminate or minimize impacts to any BLM sensitive species. Management measures, as written in the FFO Special Management Species policy, would apply to the proposed new lease parcels on BLM-administered lands.

4.2.8.3. *Migratory Birds*

All of the proposed parcels have suitable nesting habitat that would be impacted by oil and gas development. In general, no major or long-term effects on nesting migratory birds are anticipated from the proposed lease sale, however, certain species would be impacted due to loss of foraging and nesting habitat. Incidental mortality or displacement of migratory bird species is likely on a local scale due to construction disturbance. However, many birds in the local area would move into adjacent unoccupied habitat in response to habitat loss. Adult migratory birds would not likely be directly harmed by the proposed project because of their mobility and ability to avoid areas of human activity. Noise and visual

disturbances associated with project construction could temporarily deter this species from utilizing the proposed project area and immediate adjacent lands.

Vegetation removal associated with the proposed project would often occur outside the migratory bird breeding season (May 15–July 31). Any vegetation removal taking place within the proposed project area during the breeding season would likely be preceded by pre-construction nesting surveys to identify any occupied nests and establish avoidance buffers until the young have fledged. No eggs, nestlings, or active nests should be directly harmed by the proposed project between May 15 and July 31.

Site-specific analysis would be conducted to determine the impacts on migratory birds as proposed projects are submitted to the BLM. The BLM FFO bird policy requires migratory bird nest surveys for any proposed project (and related activities) with new disturbance from most oil and gas projects. The bird policy also has other protective measures to reduce bird risks once a project is completed (USDI 2013). Impacts to migratory birds would be reduced significantly with these management measures in place. However, not all impacts would be eliminated. Impacts such as habitat fragmentation and habitat loss would continue to impact birds and their habitat. The BLM FFO would apply BMPs to reduce impacts on migratory birds.

Examples of these BMPs can be found in the BLM FFO bird policy and the MOU between USFWS and BLM.

4.2.9. Wildlife

Removal of habitat features, including foraging, watering and security areas, directly affect the ability of many wildlife species to exist, including larger species like deer and elk. Should these leases be developed, the footprint of infrastructure, including roads, pads and pipelines would result in a measurable loss of habitat (Watkins et. al 2007). Invasion of competitive, non-palatable or noxious weed species can be exacerbated by removal of native vegetation, blading, pipeline construction, road building, or any other disturbances. These invasions can expand loss of habitat beyond directly disturbed areas.

Big game species have demonstrated varying degrees of avoidance around areas of energy development. The influence of each facility (e.g. well pad, road, pipeline) extends to surrounding areas. For mule deer, alert and flight reactions have been detected up to 0.3 mile from the source of disturbance, whereas habitat avoidance responses might extend to distances of 2.5-4.3 miles (Sawyer et al. 2009). Elk have exhibited zones of disturbance from 0.5-0.9 mile of disturbance (Riley et al. 2012). Extended zones of disturbance, reduced or increased by habitat and topography, has varying impacts on lost habitat and habitat fragmentation that results from facility development and activity levels. It is assumed that these impacts would be greatest during initial well drilling and completion activities and that impacts would decline as activity associated with production declines.

Animals that remain within developed, or increasingly developed areas, are subject to increased physiological stress and energy expenditures. Energy expenditures in response to disturbance are of greatest concern during winter months, when energy conservation is fundamental to survival and reproduction.

The assumed APE encompassed by the proposed parcels includes existing oil and gas infrastructure, including roads, well pads and pipelines. As densities of well pads, roads and facilities increases, habitat within and near well fields become progressively less attractive, sometimes correlating with reduced populations (Riley et al. 2012). The magnitude of existing direct and indirect effects would be exacerbated by each additional development. The duration of current, long-term impacts associated with current development and existing production facilities would be increased at the landscape scale with the inclusion of new developments. Impacts from the development of the proposed leases would be realized at the time of anticipated development. During development, impacts to wildlife can be measured in two ways; 1) direct impacts to wildlife habitat and 2) indirect impacts to wildlife caused by disturbance and

activity. Direct impacts to big game habitat include; acres of habitat (forage and cover) removed through construction of road, pipelines and well pads. Indirect impacts are species dependent and vary based on the type of disturbing activity, animal density, habitat quality and timing. The APE for big game habitat would include any proposed, current and reasonably foreseeable ground disturbing activities and the area wildlife are anticipated to avoid. The APE for indirect impacts includes the avoidance of heavily utilized roads, infrastructure, and development activities. In the FFO resource area, a study is being conducted to determine the avoidance area and timing for oil and gas development. Preliminary data has shown that mule deer avoid and shift habitat use by approximately 400 meters during construction, drilling and completion activities (Sawyer 2017 Pers. Com.). This could not be quantified at the leasing level, but would be addressed at a site-specific level when the amount of surface disturbance, timing, animal density, and type of development activity is determined. Specific mitigation may be included in the Biological Survey Report or developed at the time of the onsite for proposed projects if warranted.

4.2.10. Water Resources

4.2.10.1. *Surface Water*

The infrastructure associated with the Proposed Action (well pads, roads, pipelines, etc.) may result in disturbance to jurisdictional watercourses through the alteration of topography and the crossing of waterways. Surface water features and drainages would first be avoided by the proposed projects as much as practicable. However, in situations where avoidance is not practicable in lieu of other resources, the following would apply. Drainage diversions would be utilized to route water around long-term infrastructure to maintain local drainage patterns. Culverts would be used to maintain cross-drainage for proposed access roads. These culverts would have the appropriate capacity and would be placed as needed to prevent damming or obstruction of the natural water course from road construction. Disturbance within waterways from pipeline disturbance would be temporary and the bed and bank of the watercourses would be replaced back to preconstruction condition upon installation of the well-connect pipelines. As such, it is not likely that permanent fills to these drainages would result from construction and installation of future proposed projects.

Exposure of soils, particularly on slopes, would lead to an increase in an undetermined amount of sediment transport, particularly during and following storm events. Alteration in drainage patterns may also lead to an increase in sediment transport. These increases in sediment transport may persist for several years until the disturbed soils are stabilized. The potential for sediment transport into the drainages would be minimized through the implementation of erosion-control measures and reclamation for site specific projects.

Proposed projects would be designed to avoid discharge into any watercourse that may be potentially USACE jurisdictional and would not result in the loss of greater than ½ acre of waters of the U.S. As such, disturbance would likely be covered under the USACE Nationwide Permit program or would be permitted under an individual permit through the USACE as necessary. Most access road crossings would meet the requirements to be covered under the USACE Nationwide Permit #14 (Linear Transportation Projects) and proposed well-connect pipeline crossings would meet the requirements to be covered under Nationwide Permit #12 (Utility Line Activities). The BLM project Lead would send site-specific Army Corp Pre-Jurisdictional Determination letters requesting concurrence from the USACE for any jurisdictional waterway impacted.

4.2.10.2. *Groundwater*

The producing zones of the proposed oil and gas lease sale could vary from shallower coalbed methane reserves to deeper oil and gas reserves located in sandstones and siltstones that are encased or surrounded both horizontally and vertically by the impermeable Mancos Shale interval. The Mancos Shale interval is over 2,000 feet thick and below any underground sources of drinking water. The Mancos Shale formation

is in itself a barrier to fluid migration and is also overlain by other continuous confining layers. There are two geological confining layers, the Lewis Shale and the Kirtland Shale formations, that are located above the Mancos Shale and Mesaverde formations. The Lewis Shale (up to 2,000 feet thick) and the Kirtland Shale (up to 1,500 feet thick) are impermeable layers that isolate the Mancos Shale and Mesaverde formations from both identified sources of drinking water and surface water. On average, total depth of proposed well bores in the Basin Mancos formation would be about 5,000 feet below the ground surface. Current fracturing in the Basin Mancos formation is not expected to occur above depths of 4,000 feet below the ground surface. Fracturing is not likely to extend into the Mesaverde formation from the lower portion of the Basin Mancos formation because of its depth and high relative levels of total dissolved solids. Coalbed methane reserves are typically at shallower depths (less than 2,000 feet below the ground surface) throughout the San Juan Basin. Development of coalbed methane resources is dependent upon the removal of water within the Fruitland formation to reduce pressure and allow methane molecules to detach from the surrounding coal matrix. Coalbed methane formation water is at times pumped for livestock use.

Fracturing and other well-stimulation techniques vary across the San Juan Basin depending on the type of well. Water and sand typically make up 98% to 99% of the composition of fracking fluid, with chemical additives comprising the remaining 1% to 2% (EPA 2004, GWCP 2009, EPA 2016d). Chemicals added to fracking fluids may include friction reducers, surfactants, gelling agents, scale inhibitors, acids, corrosion inhibitors, antibacterial agents, and clay stabilizers (GWCP 2009); and may vary depending on company preference, source water quality, site specific characteristics of the target geological formations, and the type of well. Nitrogen may be used in place of water in more oil-prone areas and water-based fluids may be used in more gas-prone areas.

Potential impacts to groundwater resources would vary depending on the type of oil and gas reserves developed. These impacts could include groundwater depletion and contamination or cross-contamination of aquifers during the drilling and completion phases, among others. Contamination of groundwater resources could occur from a mechanical or integrity failure of the well or by an undesired migration of gases or liquids within targeted or adjacent geologic formations. Mechanical integrity failures of a well are typically associated with problems with the well casing and cement quality. Failures of this nature could also allow hydraulic fracturing fluid to migrate outside of the targeted formations that would be hydraulically fractured.

Water for any oil and gas development activities would be sourced in compliance with all federal and state laws and regulations. The 2014 RFD for the BLM FFO estimated that recent horizontally drilled wells within the Mancos/Gallup formations of the San Juan basin each used approximately 1,020,000 gallons of water on average (3.13 acre feet). The BLM FFO's casing, cementing, and inspection requirements would limit the potential for groundwater resources to be impacted by hydraulic fracturing operations. The casing program and cement specifications would be submitted to the BLM and NMOCD for approval to ensure that well construction design would be adequate to protect the subsurface environment, including potential risks identified by the geologist and all known or anticipated zones with potential risks. Surface casing would be set to an approved depth, and the casing and cementing would stabilize the wellbore and provide protection to any overlying freshwater aquifers by isolating hydrocarbon zones from overlying freshwater aquifers. Before hydraulic fracturing takes place, all surface casings and intermediate zones are required to be cemented from the bottom of the cased hole to the surface. The cemented well would be pressure tested to ensure there are no leaks and a cement bond log is run on certain strings to confirm the cement has bonded to the steel casing strings and to the surrounding formations. Prior to approving an APD, a BLM geologist would identify 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.

Saltwater disposal wells are also subject to the specifications and COAs mentioned above, such as having the correct casing, cementing, and pressure testing, to protect groundwater formations. The NMOCD regulates and monitors underground injection wells. Produced water would be disposed of at regulated and permitted commercial facilities subject to COAs and the aforementioned BMPs to prevent contamination of aquifer.

CHAPTER 5. CUMULATIVE IMPACTS

The NMSO manages approximately 41 million acres of Federal mineral estate. Of the 41 million acres, 35 million acres are available for oil and gas leasing. Approximately 15 percent of the 35 million acres of federal oil and gas mineral ownership in New Mexico is currently leased (79 percent of the leases are in production and 78 percent of the lease acres are in production), as shown in Table 25. The NMSO received 35 parcel nominations (6,792.440 acres) for consideration in the March 8, 2018, Competitive Oil and Gas Lease Sale, and is proposing to lease 25 (4,434.370 acres)(Table 26). If these 25 parcels were leased, the percentage of Federal minerals leased would not significantly change, as shown in Table 27, since several leases in the San Juan Basin have already expired and others would expire this calendar year under their primary term.

Table 25. Actual - Acres of Federal Minerals/Acres Available/Acres Leased.

State	Federal Oil and Gas Mineral Ownership	Acres Available	Acres Leased	Percent Leased
Kansas	744,000	614,586	119,154	19%
New Mexico	34,774,457	29,751,242	4,355,252	15%
Oklahoma	1,998,932	1,668,132	201,167	12%
Texas	3,404,298	3,013,207	367,094	12%
Totals/Average	40,921,687	35,047,167	5,042,667	14%

Table 26. Parcels Nominated and Offered in the March 2018 Oil and Gas Lease Sale.

Field Office	Number of Nominated Parcels	Acres of Nominated Parcels	Number of Parcels to be Offered	Acres of Parcels to be Offered
Farmington	35	6792.440	25	4,434.370

Table 27. Foreseeable - Acres of Federal Minerals/Acres Available/Acres Leased.

State	Federal Oil and Gas Mineral Ownership	Acres Available	Acres Leased	Percent Leased
Kansas	744,000	614,586	119,154	19%
New Mexico	34,774,457	29,751,242	4,355,252	15%
Oklahoma	1,998,932	1,668,132	201,167	12%
Texas	3,404,298	3,013,207	367,094	1% 12%
Totals/Average	40,921,687	35,047,167	5,042,667	1% 14%

The cumulative impacts fluctuate with the gradual reclamation of well abandonments and the creation of new additional surface disturbances in the construction of new access roads and well pads. The on-going process of reclamation of abandonments and creating new disturbances for drilling new wells gradually accumulates as the minerals are extracted from the land. Conserving as much land as possible and applying appropriate mitigation measures would alleviate the cumulative impacts. Appendix D outlines a number of lease stipulations that can be used to alleviate cumulative impacts.

5.1. 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 (BLM 2017).

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 EPA.

Combustion of produced oil and gas – it is expected that operations would 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 BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science.

The BLM does not have the ability to directly associate a BLM 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 (see also Section 4.2.3, Uncertainties of GHG Calculations). When further information on the effect to climate change is known, such information would be incorporated in the BLM’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 EPA provides links to statewide GHG emissions inventories (EPA 2015). Guidelines for estimating project-specific GHG emissions are available (BLM 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 BLM 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, COAs, and BMPs, as described earlier in this EA, would help to minimize the potential for significant adverse cumulative effects.

5.1.1. 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.

5.1.2. 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. In 2010, estimated worldwide emissions from human activities totaled nearly 46 billion metric tons of greenhouse gases, expressed as carbon dioxide equivalents (EPA 2017c). The San Juan basin is estimated to emit 2,550,325 metric tons annually which equate to 0.005 percent of the global emissions. The potential development of this lease sale could result in an estimated increase of 10,805.4 metric tons of greenhouse gases which equates to 0.00002 percent of the global emissions.

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 (EPA 2017b).

5.2. Heritage/Archaeological Resources

The Proposed Action Alternative undertaking area lies within four generalized cultural resources analysis units, based on natural 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 NMCRIS database. These analysis units, MSJ, WBC, ECU, and GU, are defined under Section 3.2.3 above.

The four analysis units encompass 1,518,793 acres. Based on NMCRIS data (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 average overall site density of one site recorded for every 17.6 acres of Class III inventory (1:17.6) although site density varies between 1:16.6 acres to 1:21.4 acres across the analysis units. Approximately 68.2 percent of the sites (n≈3226 of 4732 sites with detailed eligibility data) are historic properties or potentially eligible for the NRHP. The 93 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 CCNHP, Chaco Protection Sites, and portions of the Chaco Culture UNESCO World Heritage property.

- What impacts would surface disturbance for the proposed action have on historic properties in the analysis area?

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 would be identified and addressed during site-specific analyses for future associated developments. In some instances, the application of visual resource management prescriptions equivalent to VRM Class II management may be necessary to achieve a weak contrast rating and avoid adverse effects to historic properties susceptible to indirect effects or to avoid significant impacts to important cultural resources other than historic properties.

- What impacts would the project have on unknown (buried, not visible) historic properties in the analysis area?

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 BLM FFO. Between Fiscal Year (FY) 2000 and FY2016, 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. Given the Proposed Action's cumulative anticipated surface disturbance of 368.52 acres, no discoveries are expected during full development of the parcels and more than one discovery is highly unlikely. All authorizations (e.g. APDs, ROWs) have COAs or ROW stipulations, under penalty of law, requiring the reporting of and avoidance of further disturbing cultural discoveries during a proposed action. 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.

5.3. Socioeconomics and Environmental Justice

There are previously existing oil and gas facilities in the area of the parcels, in addition to the ROWs resulting from resource extraction. Parcels located in the general area occupied by Navajo residents

include parcels 013, 014, 017, 018, 020, 021, 029 and 030. The nearby Navajo Chapter Houses include Counselor, Ojo Encino, Torreon, and Nageezi.

Continued oil and gas development has the potential to increase road traffic in general, affecting traffic safety, water quality, visual resources and air quality. In past lease sales in these areas the BLM received comments both from individual allottees in favor of the proposed lease sale for economic reasons, and from the Chapter Houses asking that no more lease sales be held due to potential negative impacts.

Due to the use of ROW stipulations, BMPs, and COAs any additional impacts are expected to be minimal, and the exact location of any additional impacts cannot be determined until a site-specific application for development is received.

5.4. 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 VRI 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 VRM-RMPA. 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 making 25 parcels available for lease. 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. Regardless of VRM classification, management prescriptions equivalent to those associated with VRM II may be required to avoid adverse effects to nearby cultural resources sensitive to indirect effects or impacts. Cumulatively these developments could change the overall character of the VRM classification. The No Action alternative would not contribute any cumulative impacts.

CHAPTER 6. SUPPORTING INFORMATION

This section includes individuals or organizations from the public, external agencies, and the interdisciplinary team (Table 28) contacted during the development of this document.

Table 28. List of Preparers.

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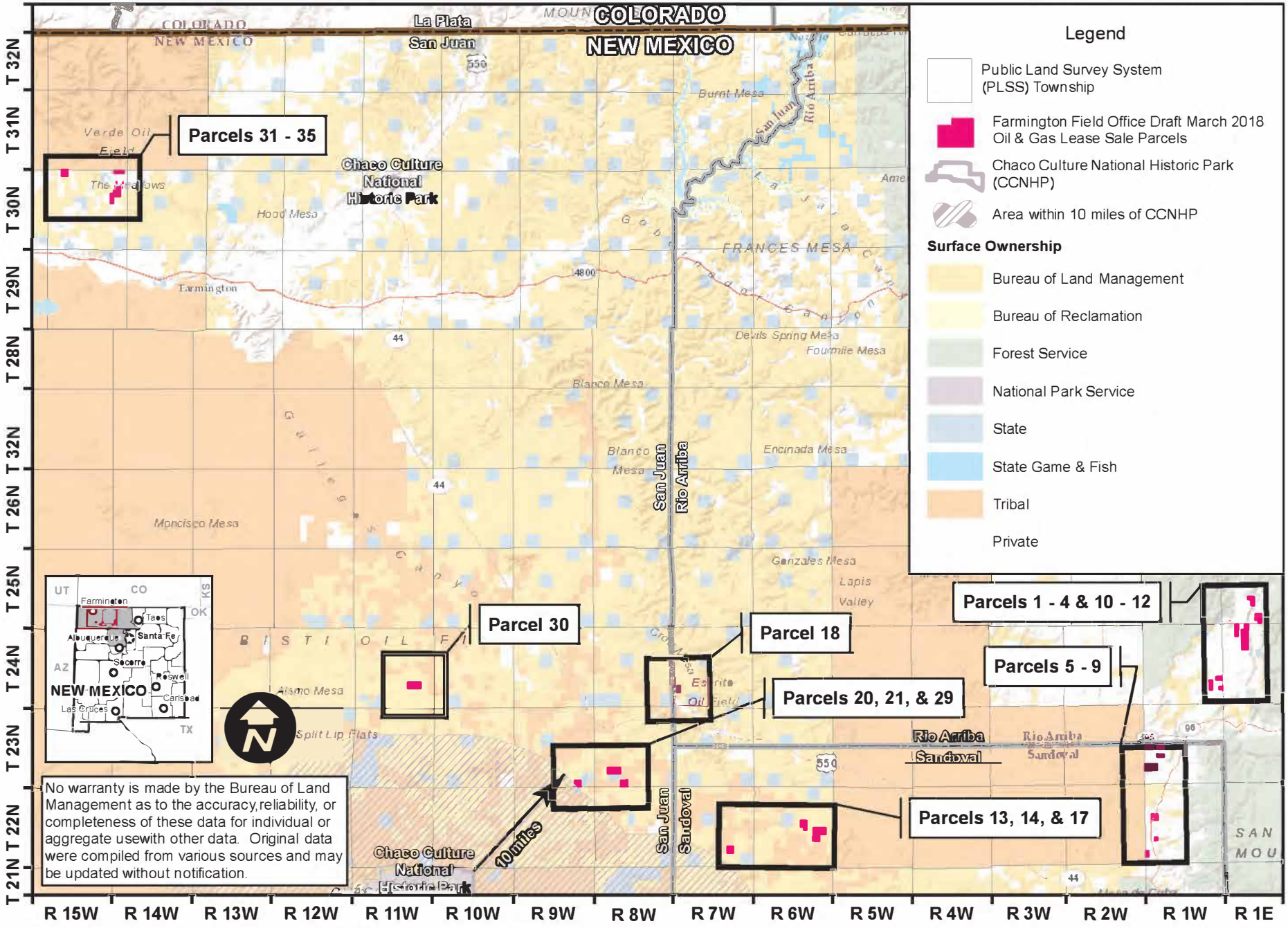
Appendix A. Maps

Nominated Parcels 15, 16, 19, and 22 - 28 have been removed from consideration by the BLM for this lease sale.

Farmington Field Office Draft March 2018 Oil & Gas Lease Sale Parcels

Revised 12/5/2017 - Parcels 29 and 35 Corrections

NAD83 UTM Zone 13 Projection



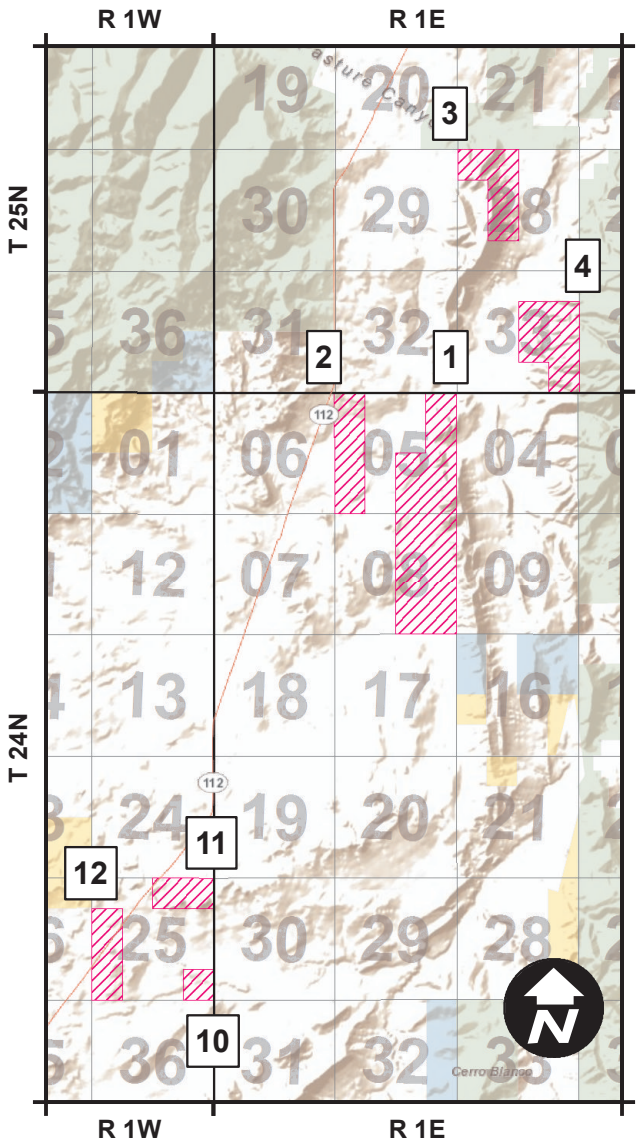
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate usewith other data. Original data were compiled from various sources and may be updated without notification.

Sources: Esri Service Layer: DeLorme, USGS, NPS, NOAA
BLM NM Ownership as of 12/5/2017
PLSS: Cadastral National Spatial Data Infrastructure (CadNSDI), Version 2

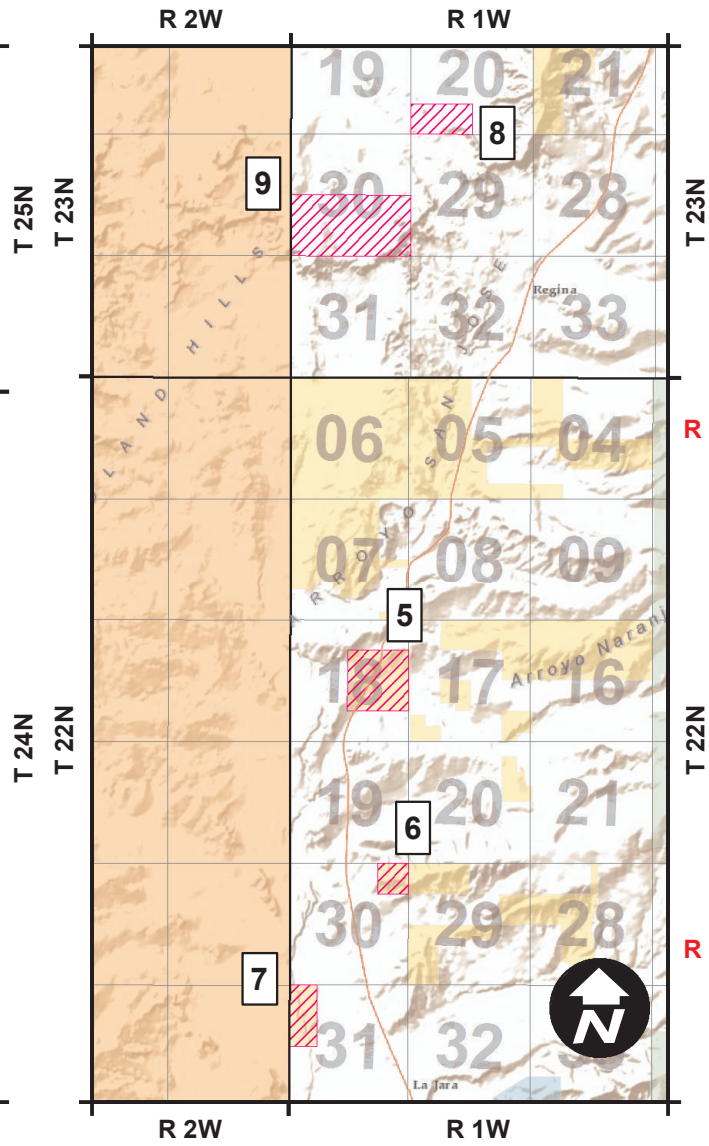
0 3 6 12 18 24 30 Miles

Scale 1 in = 10 miles (1:633,600)

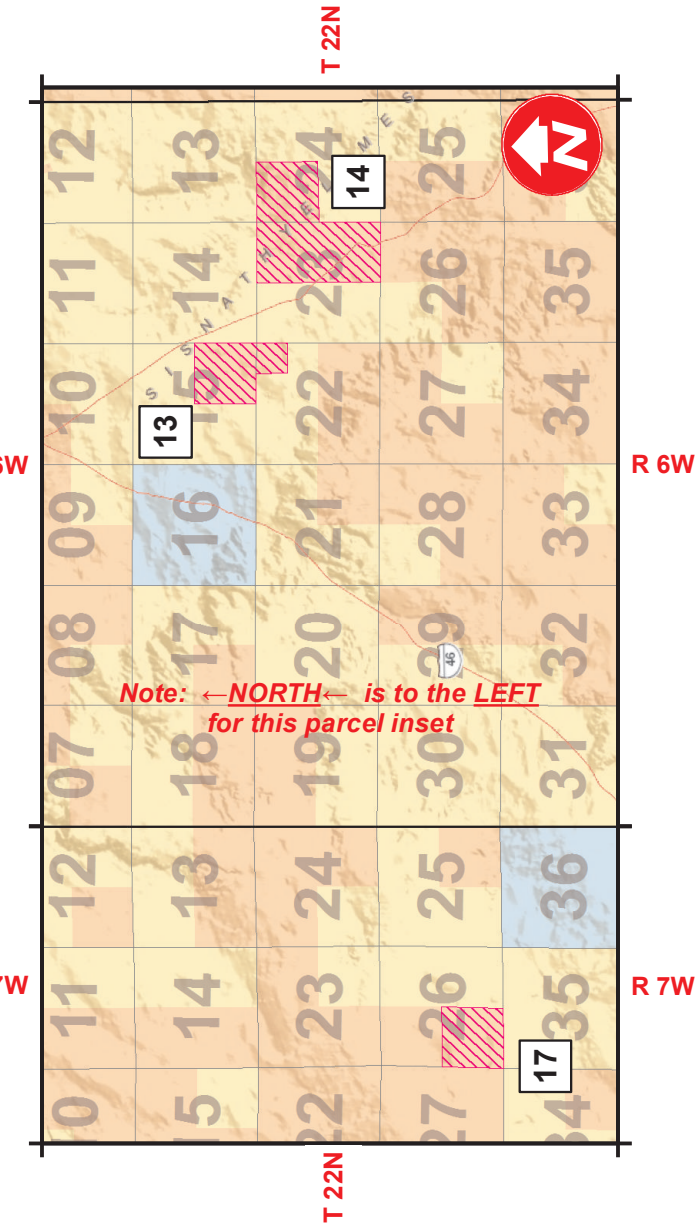
12/5/2017 MAD



Parcels 1 - 4 & 10 - 12



Parcels 5 - 9



Parcels 13, 14, & 17

Revised 12/05/2017
Parcel 15 Removed

Legend

- Public Land Survey System (PLSS) Township
- Public Land Survey System (PLSS) Section
- Farmington Field Office Draft March 2018 Oil & Gas Lease Sale Parcels
- Area within 10 miles of CCNHP

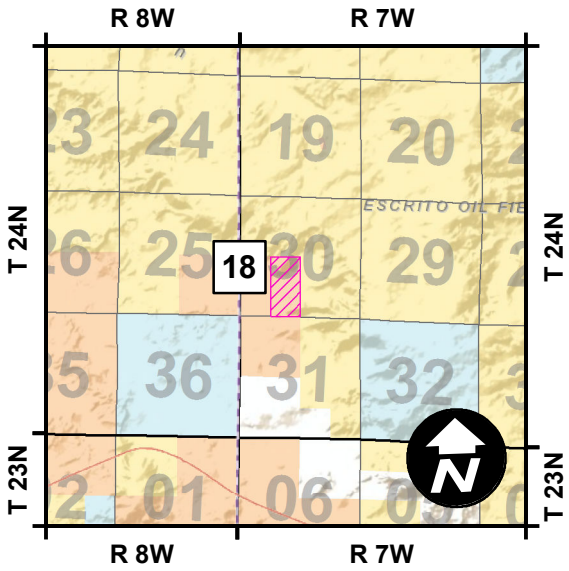
Surface Ownership

- Bureau of Land Management
- Bureau of Reclamation
- Forest Service
- National Park Service
- State
- State Game & Fish
- Tribal
- Private

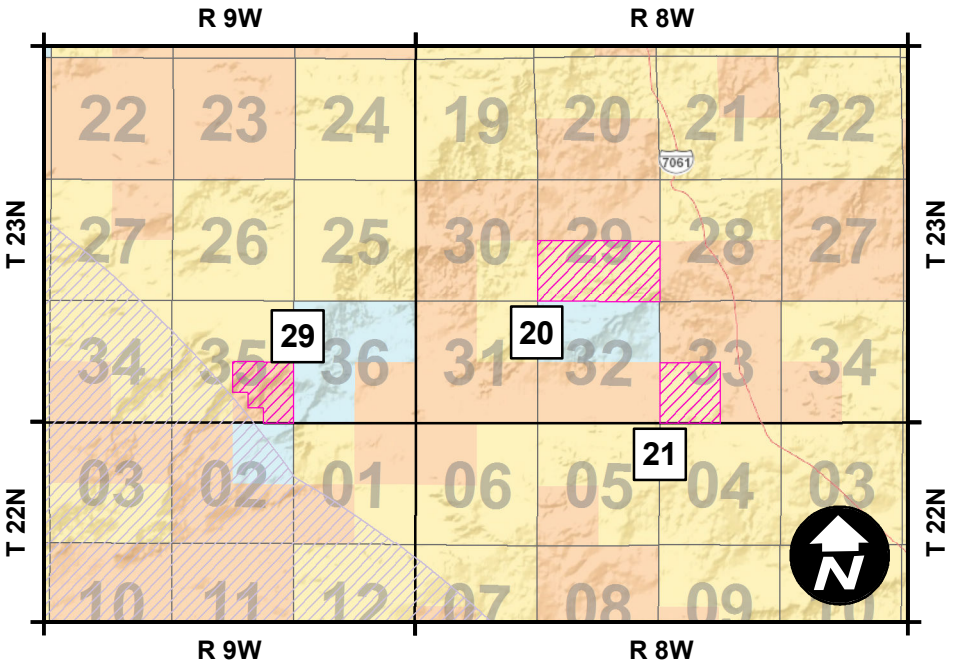
Scale 1:100,000

0 0.5 1 2 3 4 5 Miles

NAD83 UTM Zone 13 Projection

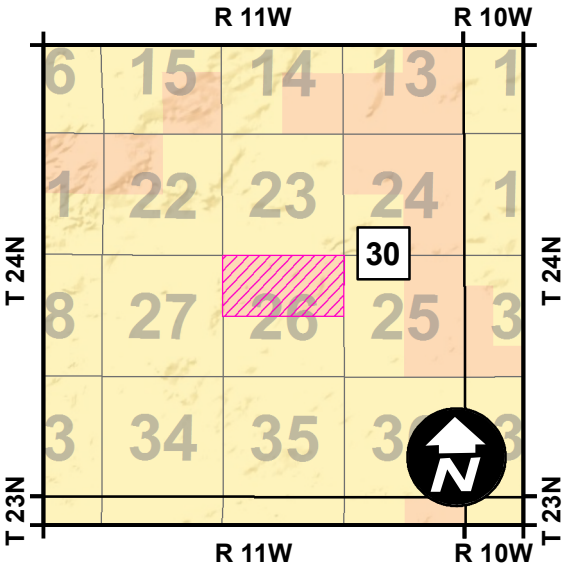


Parcel 18

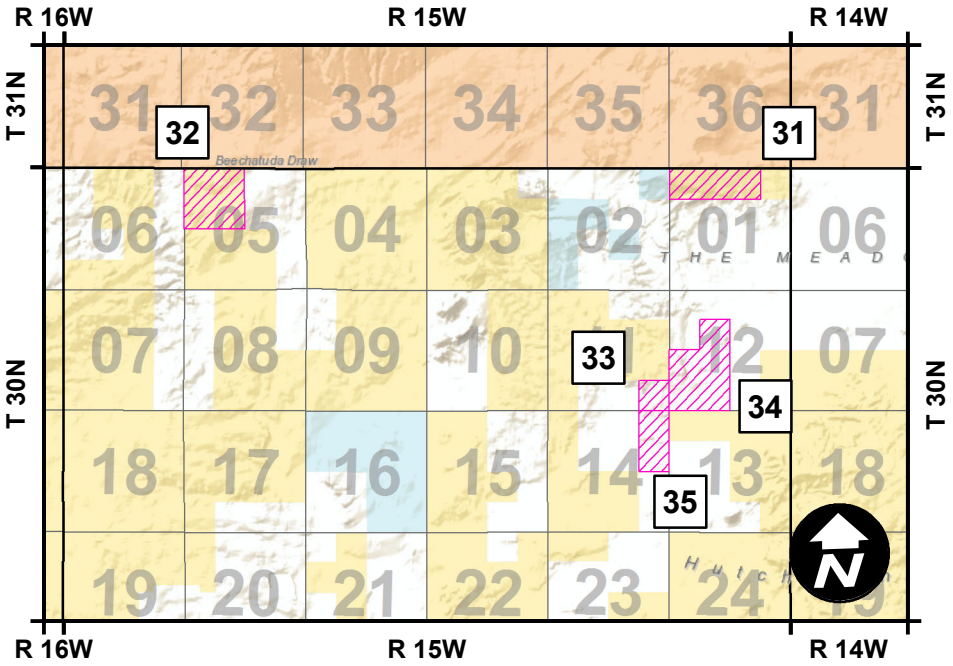


Parcels 20, 21, & 29

Revised 8/28/2017
Parcel 29 Correction



Parcel 30



Parcels 31 - 35

Revised 9/21/2017
Parcel 35 Correction

Revised 8/28/2017
Parcel 16 Removed

Legend

- Public Land Survey System (PLSS) Township
- Public Land Survey System (PLSS) Section
- Farmington Field Office Draft March 2018 Oil & Gas Lease Sale Parcels
- Area within 10 miles of CCNHP

Surface Ownership

- Bureau of Land Management
- Bureau of Reclamation
- Forest Service
- National Park Service
- State
- State Game & Fish
- Tribal
- Private

Scale 1:100,000

0 0.5 1 2 3 Miles

NAD83 UTM Zone 13 Projection

Appendix B. Interdisciplinary Team Checklist

RESOURCES AND ISSUES CONSIDERED (Includes Supplemental Authorities Appendix 1 H-1790-1)

Project Title: Farmington Oil and Gas Lease Sale, March 2018

NEPA Log Number: DOI-BLM-NM-0000-2017-0006-EA

File/Serial Number: 3100

Project Leader: Mark Ames and Katie White Bull

Determination of Staff: (Choose one of the following abbreviated options for the left column)

NP = not present in the area impacted by the proposed or alternative actions

NI = present, but not affected to a degree that detailed analysis is required

PI = present with potential for relevant impact that need to be analyzed in detail in the EA

NC = (DNAs only) actions and impacts not changed from those disclosed in the existing NEPA documents cited in Section D of the DNA form. The Rationale column may include NI and NP discussions.

Determination	Resource/Issue	Rationale for Determination	BLM Reviewer & Date
PI	Air Quality	See Chapters 3 & 4 for analysis	Whitney 08/16/2017
NI	Soils - Physical / Biological	See Section 1.6 for discussion.	Whitney 08/16/2017
PI	Watershed Hydrology , Surface and Ground Water Quality	See Chapters 3 & 4 for analysis	Whitney 08/16/2017
NI	Waters of the US	The administrative action of leasing the proposed parcels would not have a direct impact on Waters of the US. In the event that any roads or well pads affect any Waters of the US during the development of the proposed lease parcels, the BLM will consult with the US Army Corps of Engineers.	Whitney 08/16/2017
PI	Archaeological Resources	Archaeological Resources and Native American Religious Concerns: See Chapters 3 & 4 for analysis	Geoffrey Haymes 08/18/2017
NI	Designated National Trails	Designated National Trails: The Old Spanish Trial represents an important 19th century overland trade route between historically Spanish settlements in New Mexico and California. The Armijo Route, a corridor representing the path of an 1829 expedition that contains no known physical traces or associated historic properties, is the only portion passing through FFO. Five parcels are within 3 miles of the designated Armijo Route (008, 009, 010, 011, 012) and 4 (excepting 010) are partially or wholly visible from this route. There is a negligible potential for developments on parcels 008, 009, 010, 011, and 012 to introduce new, significant impacts that substantially interfere with the nature and purpose of the Old Spanish Trail. Though	Geoffrey Haymes 08/18/2017

Determination	Resource/Issue	Rationale for Determination	BLM Reviewer & Date
		no Comprehensive Management Plan created pursuant to PL 90-543 and conforming with NEPA exists for the Old Spanish NHT, this area was excluded from the possible high-potential route segments identified in the 2016 Comprehensive Administrative Strategy developed by NPS and BLM-Utah.	
PI	Native American Religious Concerns	Archaeological Resources and Native American Religious Concerns: See Chapters 3 & 4 for analysis	Geoffrey Haymes 08/18/2017
NI	Geologic Specially Designated Area (SDA)	See Section 1.6 for discussion.	Anthony Gallegos 08/14/2017
PI	Environmental Justice	See Chapters 3 & 4 for analysis	Mark Ames 08/17/2017
NI	Public Health and Safety	The lease sale would not create any immediate issues to public health or safety. This would be analyzed during future development of the leases on a case-by-case basis.	Mark Ames 08/17/2017
PI	Socio-Economics	See Chapters 3 & 4 for analysis	Mark Ames 08/17/2017
PI	Fluid Minerals / Energy Production	See Chapters 3 & 4 for analysis	Eric Creeden 08/15/2017
NI	Forestry/Fuelwood	Forestry - See Section 1.6 for discussion. Fuelwood - Proposed parcels would still be available for dispersed fuelwood gathering. Site-specific projects that may impact fuelwood resources would have appropriate COAs applied when needed to make fuelwood available to the public. See section 3.1.	Katie White Bull Jeff Tafoya 11/29/2017
NP	Fuels/Fire Management	Fuels and fire management would not be impacted by leasing.	Katie White Bull 08/08/2017
NP	Geology / Solid Minerals	There are no existing geological/solid mineral resources known to conflict with the proposed lease area. Further analysis, if necessary, would be performed at the APD phase.	Anthony Gallegos 08/14/2017
NI	Recreation	There would be no effect on recreation because the area is all classified as dispersed recreation with no designated recreation areas.	Doug McKim
NP	Special Recreation Management Area (SDA)	Proposed parcels are outside designated SRMA's	08/03/2017
NI	Travel and Travel Management	Analysis would be done at APD/ROW phase.	Doug McKim
PI	Night Skies	See Chapters 3 & 4 for analysis	Stanley Allison
PI	Visual Resources	See Chapters 3 & 4 for analysis	08/15/2017
NP	Lands with Wilderness Characteristics	Proposed parcels do not contain any Lands with Wilderness Characteristics.	Stanley Allison
NP	Wilderness Areas (SDA)	Proposed parcels are outside designated Wilderness.	08/15/2017
NP	Wilderness Study Areas (SDA)	Proposed parcels are outside Wilderness Study Areas.	Stanley Allison
NI	Lands/Access /Realty	See section 1.6 of the EA. Leasing would be subject to all valid pre-existing rights. Any proposals for future projects within the	Scott Hall 08/08/2017 Katie White Bull

Determination	Resource/Issue	Rationale for Determination	BLM Reviewer & Date
		oil and gas lease area would be reviewed on a site-specific basis when an application for a ROW is received by this office.	11/29/2017
NI	Livestock Grazing/Rangeland Health Standards	Leasing parcels would not impact livestock grazing and Rangeland Health Standards nor would it affect wetlands /riparian areas, water quality, desirable species or soil productivity. Any activity that involves surface disturbance or direct resource impacts would have to be authorized as a lease operation through future NEPA analysis at the APD stage.	Marcus White Bull 08/08/2017
NI	Noise	The lease sale would not create any immediate issues to noise. This would be analyzed during future development of the leases on a case-by-case basis.	Mark Ames 08/16/2017
NI	Paleontology	See section 1.6 of the EA	Sherrie Landon 08/11/2017
PI	Plants- Threatened, Endangered, Proposed, or Candidate, BLM Sensitive	See Chapters 3 & 4 for analysis	John Kendall 11/21/2017
PI	Animals- Threatened, Endangered, Proposed, or Candidate, BLM Sensitive (including Migratory Birds)	See Chapters 3 & 4 for analysis	John Kendall
NI	Upland Vegetation	Leasing parcels would not impact upland vegetation. Any activity that involves surface disturbance or direct resource impacts would have to be authorized as a lease operation through future NEPA analysis, on a case-by-case basis, at the APD stage.	11/21/2017
NI	Invasive Plants / Noxious Weeds	Invasive and noxious weeds invade disturbed sites and in the event noxious weeds are discovered at any time during the life of the project, treatment options identified during the site specific development at the APD stage would be deferred to. BMPs would be incorporated into the COAs of an approved APD.	Heather Perry 08/14/2017
NP	Research Natural Areas (SDA)	Not present within the proposed project area.	John Kendall 08/15/2017
NP	Riparian Areas and River Tracts (SDA)	There are no River Tracts or Ephemeral Wash SDAs within any of the lease parcels.	Craig Townsend 08/14/2017
NI	Streams, Wetlands, Floodplains	There are no streams or wetlands within the lease sale parcels. There are FEMA drawn floodplains. These areas are granted protection under the Clean Water Act, if proven to have significant nexus to a Navigable Waters of the US. Incorporated by reference are objective, management actions, and mitigation measures addressing wetlands, floodplains, and water in the RMP (p 2-20 to 2-22 and 2-32 to 2-33).	Craig Townsend 08/14/2017
NP	Wild and Scenic Rivers (SDA)	The FFO Office does not contain any rivers considered to be Wild and Scenic.	Craig Townsend 08/14/2017
NP	Wastes (hazardous/solid)	No hazardous or solid wastes would be produced as a part of the leasing process; therefore wastes would not	Katie White Bull 08/07/2017

Determination	Resource/Issue	Rationale for Determination	BLM Reviewer & Date
		be analyzed in the EA.	
NI	Water Rights	Leasing parcels would not impact water rights. Any activity that involves surface disturbance or direct resource impacts would have to be authorized as a lease operation through future NEPA analysis, on a case-by-case basis, at the APD stage.	John Kendall 08/15/2017
NP	Wild Horse and Burros	There are no Wild Horse Herd Management Areas within the proposed project area per GIS and the RMP.	Marcus White Bull 08/08/2017
NP	Wildlife Areas (SDA)	One parcel on lands administered by BLM is located within the Carracas Mesa Recreation/Wildlife Area (120.000 acres). The RMP prescribes that the Carracas Mesa Recreation/ Wildlife Area is closed to new oil and gas leasing. Therefore, this parcel is not in conformance with the RMP and will not be considered in this document. See Section 2.3 of the EA.	Craig Townsend 08/14/2017
PI	Wildlife-Non-USFWS Designated and Fish	See Chapters 3 & 4 for analysis	Craig Townsend 08/14/2017

Construction Activities

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

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

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

Drilling Operations

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

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

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

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

Completion Operations

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

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

Hydraulic Fracturing

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

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

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

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

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

Before operators or service companies perform a hydraulic fracturing treatment, a series of tests is performed. These tests are designed to ensure that the well, casing, well equipment, and fracturing equipment are in proper working order and would 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 groundwater 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 aboveground structures not subject to safety considerations are painted a standard BLM environmental color or as landowner specified.

Workovers may be performed multiple times over the life of the well. Because 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 1, Table 1 includes some of the common wastes (hazardous and non-hazardous) that are produced during oil and gas development.

APPENDIX C, TABLE 1. COMMON WASTES PRODUCED DURING OIL AND GAS DEVELOPMENT.

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

Hydraulic Fracturing

Figure 1. Typical chemical additives used in fracturing fluids.

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

Chemicals serve many functions in hydraulic fracturing, from limiting the growth of bacteria to preventing corrosion of the well casing. Chemicals are needed to insure the hydraulic fracturing job is effective and efficient. The fracturing fluids used for shale stimulations consist primarily of water but also include a variety of additives. The number of chemical additives used in a typical fracture treatment varies depending on the conditions of the specific well being fractured. A typical fracture treatment will use very low concentrations of between 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 radium226 and radium228, can be brought to the surface in drill cuttings and produced water. Radon222, a gaseous decay element of radium, can come to the surface along with the shale gas. When NORM is brought to the surface, it remains in the rock pieces of the drill cuttings, remains in solution with 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 D. Farmington Field Office Lease Stipulation Summary

Stipulation	Description/Purpose
F-1-TLS	TIMING LIMITATION STIPULATION IMPORTANT SEASONAL WILDLIFE HABITAT-RAPTOR No surface use is allowed during the following time period. This stipulation does not apply to operation and maintenance of production facilities. From March 1 to June 30. On the lands described below: For the purpose of: Protection of important seasonal wildlife habitat (bird of prey nests) If circumstances or relative resource values change or if it can be demonstrated that oil and gas operations can be conducted without causing unacceptable impacts, this stipulation may be waived, excepted, or modified by the BLM Authorized Officer, if such action is consistent with the provisions of the Farmington Resource Management Plan, or if not consistent, through a land use plan amendment and associated National Environmental Policy Act analysis document. If the BLM Authorized Officer determines that the waiver, exception, or modification shall be subject to a 30-day public review period. Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes.
F-4-TLS	TIMING LIMITATION STIPULATION IMPORTANT SEASONAL WILDLIFE HABITAT No surface use is allowed during the following time period. December 1 through March 31 In addition, no surface use is allowed during the following time period to accommodate the migration of big game within the Lajara and Regina migration route. November 15 through March 31 This stipulation does not apply to operation and maintenance of production facilities. On the lands described below: For the purpose of: Protection of important wildlife habitat (big game winter range). If circumstances or relative resource values change or if it can be demonstrated that oil and gas operations can be conducted without causing unacceptable impacts, this stipulation may be waived, excepted, or modified by the BLM Authorized Officer, if such action is consistent with the provisions of the Farmington Resource Management Plan, or if not consistent, through a land use plan amendment and associated National Environmental Policy Act analysis document. If the BLM Authorized Officer determines that the waiver, exception, or modification shall be subject to a 30-day

Stipulation	Description/Purpose
	public review period. Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes
F-6-VRM	VISUAL RESOURCE MANAGEMENT CLASS II OBJECTIVES SPECIAL STIPULATION Surface occupancy or use is subject to the following operational constraints: Surface activities in this parcel are subject to Visual Resource Management (VRM) Class II restrictions as set forth in BLM Manual 8400 – Visual Resource Management. The leaseholder is required in any surface activity to retain the existing character of the landscape. Activities may be visible, but should not attract the attention of the casual viewer. This will require additional mitigation methods such as low profile tanks, special painting stipulations, site placement, directional drilling and/or any other measures necessary to meet VRM Class II objectives. The need for additional mitigation to meet VRM Class II will be determined on a case-by-case basis for each proposed well. For the purpose of: Protecting Visual Resources
F-7-VRM	VISUAL RESOURCE MANAGEMENT CLASS III OBJECTIVES SPECIAL STIPULATION Surface occupancy or use is subject to the following operational constraints: Surface activities in this parcel are subject to Visual Resource Management (VRM) Class III restrictions as set forth in BLM Manual 8400 – Visual Resource Management. The leaseholder is required in any surface activity to partially retain the existing character of the landscape. Activities may attract attention, but should not dominate the view. This may require additional mitigation methods such as special painting stipulations, site placement, and/or any other measures necessary to meet VRM Class III objectives. The need for additional mitigation to meet VRM Class III will be determined on a case-by-case basis for each proposed well. For the purpose of: Protecting Visual Resources
F-9-CSU Paleo	CONTROLLED SURFACE USE STIPULATION PALEONTOLOGY Surface occupancy or use is subject to the following special operating constraints: Restrict vehicles to existing roads and trails and require a paleontological clearance on surface disturbing activities.
F-23-NSO	NO SURFACE OCCUPANCY STIPULATION BEECHATUDA TONGUE No surface occupancy or use is allowed on the lands described below: For the purpose of: The Beechatuda Tongue of the Cliff House Sandstone is a rock stratigraphic unit mapped in, and named for, Beechatuda Draw in T. 30 N., R. 15 W., Section 5: NW¼. This area is the type locality for the unit. As such, it is of interest to scientists and educators as a site for comparison and study of the unit, and for possible

Stipulation	Description/Purpose
	further refinement of the stratigraphic nomenclature. It is important that the unit be preserved intact to allow these studies. If circumstances or relative resource values change or if it can be demonstrated that oil and gas operations can be conducted without causing unacceptable impacts, this stipulation may be waived, excepted, or modified by the BLM Authorized Officer, if such action is consistent with the provisions of the Farmington Resource Management Plan, or if not consistent, through a land use plan amendment and associated National Environmental Policy Act analysis document. If the BLM Authorized Officer determines that the waiver, exception, or modification shall be subject to a 30-day public review period. Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes.
F-28-CSU	CONTROLLED SURFACE USE STIPULATIONS NAVAJO INDIAN IRRIGATION PROJECT Surface occupancy or use is subject to the following special operating constraints on the lands described below: For the purpose of: No oil or gas facilities will be installed that will unduly interfere with the construction or development of the area for agriculture purposes in connection with the Navajo Indian Irrigation Project. The lessee must clear with the Navajo Indian Irrigation Project Manager prior to the installation of any oil and gas equipment so that modification or relocation at a later date might be avoided. If circumstances or relative resource values change or if it can be demonstrated that oil and gas operations can be conducted without causing unacceptable impacts, this stipulation may be waived, excepted, or modified by the BLM Authorized Officer, if such action is consistent with the provisions of the Farmington Resource Management Plan, or if not consistent, through a land use plan amendment and associated National Environmental Policy Act analysis document. If the BLM Authorized Officer determines that the waiver, exception, or modification shall be subject to a 30-day public review period. Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes.
F-40-CSU	CONTROLLED SURFACE USE STIPULATION SPECIAL CULTURAL VALUES AND/OR TRADITIONAL CULTURAL PROPERTIES Controlled surface use is allowed on the lands described below: For the purpose of: Protection of known cultural resource values and/or traditional cultural properties in areas not already within ACECs. If circumstances or relative resource values change or if it can be demonstrated that oil and gas operations can be conducted without causing unacceptable impacts, this stipulation may be waived, excepted, or modified by the BLM Authorized Officer, if such action is consistent with the Farmington Resource Management Plan, or if not consistent, through a land use plan amendment and associated National Environmental Policy Act analysis document. If the BLM Authorized Officer determines that the waiver, exception, or modification involves an issue of major public concern, the

Stipulation	Description/Purpose
	waiver, exception, or modification shall be subject to a 30-day public review period. Any changes to this stipulation will be made in accordance with the land use plan and or the regulatory provisions for such changes.
F-41-LN	LEASE NOTICE - BIOLOGICAL SURVEY A biological survey may be required prior to any surface disturbing activity on BLM managed lands. Proposed activities may be subject to seasonal closures within sensitive species habitat. Federal land management agencies are mandated to manage special status species so they should not need to be listed under Endangered Species Act (ESA) in the future.
F-44-NSO	NO SURFACE OCCUPANCY-COMMUNITY & RESIDENCE No surface occupancy is allowed within 660 feet of any occupied residences of a community to reduce impacts to the community of drilling and production activities. This stipulation may be waived, excepted, or modified by BLM, if such action is consistent with the Resource Management Plan.
F-46-CSU	CONTROLLED SURFACE USE STIPULATION – TOPOGRAPHY Surface-disturbing such as well pad activities and related facilities are prohibited on slopes 15% and greater and/or side hill cuts of more than 3 feet vertical. Maximum grade on collector and arterial roads is 8% (except pitch grades not exceeding 300 feet in length and 10% in grade). For the purpose of: To maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, and to avoid areas subject to slope failure, mass wasting, piping, and/or having excessive reclamation challenges. If circumstances or relative resource values change or if the lessee demonstrates that operations can be conducted without causing unacceptable impacts, this stipulation may be excepted, modified or waived by the Authorized Officer if such action is consistent with the provisions of the applicable land use plan, or if not consistent through a planning amendment. An exception, modification, or waiver of this stipulation will require compliance with the National Environmental Policy Act and may be subject to a 15-day public review period. Any changes to this stipulation will be made in accordance with the land use plan and/or regulatory provisions for such changes. (For guidance on the use of this stipulation, see Bureau of Land Management Manuals 1624 and 3101 or Forest Service Manuals 1950 and 2820). The following is the criteria for exceptions, modifications and waivers: Exception: The authorizing officer may grant an exception to this condition for short distances (less than 300 feet and 10% in grade) for access roads if the operator submits a certified engineering and reclamation plan that clearly demonstrates impacts from the proposed actions are acceptable or can be adequately mitigated. This plan must include and demonstrate how the following will be accomplished: - Restoration of site. - Adequate control of surface runoff. - Protection of the site and adjacent areas from accelerated erosion, such as drilling,

Stipulation	Description/Purpose
	gullying, piping, and slope failure and mass wasting. - Protection of nearby water sources from sedimentation. Water quality and quantity will be in conformance with state and federal water quality standards. - Completion of site-specific analysis of soil physical, chemical and mechanical (engineering) properties and behavior. - Timing of surface-disturbing activities these activities will not be conducted during extended wet periods. - Timing of reclamation as reclamation will not be allowed when soils are frozen. In addition, the operator must also provide an evaluation of past practices on similar terrain and be able to demonstrate success under similar conditions.
NM-10-LN	LEASE NOTICE- DRAINAGE All or part of the lands contained in this lease is subject to drainage by well(s) located adjacent to this lease. The lessee shall be required within 60 days of lease issuance to submit to the authorized officer plans for protecting the lease from drainage. Compensatory royalty will be assessed effective the expiration of this 60-day period if no plan is submitted. The plan must include either an Application for Permit to Drill (APD) a protective well, or an application to communitize the lease so that it is allocated production from a protective well off the lease. Either of these options may include obtaining a variance to State spacing for the area. In lieu of this plan, the lessee shall be required to demonstrate that a protective well would have little or no chance of encountering oil and gas in quantities sufficient to pay in excess the costs of drilling and operating the well. In the absence of either an acceptable plan for protecting the lease from drainage or an acceptable justification why a protective well would be uneconomical, the lessee shall be obligated to pay compensatory royalty to the Office of Natural Resources Revenue at a rate to be determined by the authorized officer.
NM-11- LN	LEASE NOTICE – CULTURAL RESOURCES All development activities proposed under the authority of this lease are subject to compliance with Section 106 of the NHPA and Executive Order 13007. The lease area may contain historic properties, traditional cultural properties (TCP's), and/or sacred sites currently unknown to the BLM that were not identified in the Resource Management Plan or during the lease parcel review process. Depending on the nature of the lease developments being proposed and the cultural resources potentially affected, compliance with Section 106 of the National Historic Preservation Act and Executive Order 13007 could require intensive cultural resource inventories, Native American consultation, and mitigation measures to avoid adverse effects—the costs for which will be borne by the lessee. The BLM may require modifications to or disapprove proposed activities that are likely to adversely affect TCP's or sacred sites for which no mitigation measures are possible. This could result in extended time frames for processing authorizations for development activities, as well as changes in the ways in which developments are implemented.
WO-ESA-7	ENDANGERED SPECIES ACT- SECTION 7 CONSULTATION STIPULATION The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may

Stipulation	Description/Purpose
	recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground- disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 USC. 1531 et seq., including completion of any required procedure for conference or consultation.
WO-NHPA	CULTURAL RESOURCES AND TRIBAL CONSULTATION STIPULATION This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer (SHPO) and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.

BIA-1 - THE NAVAJO NATION STIPULATIONS

1. The surface ownership of lands contained in this lease may be all or partly managed by the Navajo Tribe. Site-specific rights-of-way clearances and/or inventories may be required prior to entry upon the surface for operation of the lease holdings. Prior contact with the Navajo Nation will be required prior to operations beginning. All applicable laws of the Navajo Nation (including tax laws, water codes, requirements of Environmental Protection Administration, etc.) shall be complied with by the lessee.
2. The Navajo Nation requires a copy of complete exploration and development data (drilling logs, seismic data, etc.) obtained by the lessee on the subject lands will be provided to the Navajo Nation at no cost. All materials data will be held confidential as described in 43 CFR 3162.8.
3. Navajo grazing rights to the surface of the lands so leased shall be protected, and the Nation's rights respecting the use of water shall be unimpaired.
4. Lessee shall not obtain water for use in drilling from Indian-owned wells, tanks, springs, or stockwater reservoirs without prior written permission from the Navajo Nation. Lessee shall not drill any water wells for its use without prior written consent of the Navajo Nation and the Area Director.
5. Lessee shall compensate the Navajo Nation and its grazing permittees (if any), for all surface use(s) as well as damages to crops, buildings, and other improvements of surface landowner, including loss of grazing lands, occasioned by the lessee's operations except the Lessee's control. Compensation for surface use shall be negotiated by Lessee and the Navajo Nation and will be based upon the duration of activity on the land.
6. Lessee shall not drill any well within 500 feet of any house, structure, or reservoir of water without the Navajo Nation's written consent.
7. Lessee shall bury all pipelines crossing tillable lands below plow depth unless other arrangements are made with the Navajo Nation.

8. Upon the request of the Navajo Nation or if so required by the Area Director or his authorized representative, and under the direction of the Field Manager, Bureau of Land Management, the Lessee shall condition any well drilled which does not produce oil or gas in paying quantities, but which is capable of producing water satisfactorily for domestic, agricultural, or livestock use by the Navajo Nation. Otherwise, after the expiration or termination of the lease, the Lessee shall remove all pumping equipment installed by Lessee at any well.

BIA-3 - NAVAJO AREA, BUREAU OF INDIAN AFFAIRS SURFACE MANAGEMENT AGENCY LEASE STIPULATIONS FOR FEDERAL OIL AND GAS LEASE OFFERING

The pipeline will be so installed that it will not interfere with the construction and/ or development of the area for agricultural purposes and/ or operation of same in connection with the Navajo Indian Irrigation Project. Any changes or relocations found to be necessary during said construction and/ or development will be accomplished at the Company's expense.

In addition, the pipeline will be buried to a depth of 48 inches and any permanent metering and production equipment installed at the actual site will conform to "no well and/or production equipment within irrigable fields of the Navajo Indian Irrigation Project will exceed two feet above natural surface elevation and be adequately barricaded for safety." Further, if crops are planted prior to accomplishment of the pipeline work, surface damages must be negotiated with Navajo Agricultural Products Industry.

Note: Not all features and practices apply to all situations. Applicable measures will be identified during project analysis prior to decision.

Construction, Production, and Reclamation

Construction & Reclamation Notification: The operator or their contractor will contact the Bureau of Land Management Farmington Field Office (BLM FFO) Surface and Environmental Protection Staff (505) 564-7600 at least 48 hours prior to any construction or reclamation activities on this project.

Staking: The operator shall place slope stakes, culvert location and grade stakes, and other construction control stakes as deemed necessary by the BLM FFO Authorized Officer to ensure construction is in accordance with the plan of development and Onshore Oil and Gas Order No. 1. If stakes are disturbed, they shall be replaced before proceeding with construction.

Weather: No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of 6 inches deep, the soil shall be deemed too wet.

Pits: Pits will be stepped down into at least 50% cut material. Pits will be fenced on three sides when a rig is on location; the fourth side will be fenced once the rig leaves the location. All fencing must be a legal fence in accordance with New Mexico State Law. All unguarded pits (reserve/production/blow pits) containing liquids will be fenced with woven wire. The pit should have adequate capacity to maintain 2 feet of free board. Liquids in pits will be properly disposed of before pits are filled and re-contoured. Under no circumstances will pits be cut and drained. The pit must not be breached (cut) or filled (squeezed) while still containing fluids. The final grade of a reserve pit (after reclamation) shall allow for drainage away from the pit area and will be restored to a condition that blends with the rest of the reclaimed area. Soil cover for burial-in-place or cuttings pit burial shall consist of a minimum of four feet of compacted, non-waste-containing earthen material. The soil cover shall include either the background thickness of topsoil or one foot of suitable material to establish vegetation at the site, whichever is greater.

Pit Closure: The operator or their contractor will contact the BLM FFO Surface and Environmental Protection Staff (505) 564-7600 at least 48 hours prior to any closure efforts associated with this project.

Reserve pits will be closed and rehabilitated 90 days after well completion or 120 days from the well spud date. All reserve pits remaining open after 90 days will need written authorization by the BLM FFO Authorized Officer. This requirement is addressed in the General Requirements in Onshore Oil and Gas Order No. 7.

Liquids in pits will be properly disposed of before pits are filled and re-contoured. The Authorized Officer will be will be notified 24 hours prior to fluid hauling. Under no circumstances will pits be cut and drained. Aeration of pit fluids must be confined within the pit area. Upon completion of the well the reserve pit will be covered with screening or netting and remain covered until the pit is reclaimed.

Upon achieving all applicable waste stabilization in the temporary pit or transfer of stabilized wastes to a temporary pit or cuttings pit (Closed Loop System), the operator shall:

Fold the outer edges of the pit liner to overlap waste material in the pit prior to the installation of the geomembrane cover;

Install a geomembrane cover over the waste material in accordance with the New Mexico Oil Conservation Division Pit Rule requirements.

Storage Tanks: All open top permanent production or storage tanks, regardless of diameter and made of fiberglass, steel, or other material used for the containment of oil, condensate, produced water and/or other production waste shall be screened, netted or otherwise covered to protect migratory birds and other wildlife from access.

Berms: Berms or firewalls will be constructed around all storage facilities sufficient in size to contain the storage capacity of tanks, or the combined capacity of tanks if a rupture could drain more than one tank. Berm walls will be compacted with appropriate equipment to assure proper construction. Metal containment barriers, used for secondary containment, will be properly installed, per the manufactures directions.

Compressors: Compressor units on this well location not equipped with a drip pan for containment of fluids shall be lined with an impervious material at least 8 millimeters thick and be surrounded by a 12 inch tall berm. The compressor will be painted to match the well facilities. Any variance to this must be approved by the BLM FFO Authorized Officer.

Soil Preparation and Seeding: All areas of the well site location not utilized for production operations on a daily basis will be reseeded with the specified BLM FFO seed mix. Compacted areas shall be ripped to a depth of 12 inches and disked to a depth of 6 inches before seeding. Where compacted soils cannot be successfully de-compacted with an initial attempt, it will be necessary to rip compacted areas multiple times; often perpendicular to the original rips, to ensure the compacted soils are adequately loosened and an adequate seedbed is established. Seeding shall be done with a disk-type drill with multiple boxes for various seed sizes. The drill rows shall be 8 to 10 inches apart. Seed shall be planted at a depth of ½ to 1 inch in depth. The seeder shall be followed with a drag, packer, or roller to ensure uniform coverage of the seed, and adequate compaction. Drilling shall be done along the contour where possible; not up and down the slope. Where slopes are too steep for contour drilling a "cyclone" hand seeder or similar broadcast seeder shall be used. Seed shall then be covered to the depth described above by whatever means is practical (i.e. hand raked). Seed mixture used must be certified weed free. Seed labels from each bag shall be available for inspection while seed is being sown. Seeding shall be accomplished within 120 days of completion of the construction project (timeframes may be extended on a case-by-case basis with approval from the BLM FFO Authorized Officer. Seeding shall be repeated if satisfactory regrowth is not obtained as determined by the BLM Authorized Author upon evaluation after the second growing season.

Maintenance: In order to perform subsequent well operations or install new and/or additional equipment, it may be necessary to drive, park, and operate on restored, interim vegetation within the previously disturbed area. This is generally acceptable provided damage is promptly repaired and reclaimed following use. Where vehicular travel has occurred as a “convenience” and interim reclamation/vegetation has been compromised, immediate remediation of the affected areas is required. Additionally, where erosion has occurred and compromised the reclamation of the well location, the affected area must be promptly remediated so that future erosion is prevented and the landform is stabilized.

Culverts: Silt Traps/Bell Holes will be built at the openings of all culvert locations.

Contouring of Cut and Fill Slopes: The interim cut and fill slopes shall grade as close to the original contour as possible. To obtain this ratio, pits and slopes shall be back sloped into the well pad during interim reclamation. Only subsurface soil and material shall be utilized in the contouring of the cut and fill slopes. Under no circumstances shall topsoil be utilized as substrate material for contouring of cut and fill slopes.

Roads and Pipelines

Open Trenches: No more than ½ mile of trench or the amount of trench that can be worked in one day will be open at any given time. Backfilling operations would will be performed within a reasonable amount of time of the pipe lowering operation to ensure the trench is not left open for more than 24 hours. Trenches left open overnight will be fenced with a temporary fence or other methods approved by the BLM FFO Authorized Officer. The ends of the trench will be sloped 3:1 ratio to allow animals to escape. Escape ramps/cross overs will be constructed every 1,320 feet, or every 500 feet in areas where active grazing is taking place or in designated wildlife areas. Established livestock and wildlife trails will be left in place as cross overs. Escape ramps/cross overs will be a minimum of 10 feet wide and will not be fenced. The trench shall be inspected for the presence of animals before it is closed. Any trapped wildlife or livestock discovered will be promptly removed and released at least 150 yards from the open trench.

Capping: The ends of the strung pipe will be capped to prevent animals from crawling in.

Staking: The operator shall mark the exterior boundaries of the right-of-way with stake and/or lath at 100 to 200 foot intervals. The intervals may be varied at the time of staking at the discretion of the BLM FFO Authorized Officer. The tops of the stakes and/or laths will be painted and the laths flagged in a distinctive color as determined by the operator. The survey station numbers will be marked on the boundary stakes and/or laths at the entrance to and the exit from public land. The operator shall maintain all boundary stakes and/or laths in place until final cleanup and restoration is completed and approved by the BLM FFO Authorized Officer. The stakes and/or laths will then be removed at the direction of the AO.

Driving Surface Area: All activities associated within the construction, operation, maintenance, and abandonment of the well location will be limited to areas approved in the Application for Permit to Drill (APD) or right-of-way (ROW) permit. During the production of the well, vehicular traffic is limited to the daily driving surface area established during interim reclamation construction operations. This area typically forms a keyhole or teardrop driving surface from which all production facilities may be serviced or inspected. A v-type ditch may be constructed on the outside of the driving surface to further define the driving surface and to deter vehicular traffic from entering onto interim reclamation areas.

New & Existing Access: All sections of the access road associated with this permit shall be sited, designed, constructed, upgraded, and maintained utilizing standards, requirements, guidelines and instructions specified in BLM Manual 9113 (BLM 2011a), BLM Handbook 9113-1 (BLM 2011b), BLM Handbook 9113-2 (BLM 2011c), and Surface Operations and Guidelines for Oil and Gas Exploration and Development (The Gold Book; BLM 2005).

Air

Air Quality: The BLM's regulatory jurisdiction over field production operations has resulted in the development of Best Management Practices designed to reduce impacts to air quality by reducing emissions from field production and operations. Typical measures could include flaring hydrocarbons and gases at high temperatures in order to reduce emissions of incomplete combustion, requiring that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored, and revegetating areas not required for production facilities to reduce the amount of dust.

Compressor Emission Control: Compressor engines 300 horsepower or less used during well production must be rated by the manufacturer as emitting NOx at 2 grams per horsepower hour or less to comply with the New Mexico Environmental Department's Air Quality Bureaus guidance.

Dust Abatement: The operator shall implement dust abatement measures to prevent fugitive dust from vehicular traffic, equipment operations, or wind events. The BLM may direct the operator to change the level and type of treatment (watering or application of various dust agents, surfactants, and road surfacing material) if dust abatement measures are observed to be insufficient to prevent fugitive dust. Water application using a rear-spraying truck or other suitable means will be the primary method of dust suppression along roads. Magnesium chloride, organic-based compounds, or polymer compounds could also be applied to roads or other surfaces to reduce fugitive dust. Neither petroleum-based products nor produced water will be used.

Soils

Stockpile of Topsoil: The top 6 inches of soil material will be stripped and stockpiled in the construction zones around the well pad. Construction zones may be restricted or omitted to allow for resource avoidance. The stockpiled soil will be free of brush and tree limbs, trunks and roots. Stockpiled soil material will be spread on the reclaimed portions of the well pad, including the reserve pit and cut and fill slopes, prior to reseeding. Spreading soil shall not be done when the ground or topsoil is frozen or wet.

Topsoil and sub-surface soils will be replaced in the proper order, prior to final seedbed preparation. Spreading shall not be done when the ground or topsoil is wet. Vehicles and equipment will not be allowed to cross topsoil stockpiles. If topsoil is stored for a length of time such that nutrients are depleted from the topsoil, amendments may need to be added.

Chipping and Mulching: Vegetation removed during construction, including all trees and slash/brush, will be chipped or mulched and incorporated into the topsoil as additional organic matter.

Water and Riparian

Acquisition of Water: Water acquired for construction, production, and maintenance actions authorized by the APD must be acquired from permitted water sources, or water authorized for use by the New Mexico Oil Conservation Division. The BLM FFO Authorized Officer shall be provided with documentation of water sources upon request.

Ephemeral Wash Riparian Area: Ephemeral Wash Riparian Areas were established in the BLM's Farmington Resource Management Plan with Record of Decision (RMP December 2003 page C-134). No surface occupancy is allowed in active floodplains and controlled surface use subject to special mitigation measures may be required in 100-year floodplains. Outline data of active floodplains and 100-year floodplains was obtained using floodplain maps from the Federal Emergency Management Agency. USGS Watercourses are used to determine US Army Corps of Engineers (USACE) jurisdiction over Navigable Waters of the US and Significant Nexuses. Any project that would impact, or alter these channels would be subject to permitting and mitigation measures outlined by the USACE to be compliant with the Clean Water Act.

Bank Stabilization: Channel bank stabilization is required. The operator will submit a stabilization plan to BLM for review and approval. The operator may propose any method of stabilization that is appropriate to the situation and follows applicable rules, regulations, and permits of the US Army Corps of Engineers that may apply to construction projects in waters of the United States. Stabilization methods may include sedimentation fences, fabrics, riprap, gabion structures, or other methods. The operator may coordinate with BLM during all phases of planning and construction of mitigation measures.

Livestock Grazing

Fences, Barriers, and Existing Improvements: Disturbance to existing fences and other improvements on public land will be minimized and will be promptly repaired to their former state or better. Their functional use will be maintained at all times. The owner of any improvement will be contacted prior to a disturbance to the improvement. Fences will be H-braced and secured on both sides prior to wire being cut to prevent slacking of the wire. Fence openings created during construction will be temporarily closed as necessary to prevent passage of livestock. A minimum of 10 feet of undisturbed surface will be maintained between fence lines and roads and/or pipelines that are constructed parallel to fences. Gaps opened in natural barriers used for livestock control during construction will be fenced to prevent drift of livestock, as directed by the BLM FFO Authorized Officer.

Cattle guards: Cattle guards shall have grid identification marks welded into them indicating ownership, well name and number associated with the cattle guard, and foundation designs. Construction shall meet the American Association of State Highway and Transportation Officials (AASTHO) load rating H-20, although AASTHO U-80 rated grids shall be required where heavy loads, (exceeding H-20 loading) are anticipated. Consult BLM standard drawings for cattle guards. Cattle guard grid width shall be no less than 8 feet and length shall be no less than 14 feet. A wire gate with a minimum width of 16 feet will be provided on one side of the cattle guard. Cattle guards will be kept clean, and will be repaired or replaced when needed.

Grazing Permittee Notification: The operator will notify the grazing lease operator(s) at least ten business days prior to beginning any construction activity to ensure there will be no conflicts between construction activities and livestock grazing operations. The operator is in no way obligated to cease or delay construction unless directed by the BLM FFO Authorized Officer. Any range improvement (fences, pipelines, ponds, etc.) disturbed by construction activities will be repaired immediately following construction, and will be repaired to the condition they were in prior to disturbance.

Wildlife

Threatened, Endangered, or Sensitive Species: If, in operations the operator/holder discovers any Threatened, Endangered, or Sensitive species, work in the vicinity of the discovery will be suspended and the discovery will be promptly reported to the BLM FFO T&E specialist (505) 599-8900. The BLM will then specify what action is to be taken. Failure to notify the BLM about a discovery may result in civil or criminal penalties in accordance with The Endangered Species Act (as amended).

Nesting: If a bird nest containing eggs or young is encountered in the path of construction the operator will cease construction and consult with BLM to determine appropriate actions.

Burrowing Owls: A preconstruction survey for burrowing owls is required for proposed projects scheduled to be constructed within designated potential habitat during the nesting season of April 1 to July 31. Occupied burrowing owl nests will not be disturbed within a 50 meter radius from April 1 to August 15. After August 15, any project that will cause destruction of the nest burrow can only begin after confirmation by a BLM FFO biologist that the nest burrow is no longer occupied.

Raptors: No construction, drilling, or completion activities shall be conducted between February 1 and June 30 within 1/3 mile of an active or historic nest. An entity that proposed an action that may be impacted by the raptor stipulation may contact BLM FFO and inquire about the status of the affected nest. The BLM FFO Authorized Officer may release the proposed action before June 30 if BLM FFO determines that the young of the year have fledged and left the area, or that surveys have conclusively determined the nest is not active. Under The BLM FFO Raptor Management Policy, the following mitigation measures are addressed:

In golden eagle, ferruginous hawk, and prairie falcon nest sites, no construction, drilling, or completion activities shall be conducted between March 1 and June 30 in a radius of 1/3 mile around active nest sites;

Mitigation for peregrine falcon nest sites will be determined on a site specific basis using the principle of designating sensitive zones in which disturbance is seasonally restricted as delineated in Johnson (1994).

Piñon Mesa: The proposed well pad is located within the Piñon Mesa Recreation Area. Piñon Mesa offers nesting habitat for various raptor species. Raptors are considered a BLM "special status species" and are managed under the 2000 BLM FFO Raptor Management Policy. Piñon Mesa is surveyed for raptors yearly and there have been no known active raptor nests since 1999. The 2003 BLM Farmington Resource Management Plan (RMP; C-122) states that, "no construction, drilling completion, plugging, seismic exploration, and workover activity is allowed when "they would interfere with authorized recreation events and from 3/1 through 6/30 for various raptor species protection and 3/1 to 8/1 for peregrine falcon protection." In April 2004, a BLM biologist surveyed all potential raptor (including peregrine falcon) habitat in the Piñon Mesa area and found no nesting activity.

Mountain Plover: The mountain plover was listed by the US Fish and Wildlife Service as a proposed species for listing pursuant to the Endangered Species Act on February 16, 1999. BLM FFO designated potential mountain plover habitat and established mountain plover management in the September 2002 Biological Assessment conducted for the 2003 Farmington Resource Management Plan. The US Fish and Wildlife Service determined that listing the mountain plover was not warranted on September 9, 2003. BLM FFO will continue to manage mountain plover according to the September 2002 Biological Assessment conducted for the 2003 Farmington Resource Management Plan. A preconstruction survey for mountain plover is required for proposed projects scheduled to be constructed within designated potential habitat during the nesting season of April 1 to July 31. Occupied mountain plover designated habitat will not be disturbed from April 1 to July 31.

Yellow-billed Cuckoo: The US Fish and Wildlife Service (USFWS) added the yellow-billed cuckoo to their candidate species list on July 25, 2001. It was then listed by the USFWS as Threatened in October, 2014. Potential critical habitat and specific management requirements were outlined in the Federal Register: Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus).

BLM FFO conducted surveys to determine the presence of yellow-billed cuckoo within the boundaries of the field office. Yellow-billed cuckoo have been found in wooded portions of designated riparian areas and river tracts. River tracts and ephemeral wash riparian areas are closed to wood cutting and existing oil and gas leases are managed under no surface occupancy in active floodplains. A preconstruction survey for yellow-billed cuckoo will be required for any proposed ROW or any other project that may impact wooded habitat in a river tract or designated ephemeral wash riparian area during the breeding season of April 1 to August 31. Occupied yellow-billed cuckoo habitat will not be disturbed from April 1 to August 31.

Mexican Spotted Owl ACEC: The proposed project is located in the Mexican Spotted Owl ACEC. No construction, drilling, completion, or work over activities are allowed between March 1 to September 1 until US Fish and Wildlife developed protocol surveys for Mexican spotted owl are completed. If an occupied territory is located in the project area, no construction, drilling, completion, or work over activities will take place within ¼ mile around a nest site from March 1 to September 1.

Hazards: Wildlife hazards associated with the proposed project will be fenced, covered, and/or contained in storage tanks, as necessary.

Migratory Birds: For any proposed project with, collectively, 4.0 acres or more of vegetative disturbance within 1 48 hour period, no construction activities from May 15 to July 31 will be permitted without a migratory bird nest survey. This includes proposed vegetation disturbance outside of this Environmental Assessment within the same general area. These surveys will be conducted by a BLM FFO approved biologist using survey protocol provided by a BLM FFO approved biologist. If any active nests are located within the proposed project area, project activities will not be permitted until written approval is granted by a BLM FFO biologist. The BLM FFO will monitor any active nests located from a nest survey.

Vegetation

Knowlton's Cacti: No herbicide spraying is allowed within 3 miles of known locations of Knowlton's cacti. Aerial spraying from an airplane shall not take place. Nozzles that produce large droplets (500-1000 microns or 0.02-0.04 inches) should be used. Oil bases rather than surface tension reducers or wetting agents are preferred to keep droplet sizes large. Spraying should be done on a windless day, and spraying should not take place during the blooming period for Knowlton's cactus (April 1 to June 15). A BLM FFO approved biologist shall be present at the time of application to make sure these recommendations are followed.

Trees, Slash, and Brush: All trees 3 inches or less in diameter, slash, and brush will be chipped, mulched, and incorporated into the topsoil. When chipping trees, slash, and brush, the "chips" shall be distributed in a manner that will not impede seeding with machinery and the establishment of successful revegetation. Trees 3 inches or greater in diameter at ground level will be cut and de-limbed. Trunks will be left whole along the access road or existing road(s) for wood gathering. The subsurface portion of trees (root balls) will be placed in adjacent areas needing soil stabilization or hauled to an approved disposal facility.

Ponderosa Pine/Hardwood: No hardwood tree with a diameter of 10 inches or more at its base or any ponderosa pine, Douglas-fir, or aspen tree is to be removed or damaged without approval from the BLM FFO Authorized Officer.

Brack's Cactus and Aztec Gilia: In occupied habitat for Brack's cactus and Aztec gilia, a BLM approved biological consultant will be on site to monitor mitigation. The biological consultant will be notified at least 48 hours prior to any construction activities. All individual Brack's cactus will be transplanted by the biological consultant prior to construction. The transplant site will be recorded by a GPS (Global Positioning System) instrument. The biological consultant will identify the extent of suitable soil that supports Brack's cactus or Aztec gilia. The top 6 inches of soil identified by the biological monitor will be scraped, stockpiled, and stored separately from other top soil on the project site during construction. The stockpiled suitable soil identified by the biological monitor will be re-spread to a depth of approximately 6-inches on the 50-foot construction buffer area or other suitable sites approved by the biological consultant within the project area. Re-spread soil will be appropriately reseeded when the pits, unused areas on the well pad, and the construction zone are reclaimed. The biological consultant will be on site for the scraping, stockpiling, and re-spreading of the suitable soil. The biological consultant will coordinate with the operator and BLM when questions or problems arise. A report will be submitted by the biological consultant to the BLM that includes the number of Brack's cactus transplanted, the location of the transplant site in UTM (Universal Transverse Mercator), and photos of the transplant site and where suitable soils were re-spread.

Invasive Plants and Noxious Weeds

Noxious Weed Inventory: An inventory of the proposed project location for the presence of noxious weeds was completed. Noxious weeds are those listed on the New Mexico Noxious Weed List or

USDA's Federal Noxious Weed List. The New Mexico Noxious Weed List or USDA's Noxious Weed List can be updated at any time and should be regularly checked for any changes. The following weeds have been identified as occurring on lands within the boundaries of the BLM FFO.

Common Name	Scientific Name	Common Name	Scientific Name
African rue	Penganum harmala	Leafy spurge	Euphorbia esula
Bull Thistle	Cirsium vulgare	Musk thistle	Carduus nutans
Camelthorn	Alhagi pseudalhagi	Perennial pepperweed	Lepidium latifolium
Canada thistle	Cirsium arvense	Russian knapweed	Centaurea repens
Dalmation toadflax	Linaria genistifolia	Saltcedar	Tamarix sp.
Diffuse knapweed	Centaurea diffusa	Scotch thistle	Onopordum acanthium
Halogeton	Halogeton glomeratus	Spotted knapweed	Centaurea maculosa
Hoary cress	Cardaria draba	Yellow toadflax	Linaria vulgaris

Treatment: Identified weeds will be treated prior to new surface disturbance if determined by the BLM FFO Noxious Weed Coordinator. A Pesticide Use Proposal (PUP) shall be submitted to and approved by the BLM FFO Noxious Weed Coordinator prior to application of pesticide. The BLM FFO Noxious Weed Coordinator (505) 564-7600 can provide assistance in the development of the PUP.

Only pesticides authorized for use on BLM lands will be used and applied by a licensed pesticide applicator. The use of pesticides will comply with federal and state laws and will be used only in accordance with the registered use and limitations. The operator's weed-control contractor will contact the BLM FFO prior to using these chemicals.

Noxious/invasive weed treatments will be reported to the BLM FFO Noxious Weed Coordinator. A Pesticide Application Record (PAR) is required to report any mechanical, chemical, biological, or cultural treatments used to eradicate, and/or control noxious or invasive species. Reporting will be required quarterly and annually or per request from the BLM FFO Noxious Weed Coordinator.

Inspection and Cleaning: Vehicles and equipment should be inspected and cleaned prior to coming onto the work site. This is especially important on vehicles from out of state or if coming from a weed-infested site.

Fill Material: If any fill dirt or gravel will be required, the source shall be free of noxious weeds and approved by the BLM FFO Noxious Weed Coordinator.

Monitoring: The site shall be monitored for the presence of noxious weeds for the life of the project (including maintenance and construction activities). If weeds are found, the BLM FFO Noxious Weed Coordinator shall be notified at (505) 564-7600 and will be provided with a Weed Management Plan and if necessary, a Pesticide Use Proposal (PUP). The BLM FFO Noxious Weed Coordinator can provide assistance in developing the Weed Management Plan and/or the PUP.

Bare Ground Trim Out: If bare ground vegetation treatment (trim-out) is desired around facility structures, the operator will submit a bare ground/trim-out design via Sundry Notice (DOI, BLM Form 3160-5) after the facility set onsite with BLM FFO personnel. The design will address vegetation safety concerns of the operator and BLM while minimizing impacts to interim reclamation efforts. The design must include what structures are to be treated and buffer distances of trim-out. Pesticide use for vegetation control around anchor structures is not approved. If pesticides are used for bare ground trim-out, the trim out will not exceed three feet from the edge of any eligible permanent structure (i.e. well heads, fences, tanks). Additional distance/areas may be requested and must be approved by the BLM FFO Authorized Officer. The additional information below must also be provided to the BLM FFO:

Pesticide use for trim out will require a Pesticide Use Proposal (PUP). A PUP is required prior to any treatment and must be approved by the BLM FFO Noxious Weed Coordinator. Only pesticides authorized for use on BLM lands will be used and will be applied by a licensed pesticide applicator. The use of pesticides will comply with federal and state laws and will be used only in accordance with their registered use and limitations. The operator's weed-control contractor will contact the BLM FFO prior to using these chemicals and provide Pesticide Use Reports (PURs) post treatment.

A Pesticide Application Record (PAR) or a Biological Use Report (BUR) is required to report any chemical, or biological treatments used to eradicate or control vegetation on site. Reporting will be required quarterly and annually or per request from the BLM FFO Noxious Weed Coordinator

Archeological and Cultural

Non-Permitted Disturbance: Construction, construction maintenance, or any other activity outside the areas permitted by the APD will require additional approval and may require a new cultural survey and clearance.

Employee Education: All employees of the project, including the Project Sponsor and its contractors and sub-contractors, will be informed that cultural sites are to be avoided by all personnel, personal vehicles, and company equipment. This includes all personnel associated with construction, use, maintenance, and abandonment of the well pad, well facilities, access road, and pipeline. Employees will also be notified that it is illegal to collect, damage, or disturb cultural resources, and that such activities are punishable by criminal and or administrative penalties under the provisions of the Archaeological Resources Protection Act (16USC. 470aa-mm).

Discovery of Cultural Resources in the Absence of Monitoring: If, in its operations, the operator/holder discovers any previously unidentified historic or prehistoric cultural resources, work in the vicinity of the discovery will be suspended and the discovery promptly reported to BLM FFO Field Manager. The BLM will then specify what action is to be taken. If there is an approved "discovery plan" in place for the project, the plan will be executed. In the absence of an approved plan, the BLM will evaluate the significance of the discovery and consult with the State Historic Preservation Officer in accordance with 36 CFR Section 800.11. Minor recordation, stabilization, or data recovery may be performed by a BLM or permitted cultural resources consultant. If warranted, more extensive treatment by a permitted cultural resources consultant may be required of the operator/holder prior to allowing the project to proceed. Further damage to significant cultural resources will not be allowed until any required treatment is completed. Failure to notify the BLM about a discovery may result in civil or criminal penalties in accordance with the Archeological Resources Protection Act of 1979 (as amended).

Discovery of Cultural Resources during Monitoring: If monitoring confirms the presence of previously unidentified cultural resources, work in the vicinity of the discovery will be suspended and the monitor will promptly report the discovery to the BLM Field Manager. The BLM will then specify what action is to be taken. If there is an approved "discovery plan" in place for the project, the plan will be

executed. In the absence of an approved plan, the BLM will evaluate the significance of the discovery and consult with the State Historic Preservation Officer in accordance with 36 CFR Section 800.11. A BLM or permitted cultural resources consultant may perform minor recordation, stabilization, or data recovery. If warranted, more extensive treatment by a permitted cultural resources consultant may be required of the operator/holder prior to allowing the project to proceed. Further damage to significant cultural resources will not be allowed until any required treatment is completed.

Damage to Sites: If, in its operations, the operator/holder damages, or is found to have damaged any previously documented or undocumented historic or prehistoric cultural resources, excluding "discoveries" as noted above, the operator/holder agrees at his/her expense to have a permitted cultural resources consultant prepare and have executed a BLM approved data recovery plan. Damage to cultural resources may result in civil or criminal penalties in accordance with the Archeological Resources Protection Act of 1979 (as amended).

Paleontology

Site Discovery: If a paleontological site is discovered, the operator or their contractor will notify the BLM FFO Paleontologist and Project Lead. The site will be avoided by personnel, personal vehicles, and company equipment. Workers will be informed that it is illegal to collect, damage, or disturb such resources, and that such activities are punishable by criminal and/or administrative penalties.

The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the BLM FFO Authorized Officer. An evaluation of the discovery will be made by the BLM FFO to determine appropriate actions to prevent the loss of significant scientific values. The operator will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the BLM FFO Authorized Officer.

Paleontology Monitor: If specified, a paleontological resource monitor will be required during trenching and or construction operations to monitor the trench walls, construction activities, and associated spoils. If vertebrate fossil material is encountered, it will be evaluated by the monitor to determine appropriate actions to prevent the loss of significant scientific values. Any fossil material is federal property, and is to be finally assessed by a vertebrate paleontologist and taken to the New Mexico Museum of Natural History.

Visual and Noise

Navajo Reservoir Noise Stipulations: All US Bureau of Reclamation land associated with Navajo Reservoir within New Mexico is a boundary-focused Noise Sensitive Area (NSA) and Notice to Lessees and Operators on Onshore Oil and Gas Leases within the Jurisdiction of the FFO (NTL 04-2 FFO) applies. For noise sources located inside boundary-focused NSA's the standard is 48.6 dB(A) Leq at 400 feet in all directions from the noise source. Noise sources located within 400 feet of the NSA boundary will generally be allowed to meet the standard 400 feet from the noise source. Survey protocol described in NTL 04-2 FFO will be used as a guide to measure sound sources.

Noise Sensitive Area: The project is located within a designated Noise Sensitive Area (NSA). Noise standards of 48.6 dB(A) Leq will be achieved at established agency receptor points. Receptors may vary in size from a single point source to several acres based on the features and resource components that are being managed. The agency will work with the operator to establish the applicable receptor points. If a compressor or pump-jack will be placed on site, a 48.6 dB(A) Leq or lower noise level will be enforced at designated receptor points. The operator is required to file a Sundry Notice (DOI, BLM Form 3160-5) prior to setting a compressor or pump-jack on location. The Sundry Notice will include information on why the compressor is needed, the estimated time the compressor will be in use, and the manufacturer's

data (size of unit, horsepower, model type and type of motor). A 1:24,000 (7.5 minute series) map will be submitted with the Sundry Notice. The map will show the proposed compressor location and all Noise Sensitive Areas (fee surface, residences, schools, churches, farms, known ACECs and SMAs, etc.) within a 2 mile radius of the well location. In addition, a 24 hour time weighted average background noise survey may be required after the compressor and/or pumping unit are installed.

Sound-proofing: Engines will be equipped with mufflers and barriers or other sound-proofing measures will be implemented to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the Jurisdiction of the FFO (NTL 04-2 FFO).

Waste Control

General Housekeeping: Working sites shall be maintained in a sanitary condition at all times. Garbage, trash, and other waste materials will be collected in portable, self-contained, and fully enclosed containers during drilling and completion operations. No trash will be buried or burned on location. Immediately after removal of the drilling rig, all debris and other waste materials not contained in trash containers will be cleaned up and removed from the well location.

Fluid Disposal: All fluids (i.e., scrubber cleaners) used during washing of production equipment, including compressors, will be properly disposed of to avoid ground contamination or hazard to livestock or wildlife.

Land Farming: No excavation, remediation, or closure activities will be authorized without prior approval, on any federal or Indian mineral estate, federal surface, or federal ROW. A Sundry Notice (DOI, BLM Form 3160-5) shall be submitted with an explanation of the remediation or closure plan for on-lease actions.

Closed Loop Systems: Drilling of horizontal laterals will be accomplished with water-based mud. All cuttings will be placed in roll-off bins and hauled to a commercial disposal facility or land farm. No blow pit will be used. Closed-loop system storage tanks will be sized to ensure confinement of all fluids and will provide sufficient freeboard to prevent uncontrolled releases.

Drilling Fluids: Drilling fluids will be stored on-site in aboveground storage tanks. Upon termination of drilling operations, drilling fluids will be recycled and transferred to other permitted closed-loop systems or returned to the vendor for reuse, as practical. All residual fluids will be hauled to a commercial disposal facility.

Spills: Any spills of non-freshwater fluids will be immediately cleaned up and removed to an approved disposal site.

Public Health and Safety

Hazardous Chemicals and Substances: No chemicals subject to reporting under the Superfund Amendments and Reauthorization Act Title III in an amount equal to or greater than 10,000 pounds will be used, produced, stored, transported, or disposed annually in association with the drilling, testing, or completing of these wells.

No extremely hazardous substances (as defined in 40 CFR 355) in threshold planning quantities will be used, produced, stored, transported, or disposed of in association with the drilling, testing, or completing of these wells.

Equipment Transportation: The hauling of equipment and materials on public roads will comply with Department of Transportation regulations. No toxic substances will be stored or used within the proposed

project area. The operator will have inspectors present during construction. Any accidents involving persons or property will be immediately reported to the BLM FFO. The operator will notify the public of potential hazards by posting signage, as necessary.

Safety Incident Reporting: Worker safety incidents will be reported to the BLM FFO as required under Notice to Lessees (NTL) -3A (USGS 1979). The operator will adhere to company safety policies, Occupational Safety and Health Administration regulations, and Department of Transportation regulations.

Fire Stipulations: The 4-Corners Interagency Fire Dispatch located in Bloomfield, New Mexico assigns a fire danger rating daily. Fire stipulations will be applied when the fire danger is rated at High, Very High, or Extreme.

A fire guard or scout will be designated for well pad construction, drilling, and completion operations. This person's job will be detached from normal work operations and will be to act as a fire guard or scout. The fire guard or scout will remain on the job site for a minimum of 1 hour after all work has been completed for the day. Worksites will have fire extinguishers and hand tools (shovels, axes, etc.).

200 gallons of fresh water will be available for fire suppression and a minimum of 300 feet of 1 ½ inch hose with nozzle will be available at the worksite.

4-Corners Fire Dispatch will be notified by telephone prior to welding or flaring operations at (505) 632-8956.