

**DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
FARMINGTON FIELD OFFICE**

**Project: January 2015 Competitive Oil and Gas Lease Sale
EA Log Number: DOI-BLM-NM-F010-2014-0227-EA
Location: Sandoval County New Mexico.**

Finding of No Significant Impact

Based on the analysis of potential environmental impacts contained in the attached Environmental Assessment (EA), I have determined the Proposed Action Alternative (Alternative B) is not expected to have significant impacts on the environment. The impacts of leasing the fluid mineral estate in the areas described with this EA have been previously analyzed in the 2003 Farmington RMP and the 2002 Biological Assessment and the lease stipulations that accompany the tracts proposed for leasing would mitigate the impacts of future development on these tracts. Therefore, preparation of an Environmental Impact Statement is not warranted.

Reviewed by:

Date _____
Gary Torres, Farmington Field Office Manager

Approved by:

Date _____
Jesse Juen, New Mexico State Director

**BUREAU OF LAND MANAGEMENT
FARMINGTON FIELD OFFICE**

**ENVIRONMENTAL ASSESSMENT FOR
JANUARY 2015 COMPETITIVE OIL AND GAS LEASE SALE
DOI-BLM-NM-F010-2014-0227-EA**

INTRODUCTION

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

The BLM New Mexico State Office (NMSO) conducts a quarterly competitive lease sale to offer available oil and gas lease parcel(s) in New Mexico, Oklahoma, Texas, and Kansas. A Notice of Competitive Lease Sale (NCLS), which lists lease parcel(s) to be offered at the auction, is published by the NMSO at least 90 days before the auction is held. Lease stipulations applicable to each parcel(s) are specified in the Sale Notice. 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.

In the process of preparing a lease sale the NMSO sends a draft parcel list to any Field Offices in which parcel(s) are located. Field office staff then review the legal descriptions of the parcel(s) 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 stipulations should be included; and if there are special resource conditions of which potential bidders should be made aware. The parcels nominated for this sale, along with the appropriate stipulations from the 2003 Farmington Resource Management Plan (RMP) and subsequent amendments, are posted online for a two week public scoping period. Comments received are reviewed and incorporated into the Environmental Assessment (EA).

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

This EA documents the Farmington Field Office (FFO) review of five (5) parcels nominated for the January 2015 Competitive Oil and Gas Lease Sale. All 5 are Navajo allotted lands/ federal minerals. These parcels were considered for lease in the October 2014 Competitive Oil and Gas Lease Sale, but deferred due to the need for additional Tribal consultation. They are being reconsidered for sale as the parcels have been recently identified as being drained (See Appendix

3 and 4). Drainage is the uncompensated loss of hydrocarbons, inert gases or geothermal resources from wells on adjacent nonjurisdictional lands or jurisdictional lands resulting in revenue losses to the Federal government. Regulations found at 43 CFR 3162.2-2 outline the BLM's responsibilities 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 serves to verify conformance with the approved land use plan, provides the rationale for deferring or dropping parcel(s) from a lease sale, as well as providing rationale for attaching additional notice to specific parcel(s). Where the surface is administered by the Forest Service and the mineral estate is also federally owned, the Forest Service and BLM share the responsibility for enforcing mineral leasing policies and regulations. Forest Service regulations under 36 CFR 228.102(e) allow the agency to authorize the BLM to lease individual, specified areas of land administratively available for lease and include the stipulations determined to be necessary.

The parcels and applicable stipulations were originally posted online for a two week public scoping period starting on March 10, 2014 and a 30-day public review and comment period starting on May 1, 2014. Comments were received. These 5 parcels are being reconsidered for sale, and the EA was made available for public review and comment for 30 days beginning August 26, 2014. Comment letters was received from Marshall Keetso, a member of the Navajo Tribe and a resident in the community of the Eastern Agency, on September 22, 2014 and from the Western Environmental Law Center (WELC), along with Amigos Bravos, Chaco Alliance, Dine Citizens Against Ruining our Environment, Earthworks, Natural Resources Defense Council, Rio Arriba Concerned Citizens, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians ("Conservation Groups"), on September 23, 2014.

Purpose and Need

The purpose is to consider opportunities for private individuals or companies to explore for and develop oil and gas resources on public lands through a competitive leasing process.

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

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

Conformance with Applicable Land Use Plan and Other Environmental Assessments

The applicable land use plan for this action is the 2003 Farmington RMP. 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 RMP, along with the 2002 Biological Assessment, also describe specific stipulations that would be attached to new leases offered in

certain areas. Therefore, it is determined that the alternatives considered conform to fluid mineral leasing decisions in the 2003 Farmington RMP and subsequent amendment and are consistent with the goals and objectives for natural and cultural resources.

Pursuant to 40 Code of Federal Regulations (CFR) 1508.28 and 1502.21, this EA is tiered to and incorporates by reference the information and analysis contained in the 2003 Farmington RMP Final Environmental Impact Statement. While it is unknown precisely when, where, or to what extent well sites or roads would be proposed, the analysis of projected surface disturbance impacts, should a lease be developed, is based on potential well densities listed in the Reasonable Foreseeable Development (RFD) Scenario included in the 2003 Farmington RMP and the 2002 Biological Assessment. While an appropriate level of site-specific analysis of individual wells or roads would occur when a lease holder submits an Application for Permit to Drill (APD), assumptions based on the RFD scenario may be used in the analysis of impacts in this EA.

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

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

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

Farmington Field Office biologists reviewed the proposed action and determined it would be in compliance with threatened and endangered species management guidelines outlined in Biological Opinions Cons. #2-22-01-I-389. No further consultation with the U.S. Fish and Wildlife Service (USFWS) is required at this stage.

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 National Historic Preservation Act (NHPA) is adhered to by following 36 CFR Part 800. Native American consultation is conducted by mail regarding each lease sale activity. A second request for information is sent to the same recipients as needed (e.g. 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 parcel(s) are offered for sale. If any responses are received, BLM cultural resources staff will discuss the information or issues of concern with the respondent to determine if all or portions of a parcel need to be withdrawn from the sale, or if stipulations need to be attached as lease stipulations.

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

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

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

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

Identification of Issues

Planning issues are points of disagreement, debate, or dispute with a proposed action based on some anticipated environmental effect. Based on external and internal scoping and the scoping comments that were received, the following planning issues were identified:

Nominated parcels included the No Action and the Proposed Action and along with the appropriate stipulations from the RMP were originally posted online at: http://www.blm.gov/nm/st/en/prog/energy/oil_and_gas/oil_and_gas_lease.html for a two week public scoping period beginning March 10, 2014 and a 30 day public review and comment period of the EA starting on May 1, 2014. These 5 parcels are being reconsidered for sale, and the EA was made available for public review and comment for 30 days beginning August 26, 2014.

Consultation meetings to discuss the 5 proposed parcels, the reasons for reconsidering them and identification of issues were held with the following:

Navajo Nation Historic Preservation Division, June 20, 2014
Navajo Nation Counselor and Nageezi Chapters, July 23, 2014
Bureau of Indian Affairs – Navajo Region, August 5, 2014

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

- *What effect will the no action have on mineral resources being drained from wells on adjacent lands?*
- *What effects will the proposed action have on the wildlife, special status species, and migratory birds?*
- *What effects will the proposed action have on air quality and climate?*
- *What effects will the proposed action have on water quality?*
- *What effects will the proposed action have on soil resources?*
- *What effects will the proposed action have on night sky resources?*
- *What effects will the proposed action have on cultural resources and landscapes?*
- *What effects will the no action and proposed action have on socio economics?*
- *What effects will the proposed action have on Environmental Justice?*

Issues considered during project scoping but dismissed from detailed analysis because there would be no potentially significant effects related to the issues resulting from any of the alternatives presented below.

- *What effects will the proposed action have on Visual Resource?*
Visual Resource Inventory is only conducted on BLM surface. None of the parcels contain BLM surface; therefore, Visual Resource Inventory will not be discussed. Visual Resource Management (VRM) classes only apply on public lands and are conducted in accordance with BLM Handbook 8410 and BLM Manual 8411. None of the parcels contain BLM surface; therefore, VRM classes will not be analyzed.
- *What effects will the proposed action have on Rangeland Resources?*
If a decision is made to lease, individual APD's and lease actions may impact rangeland resources and impacts may be analyzed specifically when they are proposed.

The following resources were determined by an ID Team of resource specialists, following their onsite visit and review of the RMP and other data sources to not be present were: Areas of Critical Environmental Concern, Floodplains, Wild and Scenic Rivers, Wetlands/Riparian Zones, and Wild Horses and Burros.

NO ACTION AND PROPOSED ACTION ALTERNATIVES

Alternative A - No Action

In the case of a lease sale, an expression of interest to lease (parcel nomination) would be denied or rejected, and the five (5) parcels would not be offered for lease during the January 2015 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 situated adjacent to the federal mineral estate lands would continue resulting in on-going loss of royalties

to the U.S. and the State of New Mexico (See Appendix 3 and 4). Selection of the no action alternative would not preclude these parcels from being nominated and considered in future lease sale.

Alternative B – Proposed Action

The Proposed Action is to lease five (5) nominated parcels of federal minerals administered by the Bureau of Land Management, Farmington Field Office, covering 2802.56 acres. Standard terms and conditions as well as lease stipulations listed in the BLM FFO RMP (as amended) and BIA stipulations per Navajo Area Bureau of Indian Affairs Surface Management Agency Lease Stipulations for Federal Oil and Gas Lease Offerings would apply. Leasing the federal mineral estate is necessary to prevent the loss of the mineral resource and loss of royalties to the U.S. and the State of New Mexico. Once sold, the lease purchaser has the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries, subject to the stipulations attached to the lease (Title 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 on a lease is not permitted until the lease owner or operator secures approval of a drilling permit and a surface use plan specified under Onshore Oil and Gas Orders listed in Title 43 CFR 3162. A permit to drill would not be authorized until site-specific NEPA analysis is conducted.

Site specific mitigation measures and Best Management Practices (BMPs) would be attached as Conditions of Approval (COAs) for each proposed exploration and development activity authorized on a lease.

The parcels recommended for leasing under the Alternative B – Proposed Action are presented below in Table 1.

Standard terms and conditions as well as lease stipulations from the BLM FFO 2003 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 Title 43 CFR 3101.3) to address site specific concerns or new information not identified in the land use planning process.

In addition to the above, the following would apply to the proposed action:

A new lease stipulation was developed to require modeling to determine “near-field” air quality impacts (See Appendix 2). Due to the close proximity of occupied buildings and residences to potential well sites on these 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 will be developed to accurately determine the near-field air quality impacts. Exact locations and equipment specifications are known at the APD stage, so the APD EA needs to contain the disclosure of the near-field air impacts from the development of these leases. The BLM will determine the near-field air impacts based on air dispersion modeling that conforms to EPA and New Mexico Environment Department guidelines. This stipulation is consistent with BLM policy to make mineral resources available for disposal and to encourage development of mineral resources while striving to ensure that mineral development is carried out in a manner that minimizes environmental damage.

Due to occupied residences located within the 5 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. In addition, the BIA-5, No Surface Occupancy, would apply to the entirety of the lease in order to minimize the impacts from development on occupied residences.

Table 1: Alternative B: Proposed Action

Lease Parcel #	Legal Description	Acres	Lease Stipulations*
NM-201501-001	T.0220N, R.0060W, NM PM, NM Sec. 004 SE; 005 SW; 006 LOTS 6, 7; 006 E2SW, SE; 008 N2; 009 N2, W2SW; 010 NW; Sandoval County- Farmington Field Office BIA-Navajo Nation	1521.16	BIA-1 BIA-3 BIA-5 No Surface Occupancy F-15-POD Plan of Development F-44-NSO Community Residence F-41-LN F-47-CSU Air Dispersion Modeling WO-ESA-7 NM-10-LN NM-11- LN
NM-201501-002	T.0220N, R.0060W, NM PM, NM Sec. 015 SE; 022 NENE; Sandoval County- Farmington Field Office BIA-Navajo Nation	200	BIA-1 BIA-3 BIA-5 No Surface Occupancy F-15-POD Plan of Development F-44-NSO Community Residence F-41-LN F-47-CSU Air Dispersion Modeling WO-ESA-7 NM-10-LN NM-11- LN
NM-201501-003	T.0220N, R.0060W, NM PM, NM Sec. 023 E2; 024 NW; Sandoval County- Farmington Field Office	480	BIA-1 BIA-3 BIA-5 No Surface Occupancy F-15-POD Plan of Development

	BIA-Navajo Nation		F-44-NSO Community Residence F-41-LN F-47-CSU Air Dispersion Modeling WO-ESA-7 NM-10-LN NM-11- LN
NM-201501-004	T.0230N, R.0070W, NM PM, NM Sec. 006 LOTS 5-7; 006 SENW, E2SW, SWSE; 007 NE; Sandoval County- Farmington Field Office BIA-Navajo Nation	441.4	BIA-1 BIA-3 BIA-5 No Surface Occupancy F-15-POD Plan of Development F-44-NSO Community Residence F-41-LN F-47-CSU Air Dispersion Modeling WO-ESA-7 NM-10-LN NM-11- LN
NM-201501-005	T.0230N, R.0070W, NM PM, NM Sec. 035 NE; Sandoval County- Farmington Field Office BIA-Navajo Nation	160	BIA-1 BIA-3 BIA-5 No Surface Occupancy F-9-CSU Paleontology F-15-POD Plan of Development F-44-NSO Community Residence F-41-LN F-47-CSU Air Dispersion Modeling WO-ESA-7 NM-10-LN NM-11- LN
* See Appendix 2 for a summary of stipulations			

Design Features

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

- The FFO purchased an infrared camera designed to detect natural gas leaks on and around well pad and pipeline facilities. FFO inspection personnel have been trained to operate the camera and FFO is currently developing a strategy to implement the use of the camera in cooperation with oil and gas operators to detect and eliminate natural gas leaks in well pad and pipeline infrastructure.
- An application for permit to drill (APD) is required for each proposed well to develop a lease. Onshore Oil and Gas Order No. 1 issued under 43 CFR 3160 authorizes BLM to attach Conditions of Approval (COA) to APDs during the permitting process. As a result of recommendations from the Four Corners Air Quality Task Force, the New Mexico Environment Department, Environmental Protection Division requested FFO attach a COA to APDs requiring new and replacement internal combustion gas field engines of between 40 and 300 horsepower to emit no more than two grams of nitrogen oxides per horsepower-hour. FFO has included a COA limiting nitrogen oxides since August of 2005.
- Required archaeological surveys would be conducted for all subsequent actions that are expected to occur from the lease sale to avoid disturbing cultural resources. All archaeological surveys would be conducted in accordance with the Navajo Nation Cultural Resources Protection Act. No site-specific mitigation measures for cultural resources have been recommended at this time for the proposed parcels recommended to proceed for sale. Specific mitigation measures, including, but not limited to, site avoidance or excavation/data recovery would have to be determined when site-specific development proposals are received. The authorizing agency (BIA) will not approve any ground-disturbing activities that may affect any such properties or resources until they complete their NHPA section 106 obligations. The BIA may require modification to exploration or development proposals to protect such properties, or won't approve any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.
- In the event that lease development practices are found in the future to have an adverse effect on Native American TCPs, the BIA, in consultation with the affected tribe, would take action to mitigate or negate those effects. Measures include, but are not limited to physical barriers to protect resources, relocation of practices responsible for the adverse effects, or other treatments as appropriate.
- To be in conformance with the Native American Graves Protection and Repatriation Act of 1991 (Public Law 101-610), the terms and conditions of the lease shall contain the following condition: In the event that the lease holder discovers or becomes aware of the presence of Native American human remains within the lease, they shall immediately notify the BIA in writing.
- The use of plastic-lined reserve pits or closed systems or steel tanks; casing and cementing requirements; storm water management, silt traps, site recontouring, timely reseeding of disturbed areas and soil stabilization would be implemented.

- The operator would stockpile the topsoil from the surface of well pads which would be used for interim and final reclamation of the well pads. Reserve pits would be recontoured and reseeded as described in attached Conditions of Approval. Upon abandonment of the wells and/or when access roads are no longer in service the Authorized Officer would issue instructions and/or orders for surface reclamation/restoration of the disturbed areas as described in the attached Conditions of Approval. During the life of the development, all disturbed areas not needed for active support of production operations should undergo “interim” reclamation in order to minimize the environmental impacts of development on other resources and uses. Site specific mitigations, determined during the onsite, such as proper project placement, storm water management, silt traps, rounding of corners and soil stabilization, would reduce erosion and sediment migration. Earthwork for interim and final reclamation must be completed within 6 months of well completion or well plugging (weather permitting). The operator shall submit a Sundry Notices and Reports on Wells (Notice of Intent), Form 3160-5, prior to conducting interim reclamation.
- Road construction requirements and regular maintenance would alleviate potential impacts to access roads from water erosion damage.
- Mitigation would include, as needed to protect impacts to resources, revegetation with native plant species, soil enhancement practices, direct live haul of soil material for seed bank revegetation, fencing of reclaimed areas, and the use of seeding strategies consisting of native and non-native grasses, forbs, and shrubs.
- In the event noxious weeds are discovered during construction of any access roads and well pads, mitigation would be deferred to the site specific development at the APD stage. Best management practices (BMPs) would be incorporated into the conditions of approval (COAs) of an approved APD.
- A biological survey may be required to determine any impacts on individual project proposals. Any potential impacts to special status species will be determined based on the biological survey report. Any new water right or depletion will also require consultation with USFWS under the Endangered Species Act. Any potential impacts to special status species will be determined based on the biological survey report. Site specific stipulations may be attached to reduce impacts to any special status species. These stipulations include (but not limited to) timing stipulations, additional surveys, additional alternatives analyzed (including twinning), and construction design stipulations.
- All construction activities will be confined to the permitted areas only. Site specific mitigation measures designed to protect migratory birds will be implemented to decrease direct impacts to nesting birds. If an active nest is observed during construction, construction activities that could result in take as defined by the MBTA would halt until practicable or reasonable avoidance alternatives are identified, the birds have fledged, or a migratory bird take permit has been granted from the USFWS. Any proposed action that would result in more than four acres of new surface disturbance; a preconstruction

migratory bird nest survey may be required if any construction activities occur between May 15 – July 31 per BLM/FFO Instruction Memorandum No. NM-F00-2010.

- Special painting schemes may be required for all facilities to closely approximate the vegetation within the setting. All facilities, including the meter building, would be painted to blend with the surrounding vegetation. If the proposed project is determined to be in a scenic area, site specific COAs, proper project placement, tree screen, low profile equipment, may be required for the proposed action.

Reasonably Foreseeable Development

At the leasing stage, it is uncertain if Applications for Permit to Drill on leased parcels would be received, nor is it known if or to what extent development would occur. Such development may include constructing a well pad and access road, drilling a well using a conventional pit system or closed-loop system, hydraulically fracturing the well, installing pipelines and/or hauling produced fluids, regularly monitoring the well, and completing work-over tasks throughout the life of the well. In Farmington, typically, all of these actions are undertaken during development of an oil or gas well; it is reasonably foreseeable that they may occur on leased parcels. See Appendix 1 for a complete description of the phases of oil and gas development.

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

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

AFFECTED ENVIRONMENT

Introduction

This section describes the environment that would be affected by implementation of the proposed action or preferred alternative described in Section 2. Elements of the affected environment described in this section focus on the relevant resources and issues.

Air Resources

Air quality and climate are components of air resources which may be affected by BLM applications, activities, and resource management. Therefore, the BLM must consider and analyze the potential effects of BLM and BLM-authorized activities on air resources as part of the planning and decision making process. Additional information on air quality in this area is contained in Chapter 3 of the Farmington Field Office (FFO) Resource Management Plan (RMP) and Final Environmental Impact Statement (FEIS; USDI BLM, 2003) which this analysis tiers to and incorporates. Much of the information referenced in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as Air Resources Technical Report) (U.S. Department of Interior Bureau of Land Management, 2014). 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.

Air Quality

The Air Resources Technical Report describes the types of data used for description of the existing conditions of criteria pollutants, how the criteria pollutants are related to the activities involved in oil and gas development, and provides a table of current National and state standards. EPA's Green Book web page (U.S. Environmental Protection Agency, 2013) reports that all counties in the Farmington Field Office 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 Farmington Field Office are described below. Total emissions of criteria pollutants from each source sector were calculated by adding together the emissions from the four counties that are located in FFO: San Juan, McKinley, Rio Arriba, and Sandoval.*

“Design Concentrations” are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2012 design concentrations of criteria pollutants are listed below in Table 4. There is no monitoring for CO and lead in San Juan County, but because the county is relatively rural, it is likely that these pollutants are not elevated. PM10 design concentrations are not available for San Juan County.

Table 2: 2012 Criteria Pollutant Monitored Values in San Juan County
(U.S. Environmental Protection Agency, 2014)

Pollutant	2012 Design Concentration	Averaging Time	NAAQS	NMAAQS
O ₃	0.071 ppm	8-hour	0.075 ppm ¹	
NO ₂	13 ppb	Annual	53 ppb ²	50 ppb
NO ₂	38 ppb	1-hour	100 ppb ³	
PM _{2.5}	4.7 µg/m ³	Annual	12 µg/m ^{3,4}	60 µg/m ^{3,6}
PM _{2.5}	14 µg/m ³	24 hour	35 µg/m ^{3,3}	150 µg/m ^{3,6}
SO ₂	19 ppb	1-hour	75 ppb ⁵	
¹ Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years ² Not to be exceeded during the year ³ 98th percentile, averaged over 3 years ⁴ Annual mean, averaged over 3 years ⁵ 99 th percentile of 1-hour daily maximum concentrations, averaged over 3 years ⁶ The NMAAQS is for Total Suspended Particulate (TSP)				

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

air quality changes.

Mean AQI values for San Juan County were generally in the good range (AQI<50) in 2013 with 80% of the days in that range. The median AQI in 2013 was 42, which indicates “good” air quality. The maximum AQI in 2013 was 156, which is “unhealthy”.

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, there are no patterns or trends to the occurrences. On 8 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”. In 2009 and 2012, there were no days that were “unhealthy for sensitive groups” or worse in air quality. In 2005 and 2013, there was one day that was “unhealthy” during each year. In 2010, there were five “unhealthy” days and two “very unhealthy days”.

Table 3: Number of Days classified as “unhealthy for sensitive groups” (AQI 101-150) or worse (U.S. Environmental Protection Agency, 2013a)

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Days	3	6	9	18	1	0	12	9	0	1

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 (U.S. Department of Interior Bureau of Land Management, 2014). The EPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. 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 (U.S. Environmental Protection Agency, 2012).

Climate

The planning area is located in a semiarid climate regime typified by dry windy conditions and limited rainfall. Summer maximum temperatures are generally in the 80s or 90s (Fahrenheit) and winter minimum temperatures are generally in the teens to 20s. Temperatures occasionally reach above 100 °F in June and July and have dipped below zero in December and January. Precipitation is divided between summer thunderstorms associated with the Southwest Monsoon and winter snowfall as Pacific weather systems drop south into New Mexico.

Table 4: 1981-2010 Climate Normals for Chaco Canyon National Monument

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Precip (inches)	0.68	0.63	0.62	0.63	0.48	0.51	1.37	1.36	1.15	0.81	0.71	0.67
Min. Temp. (F)	13.4	19.1	23.8	30.4	38.9	47.7	55.6	53.9	45.0	32.3	21.3	14.2
Avg.	28.5	34.1	40.9	48.5	57.8	67.0	72.7	70.4	62.6	50.2	37.9	29.1

Temp. (F)												
Max. Temp. (F)	43.6	49.1	58.0	66.7	76.7	86.3	89.8	86.9	80.3	68.1	54.5	44.0

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.

Heritage Resources

Cultural Resources

The nominated parcels are located within the archaeologically rich San Juan Basin of northwestern New Mexico. In general, 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 various periods and select phases within each period is provided in the Bureau of Land Management Farmington Field Office Final Environmental Impact Statement and Resource Management Plan (2003) and will not be reiterated here. Additional information is also included in an associated document (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. (cf. "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 National Register (a.k.a. "historic property").

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 BLM definition is generally applicable. On the Navajo Nation cultural resources are managed for the benefit of the Navajo Nation and its people, not the public.

Section 106 of the National Historic Preservation Act requires federal agencies to consider what effect their licensing, permitting, or otherwise authorizing of an undertaking, such as mineral leasing, may have on properties eligible for the National Register. 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."

The National Register of Historic Places (36 CFR Part 60) is 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 a cultural resource must have integrity of location, design, setting, materials, workmanship, feeling, and association, and meet one or more of the following criteria: *a)* are associated with events that have significantly contributed to the broad patterns of our history; or *b)* are associated with the lives of persons significant in our past; or *c)* embody distinctive characteristics of the type, period, or method of construction, or represents the work of a master, or possesses high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; or *d)* have yielded, or maybe likely to yield, information is important in a pre-history or history.

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/religious features, and roads and trails. In the broadest sense cultural resources include sites, buildings, structures, objects, and districts/landscapes (NPS 1997).

- A "site" is the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archeological value regardless of the value of any existing structure. A site need not be marked by physical remains if it is the location of a prehistoric or historic event or pattern of events and if no buildings, structures, or objects marked it at the time of the events.
- A "building" is created principally to shelter any form of human activity. "Building" may also be used to refer to a historically and functionally related unit, such as a courthouse and jail or a house and barn. If a building has lost any of its basic structural elements, it is usually considered a "ruin" and is categorized as a site.
- The term "structure" is used to distinguish from buildings those functional constructions made usually for purposes other than creating human shelter. If a structure has lost its historic configuration or pattern of organization through deterioration or demolition, it is usually considered a "ruin" and is categorized as a site.
- The term "object" is used to distinguish from buildings and structures those constructions that are primarily artistic in nature or are relatively small in scale and simply constructed. Although it may be, by nature or design, movable, an object is associated with a specific setting or environment.
- A "district" possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development. A district can contain buildings, structures, sites, objects, or open spaces that do not contribute to the significance of the district. A district can also be a grouping of archeological sites related primarily by their common components; these types of districts often will not visually represent a specific historic environment. In archeological districts, the primary factor to be considered is the effect of any disturbances on the information potential of the district as a whole.

Cultural Landscapes

Cultural landscapes “represent the 'combined works of nature and of man'... [and] are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal” (UNESCO 2008). The term embraces a diversity of manifestations of the interaction between humans and the natural environment and often reflects specific techniques of sustainable land use, considering the characteristics and limits of the natural environment they are established in, and a specific spiritual relation to nature.

The National Park Service has defined cultural landscapes as “a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values” (Birnbaum 1994; Birnbaum and Peters 1996).

Landscape characteristics are the tangible evidence of the activities and habits of the people who occupied, developed, used, and shaped the land to serve human needs and they may reflect the beliefs, attitudes, traditions, and values of these people. There is no comprehensive guidance on what characteristics to evaluate with regards to the landscape, or how to “read a landscape” (Birnbaum 1994). Whatever approach is taken should provide a broad overview. The National Park Service (1999; Birnbaum and Peters 1996) has offered a number of character defining features and organizational elements that should be examined when considering human use or activity in a geographic area for cultural landscapes:

- | | |
|---|--|
| 1. Land uses and activities | 7. Water features |
| 2. Patterns of spatial organization | 8. Boundary demarcations |
| 3. Response to the natural environment | 9. Vegetation related to land use |
| 4. Cultural traditions | 10. Buildings, structures, and objects |
| 5. Circulation networks (e.g. roads, paths) | 11. Clusters |
| 6. Topography | 12. Archaeological sites |
| | 13. Small-scale elements |

Zvelebil et al. (1992) identified seven major problems associated with landscape approaches to archaeological remains. To summarize, they include 1) lack of chronological resolution, 2) the palimpsest effect, 3) definition of a regional scale, 4) biases introduced through taphonomic processes, 5) variation over the landscape, 6) paleoenvironmental reconstruction, and 7) modern land use. Van Dyke (2007:8, 39) observed that “the contemporary archaeological landscape is but a distorted remnant of the ancient landscape, and interpretations of both are and were culturally situated” and that “past landscapes no longer exist.” Compounding the difficulty in defining landscapes is that they may be a composite of designed and vernacular/organic characteristics and at the same time represents a relic or fossil landscape to some and a continuing ethnographic/associative landscape to others.

A cultural landscape is also one of the categories of property qualifying for listing in the National Register as a historic site or district. A district (e.g. landscape) must be a definable geographic area that can be distinguished from surrounding properties by changes such as density, scale,

type, age, style of sites, buildings, structures, and objects, or by documented differences in patterns of historic development or associations. It is seldom defined, however, by the limits of current parcels of ownership, management, or planning boundaries. The boundaries must be based upon *shared relationship* among the properties constituting the district. A district is usually a single geographic area of contiguous historic properties; however, a district can also be composed of two or more definable significant areas separated by nonsignificant areas. Clement (1999:17) advised that "*As a general rule, it is preferable to identify a reasonably defensible smaller landscape rather than stretching boundaries to distant horizons, and perhaps threatening the credibility of the process.*"

Area of Potential Affect and Cultural Resource Identification

As previously noted, pursuant to Section 106 of the National Historic Preservation Act (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 National Register of Historic Places. This is completed by a process of collaborative identification, normally including field surveys of some kind with subsequent evaluations of significance for any districts, sites, buildings, structures, and objects that have been identified within the Area of Potential Effect (APE).

Pursuant to 36 CFR Part 800.4(a) and 800.4(b), BLM has consulted with the New Mexico SHPO, the National Park Service (Chaco Culture National Historical Park), Navajo Nation and potentially affected chapters (Nageezi, Counselor), the pueblos of Zia, Zuni, Jemez, Acoma, and Hopi, and the National Trust for Historic Preservation, and the Chaco Alliance. They were advised that the BLM was considering the parcels as the APE and were inviting them to help identify cultural resources within the nominated parcels. Only the SHPO and the Hopi responded. No objection to the APE was raised.

The New Mexico SHPO (April 10, 2014) pointed out the proximity of the Pueblo Pintado site to some of the parcels and indicated that they would provide more comments after BLM completed its cultural review. The Hopi (March 25, 2014) requested and were subsequently provided a cultural resources overview for review and comment. No further comments were received from the Hopi Tribe.

Pursuant to 36 CFR 800.16(d) BLM has identified the lease parcel themselves as the APE for undertakings that could affect aspects of a historic properties physical integrity including location, design, materials, and workmanship.

Identification of cultural resources within the nominated parcels involved use of computerized cultural resources data maintained by the New Mexico Cultural Resource Information System (NMCRIS; April 2014), BLM site location maps, ethnographic records from previously conducted small and large scale cultural resource surveys and ongoing consultation, General Land Office (GLO) records, and assorted published and unpublished records.

NMCRIS Data

Previous (1977-2013) cultural resource studies and surveys (n=43) in the nominated parcels have been generally limited to inventories related to various land use authorizations that include various public and industrial infrastructure, ranching, energy/resources extraction, and home sites. From the NMCRIS data review, there are 17 archaeological sites on record in the parcels and approximately 471 acres of that acreage (17%) has been inventoried for cultural resources. The figures may be slightly higher because not all known surveys have been electronically captured in a GIS environment on Navajo surface.

There are 18 distinct cultural/temporal components represented by the sites. The majority are recent Navajo (>1945) followed by unknown. "Unknown" most likely indicates an absence of culturally or temporally diagnostic artifacts or features, such as a scatter of stone tool debris without any diagnostic specimens, or may represent an absence of data in the record. The majority of these unknown sites are likely to be Native American.

Features common to these sites include hogans, horno/ovens, corrals and lambing pens, dumps, log cabin, ramada, house foundation, and ash stains and hearths. Some of these features are restricted to the historic periods of occupation such as hogan, corral, dump etc. Some features such as hearth and ash stains may appear at sites of any age and cultural affiliation. A complete description of these features may be found in the NMCRIS Users Guide available online at <http://www.nmhistoricpreservation.org/arms.html>.

General Land Office (GLO) Records

Original GLO maps covering the APEs were downloaded from <http://www.glorerecords.blm.gov/> and geo-referenced into a GIS map project. No historic features were identified in 1882 on the parcels. Whether this accurately reflects a low resident population density in the early 1880s, or reflects a bias to documenting non-Native American residential features is uncertain. No prehistoric structural sites were identified on the maps within the parcels.

Native American Religious Concerns

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

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

- The Archaeological Resources Protection Act of 1979 (ARPA; 16 USC 470, Public Law 96-95).
 - Protection of archaeological resources on Federal and Indian lands

Traditional Cultural Properties (TCPs; Parker and King 1998) is a term that has emerged in historic preservation management and the consideration of Native American traditional concerns. TCPs are places that are eligible for the National Register of Historic Places and have cultural values, often sacred, that transcend for instance 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. Native American perspectives on what is considered a TCP are not limited by a places National Register eligibility or lack thereof.

The identification of places of traditional religious and cultural importance (e.g. TCPs) 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. Brugge 1986; Condie et al. 1982; Fransted and Werner 1975; Fransted 1979; Kelly et al. 2006; York and Winter 1988; Van Valkenburgh 1941, Van Valkenburgh 1974).

In both the published and gray literature the known places of traditional religious and cultural importance in the San Juan Basin is heavily weighted towards places of Navajo knowledge. This most likely is a byproduct of ongoing and historic occupancy of the area and retention of knowledge pertaining to that area. For example Brugge (1993:54) notes that in a research area of approximately 810 mi.² 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. With over 200 place names and localities identified in a 540 mi.² area around Chaco Canyon with significant Navajo occupation (Fransted and Werner 1975), it's clear 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 (e.g. Acoma, Zuni, Hopi) and representatives from those pueblos have made it very clear that those sites and their environment are of traditional religious and cultural importance to them.

Identification of TCPs for 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/communities. Based on a review of the available data there appears to be only four locations in the parcels that have been ascribed traditional religious and cultural importance: plant gathering area (parcel NM-201410-032; one and possibly two burial sites or *jishchaa'* (parcels NM-201410-021 and 033); and a spring (parcel NM-201410-021).

Parcels NM-201410-021, 22, and 23 also occupy a large landform variously known as Sis Naateel, Sisnathyel Mesa, or Wide Belt Mesa. It is reported to be the home of several holy individuals important in the Blessingway ceremony and to be the location of where the Navajo acquired sheep and horses. 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 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.

World Heritage Sites

Chaco Culture NHP, Aztec Ruins National Monument, and the BLM managed Chaco outlier sites of Pierre's, Halfway House, Twin Angels, Casamero, and Kin Nizhoni were named as United National Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Sites on December 8, 1987. The World Heritage listing includes the 34,000 acres in Chaco Canyon NHP, 318 acres in Aztec Ruins National Monument, and 518 acres within the five sites managed by the BLM.

None of the parcels are physically or visibly within 15 miles of any World Heritage Site. All the parcels are approximately 15+ miles from the Pueblo Pintado unit of Chaco Culture NHP. By e-mail to the BLM, the Superintendent of Chaco Culture NHP and Aztec Ruins National Monument acknowledged this information and had no other comments to offer.

Chaco Culture Archaeological Protection Sites

Pursuant to Public Law 96-550 (1980), as amended by Public Law 104 -11 (1995), thirty-nine sites in New Mexico, Arizona, and Colorado are designated Chaco Culture Archaeological Protection Sites (Protection Site). They were designated to recognize the unique archaeological resources associated with the prehistoric Chacoan 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 m 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 parcels are 15+ miles or more from any Protection Site. Part of the legislation directs the Secretary of the Interior to continue searching for additional evidence of Chacoan sites and as needed, provide recommendations for additions or deletions to the Protection Site list. Archaeological surveys since the 1995 amendment suggest that there is unlikely to be additional Chacoan sites eligible for Protection Site status in the vicinity of the nominated lease sale parcels.

Night Sky Resources

There is a long history of stargazing, starting with the Ancestral Puebloan culture that inhabited the Chaco area. There has been focus of 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, Chaco Culture NHP has partnered with the astronomy community. Amateur astronomers regularly host stargazing events under the guidance of a park ranger with a background in archaeoastronomy. The park built a public observatory in 1998 to help accommodate the hundreds of thousands of visitors who have enjoyed the night sky at the park. The modern connection with the night sky is a substantial recreation interest and a way for the public to connect and better understand the ancient culture that once thrived in the canyon.

Water Resources

The primary aquifers in the BLM/FFO area are the sandstone based Uinta-Animas and the Mesaverde. Figure 1 shows the geologic time column that relates to aquifers in the San Juan Basin. The Uinta-Animas aquifer is composed primarily of Lower Tertiary rocks consisting of the San Jose Formation, the underlying Animas Formation and its lateral equivalent, the Nacimiento Formation, and the Ojo Alamo Sandstone. The aquifer thickness generally increases toward the central part of the basin.

The Mesaverde aquifer comprises water-yielding units in the Upper Cretaceous Mesaverde Group and some adjacent Tertiary and Upper Cretaceous formations. In the basin, the aquifer consists of sandstone, coal, siltstone, and shale of the Mesaverde Group. The aquifer has a maximum thickness of about 4,500 feet in the southern part of the basin. The quality of the Mesa Verde Aquifer is extremely variable. Sparse data indicate that the total dissolved solids (TDS) concentrations ranges from about 1,000 to 4,000 milligrams per liter (mg/L) in the basin (USDI/BLM 2003a, page 3-29) and also high in chlorides (USGS 1995). The available data in the San Juan Basin indicate recharge in the area of the Zuni Uplift, Chuska Mountains, and in northern Sandoval County, New Mexico. Transmissivity, the rate which groundwater flows horizontally through an aquifer, of the Mesaverde aquifer is less than 50 square feet per day in large areas of the Colorado Plateaus (USGS 1995).

Figure 1: Geologic Time Column of the San Juan Basin

Era	System	Formation	Thickness	Production
CENOZOIC	TERTIARY	San Jose Formation	2500 ft.	Gas
		Nacimiento Formation	500-1300 ft.	Gas
		Ojo Alamo Sandstone	250 ft.	Gas
MESOZOIC	CRETACEOUS	Kirtland Shale Farmington Sandstone	1500 ft.	Gas/Oil
		Fruitland Formation	500 ft.	Gas
		Pictured Cliffs Sandstone	250 ft.	Gas
		Lewis Shale Huerfano Bentonite	500-1900 ft.	Gas
		Cliff House Sandstone	0-800 ft.	Gas
		Menefee Formation	350-2200 ft.	Gas
		Point Lookout Formation	100-300 ft.	Gas
		Upper Mancos Shale/Tocito Sandstone	2300-2500 ft.	Gas/Oil
		Gallup Sandstone/Carlile Shale		Gas/Oil
		Greenhorn Limestone		
		Graneros Shale		
	JURASSIC	Dakota Sandstone	150-200 ft.	Gas/Oil
		Morrison Formation	400-900 ft.	
		Wanakah Formation	50-200 ft.	
		Todilto Limestone		
	TRIASSIC	Entrada Sandstone	100-300 ft.	Oil
		Chinle Formation	500-1600 ft.	
PALEOZOIC	PERMIAN	Cutler Formation	1500-2500 ft.	
	PENNSYLVANIAN	Honaker Trail Formation		
		Paradox Formation	200-3000 ft.	Gas?
		Pinkerton Trail Formation		
		Molas Formation	0-100 ft.	
	MISSISSIPPIAN	Leadville Limestone	0-165 ft.	
	DEVONIAN	Elbert Formation	0-325 ft.	
	CAMBRIAN	Ignacio Quartzite	0-100 ft.	
	PRECAMBRIAN			

Source: USDI/BLM 2003a

Groundwater is readily available in most of the FFO planning area and is of fair to poor quality. Generally TDS exceed 1,000 mg/L and ranges from 400 up to 4,000 mg/L. The water is hard to very hard with chemical composition dependent on location of withdrawal and the producing aquifer. Calcium or sodium is usually the predominant cation with bicarbonate or sulfate the predominant anion (USDI/BLM 2003a, page 3-30).

Most onshore produced water (water that is produced along with oil or gas from target formations) is injected deep underground for either enhanced recovery or disposal. With the passage of the Safe Drinking Water Act in 1974, the subsurface injection of fluids came under federal regulation. In 1980, the USEPA promulgated the Underground Injection Control regulations. The program is designed to protect underground sources of drinking water. The NMOCD regulates 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). According to the NMOCD, produced water if predictable in salt concentration, can be used for drilling and completion and possibly cementing (Jones, pers. comm. 2012).

According to NMED data, there are no drinking water sources located in or near the proposed parcels. Wells registered with the NM Office of the State Engineer (OSE) are located in and near parcel -171, but these wells appear to be associated with coal exploration. A domestic water well registered with NMOSE is located between parcels -167 and -156. A few other wells located in or near the nominated parcels are described as being used either for livestock, wildlife, or oil and gas use. All of the nominated parcels are located in the San Juan declared ground water basin.

Fragile Soils

FFO reviewed Natural Resource Conservation Service (NRCS) soil surveys and has identified the following mapping units for each lease parcel that are potentially fragile depending on percent slope.

Fragile soils exhibit physical characteristics and features that affect soil behavior. Characteristics consist of Erosion Factors (Kw's) that indicates the susceptibility and erodibility of a soil to sheet and rill erosion by water. The Kw estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Features consist of slope length, gradient and runoff potential based on the rate of water infiltration when the soils are not protected by vegetation. Soils are assigned to one of four Hydrologic Soil Groups (A,B,C,D), with Group D soils having a very slow infiltration rate (high runoff potential) when thoroughly wet.

Table 5: Fragile Soil Types

Lease Parcel #	Fragile Soil Type	Fragile Soil Acres	Total Acres
NM-201501-001	N/A	0	1521.16
NM-201501-002	N/A	0	200
NM-201501-003	N/A	0	480
NM-201501-004	Rock Outcrop-Vessilla-Menefee Complex	231	1521.16
NM-201501-005	N/A	0	160

220 Rock Outcrop-Vessilla-Menefee Complex, 15 to 45 percent slopes

The Rock Outcrop-Vessilla-Menefee soil unit landform setting is associated with escarpments, ridges, and breaks. The Rock Outcrop consists of barren or nearly barren areas of exposed sandstone bedrock. The Vessilla and Menefee landform setting is associated with breaks. These soils were derived from alluvium over residuum weathered from sandstone and colluvium over residuum weathered from shale. Permeability is moderately rapid to slow with a very low available water capacity. Effective rooting depth varies from 10 to 20 inches. Runoff potential is high to very high with water erosion severe. The hazard of soil blowing is severe. This mapping unit has limitations due to lack of soil depth and slopes. Roads can be protected from erosion by

construction of water bars and by seeding of cuts and fills. The major use of soil unit is wood products with a potential plant community consisting of pinyon-juniper, bottlebrush squirreltail, prairie junegrass, Indian ricegrass, mountain mahogany and various forbs. Minor components include badlands, 5 %.

Special Status Species

USFWS Threatened or Endangered Species

Under Section 7 of the Endangered Species Act of 1973 (as amended), the BLM is required to consult with the U.S. Fish and Wildlife Service (USFWS) on any proposed action which may affect federal listed threatened or endangered species or species proposed for listing. Based on FFO's field inspection and reviews, it was determined that there are no known threatened or endangered species located within the area of analysis. The proposed action would not be in compliance with the 2002 Biological Assessment for the 2003 BLM/FFO RMP (Cons. #2-22-01-I-389). Consultation with USFWS under the Endangered Species Act may be required for any new ground disturbing activity. Any proposed project within the proposed leases would require new effects determination on federally-listed species to ensure any proposed project does not contribute to the demise of the listed species or their habitat. Table 12 lists all the federally-listed and Candidate species in San Juan, Rio Arriba and Sandoval Counties.

Table 6: Habitat Descriptions and Presence of Federally-Listed Threatened, Endangered, and Candidate Species in San Juan, Rio Arriba, and Sandoval Counties.

Species Name	Conservation Status	Habitat Associations	Potential to Occur in the Proposed Action Area
BIRDS			
Southwestern willow flycatcher (<i>Empidonax traillii extimus</i>)	Federal-Endangered	Riparian habitats along rivers, streams, or other wetlands with dense growths of willows or other shrubs and medium sized trees.	There are no riparian habitats suitable for willow flycatchers in the proposed action area.
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	Federal-Endangered	Mature montane forest and in shaded, woody, and steep canyons.	No montane forests are located within the proposed action area.
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	Proposed-Threatened	Low to mid-elevation riparian woodlands, deciduous woodlands, and abandoned farms and orchards.	There are no large cottonwood galleries in, or near the proposed action area.

Whooping crane (<i>Grus americana</i>)	Experimental, non-essential population; Rocky Mountain population	Nests at shallow diatom ponds that contain bulrush. Migration: wetland mosaics most suitable. Feeding: primarily use shallow, seasonally and semi permanently flooded palustrine wetlands for roosting, and various cropland and emergent wetlands.	No suitable wet areas or cropland occur in or near the analysis area. Rocky Mountain experimental population has been discontinued.
Least tern-interior pop. (<i>Sterna antillarum</i>)	Federal- Endangered	Breeds on sandbars or sandy shorelines along perennial rivers, lakes, and reservoirs east of the Continental Divide and forages over open waters.	There are no perennial water bodies in the proposed action area.
FISH			
Colorado pikeminnow (<i>Ptychocheilus lucius</i>)	Federal- Endangered	Large rivers with strong currents, deep pools, and quiet backwaters.	USFWS designated critical habitat within one mile of Parcel #73.
Razorback sucker (<i>Xyrauchen texanus</i>)	Federal- Endangered	Habitats include slow areas, backwaters and eddies of medium to large rivers; impoundments.	Habitat within one mile of Parcel #73.
Rio Grande cutthroat trout (<i>Oncorhynchus clarki virginalis</i>)	Federal- Candidate	Small streams and Lakes at High Elevations 7500-10750 feet in elevation	There are no perennial high elevation streams or lakes within the proposed action area.
Rio Grande silvery minnow (<i>Hybognathus amarus</i>)	Federal- Endangered	River with silty substrates in eddies, and backwaters of the Rio Grande River and its tributaries.	There are no perennial rivers with eddies and backwaters located in the proposed action area.
Roundtail chub (<i>Gila robusta</i>)	Federal- Candidate	Occurs in cool to warm water, mid-elevation streams and rivers with deep pools adjacent to swifter riffles and runs. Cover is usually present (large boulders, tree rootwads, submerged large trees, etc.)	Proposed action area does not contain suitable habitat.
MAMMAL			
Black footed ferret (<i>Mustela nigripes</i>)	Federal- Endangered	Grassland plains where it occurs in association with prairie dogs. At a	No prairie dog colonies

		minimum, the black-footed ferret requires prairie dog towns of at least 80 acres for suitable habitat.	are located within the proposed action area.
New Mexico jumping mouse (<i>Zapus hudsonius luteus</i>)	Proposed-Endangered	Riparian zones along permanent waterways with dense and diverse vegetation consisting of grasses, sedges, and forbs	No riparian zones occur within the proposed action area.
Canada lynx (<i>Lynx canadensis</i>)	Federal-Candidate	Mature subalpine coniferous forests with uneven-aged stands, boulder outcrops, and downed logs.	No subalpine forests occur within the proposed action area; elevation too low. No riparian corridors suitable for migration occur in or near the proposed action area.
PLANTS			
Knowlton's cactus (<i>Pediocactus knowltonii</i>)	Federal-Endangered	Alluvial deposits that form rolling, gravelly hills in piñon-juniper and sagebrush communities (6,200-6,400 ft.).	Soils in the proposed project area are clay and sandy in texture and do not contain a high content of organic matter
Mancos milkvetch (<i>Astragalus humillimus</i>)	Federal-Endangered	Cracks of Point Lookout Sandstone of the Mesa Verde series (5,000-6,000 ft.).	Point Lookout Sandstone does not occur in the proposed action area.
Mesa Verde cactus (<i>Sclerocactus mesae-verde</i>)	Federal-Threatened	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland formations (4,000-5,550 ft.)	Parcel #73 does include Mancos or Fruitland Shale Formations.

Other Special Status Species

In accordance with BLM Manual 6840, the Farmington Field Office of the Bureau of Land Management (FFO) has prepared a list of BLM sensitive species, as well as a special management species list that focuses on species management efforts to better maintain habitat areas under a multiple use mandate. These species are referred to as FFO Special Management Species (SMS). The BLM manages certain sensitive species not federally listed as threatened or endangered in order to prevent or reduce the need to list them as threatened or endangered in the future (IM-NM-200-2008-001). Table provides an evaluation of the potential for Special Management Species, BLM Sensitive Species and other special status species to occur in the proposed action area. The FFO has mapped potential habitats for those species which have readily defined habitat characteristics. The San Juan milkweed and the Mancos saltbush habitat have yet to be mapped due to their recent addition to the BLM Sensitive Species list (2011).

Table 7: Habitat Descriptions and Presence of BLM FFO Special Status Species

Species Name	Conservation Status		Habitat Associations	Potential to Occur in Analysis Area
	BLM/ USFW S	State of NM		
Birds				
Golden Eagle (<i>Aquila chrysaetos</i>)	SMS		In the West, mostly open habitats in mountainous, canyon terrain. Nests primarily on cliffs and trees.	The proposed action area contains suitable habitat for foraging, but nesting habitat marginal.
Ferruginous hawk (<i>Buteo regalis</i>)	SMS		Grasslands and semi-desert shrub; occasionally piñon-juniper edge habitat. Nest on rock spires in NW New Mexico.	The proposed action area contains suitable piñon-juniper edge habitat for foraging with some nesting habitat.
Prairie falcon (<i>Falco mexicanus</i>)	SMS		Arid, open country, grasslands or desert scrub, rangeland; nests on cliff ledges, trees, power structures.	The proposed action area contains suitable habitat for foraging and nesting.
Mountain plover (<i>Charadrius montanus</i>)	SMS		Semi desert, grasslands, open arid areas, bare fields, breeds in open plains or prairie.	The proposed action area does not contain flat, open grasslands for suitable habitat.
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	SMS BLM-S FWS-C		Low to mid-elevation riparian woodlands, deciduous woodlands, and abandoned farms and orchards. Rare in the San Juan River valley.	The proposed action area does not contain riparian areas for suitable habitat.
American peregrine falcon (<i>Falco peregrinus anatum</i>)	SMS FWS- SC	NM-T	Open country near lakes or rivers with rocky cliffs and canyons. Tall city bridges and buildings also inhabited.	The proposed action area lacks suitable habitat for nesting.
Bald eagle (<i>Haliaeetus leucocephalus</i>)	SMS BLM-S	NM-T	Near lakes, rivers and cottonwood galleries. Nests near surface water in large trees. May forage terrestrially in winter.	The proposed action area does not contain suitable habitat for nesting, foraging opportunities possible.
Western Burrowing owl (<i>Athene cunicularia</i>)	SMS BLM-S FWS-		Associated with prairie dog towns. In dry, open, short-grass, treeless plains	The proposed action area does contain suitable habitat for foraging and

	SC			nesting. Historic prairie dog colonies occur in the planning area but not active.
Plants				
Brack's hardwall cactus (<i>Sclerocactus cloveriae</i> ssp. <i>brackii</i>)	SMS BLM-S FWS- SC	NM-E	Sandy clay slopes of the Nacimiento Formation in sparse semi desert, piñon-juniper grasslands and open arid areas of badland habitat (5,000-6,000 ft).	The proposed action area meet suitable habitat requirements for this species.
Aztec gilia (<i>Aliciella formosa</i>)	SMS BLM-S FWS- SC	NM-E	Arid and sparsely vegetated Badland /Salt desert scrub communities in soils of the Nacimiento Formation (5,000-6,000 feet).	The proposed action area meet suitable habitat requirements for this species.
Grama grass cactus (<i>Sclerocactus papyracanthus</i>)	BLM-S		Open grasslands mixed with juniper-piñon woodlands, 5,000-7,000 ft. elevation.	The proposed action areas may meet suitable habitat requirements for this species.
Gypsum Townsend's aster (<i>Townsendia gypsophila</i>)	BLM-S	NM-SOC	Weathered gypsum outcrops of the Jurassic-age Todilto and overlying Morrison formations, 5,900-6,450 ft. elevation.	The proposed action areas are not known to include suitable habitat requirements for this species.
Knight's milkvetch (<i>Astragalus knightii</i>)	BLM-S	NM-SOC	Rimrock ledges of Dakota Formation sandstone in juniper savannah and grassland, 5,700-5,900 ft. elevation.	The proposed action areas may meet suitable habitat requirements for this species.
Mancos Saltbush (<i>Proatriplex pleiantha</i>)	BLM-S	NM-SOC	Desert badlands of Colorado Plateau on saline clay soils of the Mancos and Fruitland shale formations; 5,000-5,500 ft.	The proposed action areas meet suitable habitat requirements for this species.
Parish's alkali grass (<i>Puccinellia parishii</i>)	BLM-S	NM-E	Alkaline springs, seeps, and seasonally wet areas that occur at the heads of drainages or on gentle slopes, 2,600-7,200 ft. elevation.	The proposed action areas are not known to include suitable habitat requirements for this species.
San Juan milkweed (<i>Asclepias sanjuanensis</i>)	BLM-S	NM-SOC	Sandy loam soils, usually in disturbed sites, in juniper savanna and Great Basin desert scrub; 5,000-5,500 ft.	The proposed action areas meet suitable habitat requirements for this species.
Tufted sand verbena (<i>Abronia bigelovii</i>)	BLM-S	NM-SOC	Hills and ridges of gypsum in the Todilto Formation, 5,700-5,400 ft. elevation.	The proposed action areas are not known to include suitable habitat requirements for this species.
NM-T = State of New Mexico Threatened Species; NM-E = State of New Mexico Endangered Species; NM-SOC=State of New Mexico Species of Concern; BLM-S BLM Sensitive Species; FWS-SC = USFWS Species of Concern; SMS = FFO Special Management Species.				

Wildlife

The Piñon-Juniper plant communities in the northeastern part of the FFO provide habitat for herds of wintering and resident populations of mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*). Mule deer and elk are found most often on FFO land north of US Highway 550, and

are much less common south of the highway due to the lack of suitable habitat. The BLM lands found in the Lindrith area north of Cuba provide yearlong habitat for a variety of wildlife species but most notably, deer and elk. The area between La Jara and Regina is utilized each fall/spring as a migration corridor for elk that migrate from the San Pedro Parks Wilderness, which is adjacent to the BLM and private lands, on their way to winter range in the Chaco area. Deer also migrate from the surrounding Apache Reservation into the Lindrith area to winter. Their numbers vary depending upon the severity of the winter. Deer and elk population density on FFO land varies by location and time of year.

Several small populations of pronghorn antelope (*Antilocapra americana*) reside in the area north and east of US Highway 550 and are much less common south of the highway due to the lack of suitable habitat. Deer and elk population density on FFO land varies by location and time of year.

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

Migratory Birds

A Memorandum of Understanding (MOU) between the BLM and USFWS dated April 12, 2010 calls for increased efforts to more fully implement the Migratory Bird Treaty Act of 1918 (DOI 2010a). In keeping with this mandate, the BLM/FFO has issued an interim policy to minimize unintentional take as defined by the MOU and to better optimize migratory bird efforts related to BLM/FFO activities (DOI 2010b). In keeping with this policy, a list of priority birds of conservation concern which occur in similar eco-regions as the proposed action area was compiled through a review of existing bird conservation plans including: Fish and Wildlife Service (USFWS) Birds of Conservation Concern (BCC), New Mexico Partners in Flight (NMPiF), New Mexico Bird Conservation Plan Comprehensive Wildlife Conservation Strategy for New Mexico (CWCS), Gray Vireo Recovery Plan, The North American Waterbird Conservation Plan, Recovery plans and conservation plans/strategies prepared for federally-listed candidate species.

The selected species have a known distribution in the FFO area within the piñon-juniper vegetation community and may be affected by the proposed action. These species and a brief assessment of their habitat can be found in Table 8.

Table 8: Migratory Birds with Potential to Occur in the Proposed Action Area

Species Name	Habitat Associations	Potential to Occur in the Proposed Action Area
Montezuma quail (<i>Cyrtonyx montezumae</i>)	Open oak, pine-oak, or piñon-juniper with well-developed grassy understory; prefers 70% or more tall grass cover.	Lack of significant grassy understory within the analysis area limits habitat.
Broad-tailed hummingbird (<i>Selasphorus platycercus</i>)	Piñon-juniper woodlands, montane riparian areas and thickets, and open, mixed conifer forests.	Piñon-juniper woodland in the analysis area could provide suitable habitat for the species.
Cassin's kingbird (<i>Tyrannus vociferans</i>)	Found in open country with scattered trees (savannahs) or open woodlands including piñon-juniper.	Piñon-juniper/sagebrush edge of the analysis area may provide preferred habitat.

Species Name	Habitat Associations	Potential to Occur in the Proposed Action Area
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Open country interspersed with improved pastures, grasslands, and hayfields. Nests in sagebrush areas, desert scrub, and woodland edges.	No open country interspersed with grassy areas occurs in or near the project area.
Gray vireo (<i>Vireo vicinior</i>)	In northern NM, stands of piñon pine and Utah juniper 5800 - 7200 ft, open with a shrub component and mostly bare ground; antelope bitterbrush, mountain mahogany, Utah serviceberry and big sagebrush often present. Broad, flat or gently sloped canyons, in areas with rock outcroppings, or near ridge-tops.	Piñon-juniper woodland in the analysis area could provide suitable habitat for the species.
Plumbeous vireo (<i>Vireo plumbeus</i>)	Denser piñon-juniper woodland at higher elevations (and ponderosa forests) with some deciduous understory.	Low elevation sparse woodland not likely to provide habitat.
Western scrub-jay (<i>Aphelocoma californica</i>)	Scrub and open woodland habitats.	Piñon-juniper woodland in the analysis area could provide suitable habitat for the species.
Piñon jay (<i>Gymnorhinus cyanocephalus</i>)	Piñon-juniper habitat, due to the species' tightly co-evolved relationship with piñon pines.	Piñon-juniper woodland in the analysis area could provide suitable habitat for the species.
Juniper titmouse (<i>Baeolophus griseus</i>)	Open, mixed woodland areas at mid-elevations, most common where juniper is dominant; high overstory cover; requires large, mature trees for cavity nesting.	Piñon-juniper woodland in the analysis area could provide suitable habitat for the species.
Western bluebird (<i>Sialia mexicana</i>)	Open piñon-juniper, often burned or moderately logged areas; requires larger trees and snags for cavity nesting.	Piñon-juniper woodland in the analysis area could provide suitable habitat for the species.
Mountain bluebird (<i>Sialia currucoides</i>)	Open piñon-juniper woodlands, mountain meadows, and sagebrush shrublands; requires larger trees and snags for cavity nesting.	Piñon-juniper woodland in the analysis area could provide suitable habitat for the species.
Bendire's thrasher (<i>Toxostoma bendirei</i>)	On the Colorado Plateau, inhabits open sagebrush with scattered junipers; sparse or degraded understory, lower elevations.	While juniper does occur in the analysis area, it is associated with piñon in a woodland setting. There is no dry open habitat typical of the preferred habitat.
Virginia's warbler (<i>Vermivora virginiae</i>)	Coniferous woodland or forest mixed with deciduous shrubs or trees; dense understory is critical; steep draws or scrubby hillsides especially favored	Lack of significant deciduous component limits preferred habitat.
Black-throated gray warbler (<i>Dendroica nigrescens</i>)	Large stands of mature piñon-juniper woodland often with brushy undergrowth.	Lack of mature woodland limits preferred habitat.
Black-chinned sparrow (<i>Spizella atrogularis</i>)	Moderately dense montane shrubs from 3-7 ft tall mixed with rocky outcroppings; large grass component and openings.	No montane shrub dominated areas exist in or near the project area.
Cassin's finch (<i>Carpodacus cassinii</i>)	Breeds in higher mountains. Fall and winter moves into lower mountains and foothills, especially areas where piñon pine cone crops are excellent.	Piñon-juniper woodland in the analysis area could provide suitable winter habitat for the species.

Environmental Justice

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

Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies. It focuses on environmental hazards and human health to avoid disproportionately high and adverse human health or environmental effects on minority and low-income populations.

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

- **Low-income population.** A low-income population is determined based on annual statistical poverty thresholds developed by the US Census Bureau. In 2012, poverty level is based on total income of \$11,720 for an individual and \$23,283 for a family of four (US Census Bureau 2012d). 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

Low-income Populations

Income and poverty data estimates for study area counties from the US Census Small Area Poverty Estimates model indicate that the percent of the population living below the poverty level in the socioeconomic study area as a whole is slightly above that of the state (21.3 percent and 20.6 percent), but it is much higher than the national average of 12.1 percent. See Table 15, Study Area County Population in Poverty (2012). Poverty levels ranged from 37.7 percent in McKinley County to 13.7 percent in San Juan County. Only that of Sandoval County was below the state average.

Table 9: Study Area County Population in Poverty (2002-2012)

	McKinley County	Rio Arriba County	Sandoval County	San Juan County	Study Area Total	New Mexico	United States
Percent of Population	21,766	7,165	19,934	22,152	71,017	421,123	34,569,951
in Poverty 2002	30.2%	17.7%	11.1%	18.2%	21.3%	20.6%	12.1%

Table 9: Study Area County Population in Poverty (2002-2012)

	McKinley County	Rio Arriba County	Sandoval County	San Juan County	Study Area Total	New Mexico	United States
Percent of Population in Poverty 2012	27,296 37.7%	8,806 22.0%	18,502 13.7%	25,802 20.3%	80,406 21.5%	327,444 17.7%	48,760,123 15.9%
Median Household Income 2002	\$25,197	\$30,557	\$45,213	\$34,329	N/A	\$34,827	\$45,409
Median Household Income 2012	\$29,821	\$36,900	\$57,376	\$45,901	N/ A	\$42,828	\$51,371
Classified as Low Income Population in 2012 based on CEQ guidelines?	No	No	No	No	No	NA	NA
Source: US Census Bureau 2013b							

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

Table 10: Study Area Key Community Race/Ethnicity and Poverty Data

Community				
	% Population Racial or Ethnic Minority	Classified as Minority Population based on CEQ?	% of Individuals Below Poverty	Classified as Low-income Population based on CEQ?
Aztec	36.4%	N	14.4%	N
Bernalillo	78.8%	Y	24.1%	N
Bloomfield	55.8%	Y	29.0%	N
Espanola	91.6%	Y	26.3%	N
Farmington	48.8%	N	15.5%	N
Gallup	76.9%	Y	20.9%	N
Rio Rancho	46.7%	N	9.8%	N
Source: US Census Bureau 2012b				
Note: American Community Survey estimates are based on data collected over a 5-year time period. The estimates represent the average characteristics of populations between January 2008 and December 2012 and do not represent a single point in time.				

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

When broken down by Census Tract, 3 out of 87 tracts in the socioeconomic study area have greater than 50 percent of individuals living below the poverty line: Census Tract 9440 in eastern McKinley County had an individual poverty rate of 54.6 percent; Census Tract 9405 in southwestern McKinley County had an individual poverty rate of 59.4 percent; and Census Tract 9409 in northwestern Sandoval County had an individual poverty rate of 51.9 percent (US

Census Bureau 2012b). These 3 Census Tracts are all relatively large, indicating a sparsely populated, rural area.

Minority Populations

Based on 2008-2012 data, minorities made up 59.5 percent of the population in New Mexico, compared to 36.3 percent in the United States as a whole (Table 17: Study Area County Population by Race/Ethnicity [2012]). The proportion of minorities in the socioeconomic study area (65.3 percent) substantially exceeded the United States and is slightly higher than the state average. At the county level, the population ranged from 89.7 percent minority in McKinley County to 52.8 percent in Sandoval County. Within relevant tribal nations, Native Americans represented the vast majority of the population. The largest minority groups were Hispanics/Latinos in Rio Arriba and Sandoval Counties and Native Americans in McKinley and San Juan Counties.

Table 11: Study Area County Population by Race/Ethnicity (2008-2012)

Population	McKinley County	Rio Arriba County	Sandoval	San Juan	Study Area	New Mexico	United States	Jicarilla Apache Nation	Navaho Nation	Ute Mountain Nation
Hispanic or Latino ethnicity of any race	9,744 13.6%	28,714 71.4%	46,334 35.3%	24,496 19%	109,288 29%	952,569 46.3%	50,545,275 16.4%	382 11.6%	2,958 1.7%	99 6.0%
White alone	7,413 10.3%	5,370 28.6%	61,977 47.2%	54,218 42.2%	128,978 34.67%	831,543 40.5%	196,903,968 63.7%	74 2.3%	3,762 2.2%	47 2.9%
Black or African American alone	353 0.5%	149 0.4%	2,704 2.1%	794 0.6%	4000 1.08%	35,586 1.7%	37,786,591 12.2%	0 0%	250 0.1%	5 0.3%
American Indian or Alaskan Native alone	52,358 72.8%	5,629 14.0%	15,964 12.2%	46,676 36.3%	120,627 32.43%	176,766 8.6%	2,050,766 0.7%	2,692 82.0%	162,920 94.3%	1,429 87.0%
Asian alone	506 0.7%	173 0.4%	1,685 1.3%	464 0.4%	2828 0.76%	25,411 1.2%	14,692,794 4.8%	73 2.2%	834 0.5%	14 0.9%
Native Hawaiian and Other Pacific Islander alone	38 0.1%	7 0%	100 0.1%	72 0.1%	217 0.06%	989 <.01%	480,063 0.2%	0 0%	209 0.1%	0 0%
Some Other Race	7 <.01%	22 0.1%	437 0.3%	84 0.1%	550 0.15%	3,623 0.2%	616,191 0.2%	0 0%	102 0.1%	0 0%
Two or more Races	1,469 2.0%	137 0.3%	2,101 1.6%	1,796 1.4%	5,503 1.48%	28,800 1.4%	6,063,063 2.0%	62 1.9%	1,660 1.0%	49 3.0%
Classified as Minority Population based on CEQ guidelines?	Yes	Yes	Yes	Yes		Yes	NA	Yes	Yes	Yes

Source: US Census Bureau 2012b

Table 11: Study Area County Population by Race/Ethnicity (2008-2012)

Population	McKinley County	Rio Arriba County	Sandoval	San Juan	Study Area	New Mexico	United States	Jicarilla Apache Nation	Navaho Nation	Ute Mountain Nation
Note: American Community Survey estimates are based on data collected over a 5-year time period. The estimates represent the average characteristics of populations between January 2008 and December 2012 and do not represent a single point in time										

Based on the CEQ definition of a minority population area (minority residents exceed 50 percent of all residents), Bernalillo, Bloomfield, Espanola, and Gallup all are considered minority communities. (See Table 16: Study Area Key Community Race/Ethnicity and Poverty Data)

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

Native American Populations

Data in Table 11: Study Area County Population by Race/Ethnicity (2008-2012), account for a substantial portion of the study area population in some areas, notably McKinley and San Juan Counties, where the population is 72.8 and 36.3 percent American Indian respectively. Three tribal governments have reservations within the planning area: the Jicarilla Apache Nation, the Navajo Nation, and the Ute Mountain Nation (see Table 18: Tribal Nations in the Planning Area). The Southern Ute Nation has lands just north of the planning area in the state of Colorado, but none within the planning area. Almost one half of the planning area is tribal lands. Each tribe maintains a general concern for protection of and access to areas of traditional and religious importance, and the welfare of plants, animals, air, landforms, and water on reservation and public lands. Policies established in 2006 by the BLM and US Forest Service, in coordination with federal 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 12: 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 Navaho Nation extends into western San Juan County and into the western portion of the planning area
Ute Mountain Nation	103,500	A portion of the Ute Mountain Nation extends into the northern portion of San Juan County, just east of the Navajo Nation, and into the northern portion of the planning area
Unknown	196,300	Lands located in the southern portion of the planning area [Note to BLM: this is due to

Table 12: Tribal Nations in the Planning Area

Tribe	Acres in Planning Area	General Location
		inconsistencies between US Census Bureau tribal areas dataset and BLM land status dataset.]
Source: BLM GIS 2014, US Census Bureau 2014		

ENVIRONMENTAL IMPACTS

No Action Alternative

Under the No Action Alternative the proposed parcels would be deferred and not offered for sale in the January 2015 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.

Mineral Resources

There would be no new impacts from oil and gas production on the proposed parcel land. Oil and gas development of federal, state, private, and Indian minerals would continue on the land surrounding the proposed parcels. No additional natural gas or crude oil from the proposed parcels would enter the public markets and no royalties would accrue to the federal or state treasuries. An assumption is that the No Action Alternative (no lease option) would not affect current domestic production of oil and gas. However, this may result in reduced Federal and State royalty income, and the potential for Federal land to be drained by wells on adjacent private or state land.

These five parcels are surrounded by leased Federal, Allotted, and State lands. There is currently active drilling around these lands targeting the Mancos/Gallup geologic horizons and a Potential Drainage Assessment (PDS) performed by BLM Geologists identified a total of 32 PDS wells against the five unleased parcels (See Appendix 3 and 4). Consequently, these lease parcels are subject to potential drainage from other mineral estates. This drainage will negatively impact the value of the Federal mineral estate. Based on a decline curve analysis, it was determined that the average horizontal oil well in the Mancos/Gallup play had an estimated ultimate recovery of 412,000 barrels of oil equivalent (BOE). With an estimated 20 wells drilled on the lease parcels, it translates to 8,240,000 BOE recovered from the leasehold. Assuming \$100 per barrel, a total revenue of \$824 million would result. The federal royalty on that would be \$103 million which would be foregone without leasing. Additionally, the five parcels comprise a total of 2,802.56 acres and current bonuses paid in the area are \$2,500 per acre. This would translate into \$7,006,650 in bonus payments to the Federal government.

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.

Environmental Justice

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

All Other Resources

No other resources 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 on the parcels. However, the selection of the no action alternative would not preclude these parcels from being nominated and considered in a future lease sale, which would result in impacts as described under the action alternatives.

Analysis of the Proposed Action Alternative

Assumptions for Analysis

The act of leasing the parcels would, by itself, have no impact on any resources in the FFO. All impacts would be linked to as yet 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 impacts and mitigation measures are described below.

Cumulative impacts include the combined effect of past projects, specific planned projects and other reasonably foreseeable future actions such as other infield wells being located within this lease. Potential cumulative effects may occur should an oil and gas field be discovered if this parcel was drilled and 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 reasonable and foreseeable development scenario developed for the Farmington RMP forecasted 497 wells would be drilled annually on existing and new leases for Federal minerals. Since 2000, an average of 459 wells has been drilled annually

Considering spacing requirements and potential formation development, Table 18 displays the number of wells and number of well pads that may be required to develop the parcels. Surface disturbance assumptions and impacts associated with oil and gas exploration and development drilling activities are based on this development scenario.

Table 13: Development Scenario by Lease Parcel

Lease Parcel #	Acres	Estimated Development
----------------	-------	-----------------------

NM-201501-001	1521.16	Considering spacing requirements and potential formation development, a maximum of eight (8) horizontal wells may be required to develop this tract from four (4) well pads.
NM-201501-002	200	Considering spacing requirements and potential formation development, a maximum of two (2) horizontal wells may be required to develop this tract from one (1) well pad.
NM-201501-003	480	Considering spacing requirements and potential formation development, a maximum of four (4) horizontal wells may be required to develop this tract from two (2) well pads.
NM-201501-004	441.4	Considering spacing requirements and potential formation development, a maximum of four (4) horizontal wells may be required to develop this tract from two (2) well pads.
NM-201501-005	160	Considering spacing requirements and potential formation development, a maximum of two (2) horizontal wells may be required to develop this tract from one (1) well pad.
* See Appendix 2 for a summary of stipulations		

One typical horizontal well pad has approximately 5.73 acres of disturbance with 1 acre of long term disturbance.

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 (U.S. Department of Interior Bureau of Land Management, 2014).

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

Air Quality

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

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

The second phase of the well 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.

The final phase is to plug and abandon the well and rehab the pad. The life of the well is unknown and emission estimates for this phase are not presented.

Criteria Pollutants

Table 14 shows total human caused emissions for each of the counties in the FFO based on EPA's 2011 emissions inventory (U.S. Environmental Protection Agency, 2014).

Table 14. Analysis Area Emissions in Tons/Year, 2011

County	NO _x ⁽¹⁾	CO ⁽²⁾	VOC ⁽³⁾	PM ₁₀ ⁽⁴⁾	PM _{2.5} ⁽⁵⁾	SO ₂ ⁽⁶⁾
McKinley	11,952.9	17,007.8	3,891.2	70,096.4	7,645.2	1,381.1
Rio Arriba	12,012.3	27,344.6	19,149.8	33,761.2	4,130.6	60.4
San Juan	42,231.5	63,568.9	26,110.8	76,638.3	9,201.0	5,559.3
Sandoval	4,143.8	19,513.9	4,373.1	39,343.0	4,510.8	109.3
Total	70,340.5	127,435.2	53,525.0	219,838.9	25,487.6	7,110.0
⁽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 0.071 ppm. While 0.071 ppm is well below the attainment value of 0.075ppm, it is the highest design value of the three monitoring stations in San Juan County. The potential amounts of ozone precursor emissions of NO_x and VOCs from the proposed lease sale are not expected to impact the current design value for ozone in San Juan County under either of the action alternatives.

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

Greenhouse Gases

Information about (GHGs) and their effects on national and global climate is presented in the Air Resources Technical Report (U.S. Department of Interior Bureau of Land Management, 2014). Analysis of the impacts of the proposed action on GHG emissions will be reported below. Only the GHG emissions associated with exploration and production of oil and gas will be evaluated here because the environmental impacts of GHG emissions from oil and gas consumption, such as refining and emissions from consumer-vehicles, are not effects of the proposed action as defined by the Council on Environmental Quality because they do not occur at the same time and place as the action. Thus, GHG emissions from consumption of oil and gas do not constitute a direct effect that is analyzed under NEPA. Nor is consumption an indirect effect of oil and gas

production because production is not a proximate cause of GHG emissions resulting from consumption. However, emissions from consumption and other activities are accounted for in the cumulative effects analysis.

Leasing the subject tracts under either 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 at such time that the lease was developed. The potential full development of the proposed lease sale is estimated at 118 oil wells (see Assumptions for Analysis for more information).

The two primary GHGs associated with the oil and gas industry are carbon dioxide (CO₂) and methane (CH₄). Because methane has a global warming potential 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.

Oil and Gas production in New Mexico is concentrated in the northwest corner, the San Juan Basin, and the southeast corner, the Permian Basin. Production in the San Juan Basin is mostly natural gas while production in the Permian Basin is mostly oil. Production statistics developed from the New Mexico Oil Conservation Division for 2012 are shown in Table for the US, New Mexico and for wells on federal leases in each basin.

Table 15: 2012 Oil and Gas Production (Petroleum Recovery Research Center, 2014)

	Oil Barrels (bbl)	% U.S. Total	Gas (MMcf)	% U.S. Total
United States	2,364,835,000	100	25,307,949	100
New Mexico	85,045,000	3.60	1,215,773	4.80
Federal leases in New Mexico	42,109,245	1.80	776,698	3.07
San Juan Basin	584,828	0.02	580,474	2.29
Permian Basin	41,524,417	1.80	70,329	0.03

Table 16 shows an estimate of greenhouse gas emissions for oil and gas field production for the U.S., New Mexico, and Federal leases by basin based on the assumption that greenhouse gas emissions are proportional to production. Because oil and gas leaves the custody and jurisdiction of the BLM after the production phase and before processing or refining, only emissions from the production phases are considered here. It should also be remembered that following EPA protocols, these numbers do not include fossil fuel combustion which would include such things as truck traffic, pumping jack engines, compressor engines and drill rig engines. Nor does it include emissions from power plants that generate the electricity used at well sites and facilities.

Table 16: 2012 Oil and Gas Field Production Emissions
(U.S. Environmental Protection Agency, 2014)

	Oil	Gas	Total O&G Production	%U.S. Total GHG emissions

(Metric Tons CO ₂ ^e)	CO ₂	CH ₄	CO ₂	CH ₄		
United States	300,000	31,000,000	10,800,000	53,400,000	95,500,000	1.65
New Mexico	10,800	1,116,000	518,400	2,563,200	4,208,400	0.07
Federal leases in New Mexico	5,400	558,000	331,560	1,639,380	2,534,340	0.04
San Juan Basin	60	6,200	247,320	1,222,860	1,476,440	0.03
Permian Basin	5,400	558,000	3,240	16,020	582,660	0.01

For natural gas, extraction accounts for 55% of total life cycle CO₂e emissions, processing accounts for 27% and transmission accounts for 18% of life cycle CO₂e emissions (U.S. Department of Energy, 2011). For oil, drilling and development is responsible for 8% of the total life cycle CO₂e emissions, whereas transportation of the petroleum to refineries represents about 10% of the emissions, and final consumption as a transportation fuel represents fully 80% of emissions (U.S. Department of Energy, 2008).

To estimate the potential emissions from the proposed lease sale, an estimate of emission per well is useful. To establish the exact number of federal wells in the 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. To determine the most transparent and publicly accessible method of estimating the number of active federal wells in the New Mexico portion of the San Juan Basin, FFO utilized BLM New Mexico Geographic Information System (GIS) and the New Mexico Conservation Division ONGARD Data Search. ONGARD was searched for all active, new, and temporarily abandoned wells in NM.

Table 17: Potential Greenhouse Gas Emissions Resulting from Proposed Lease Sale
(Referenced to Latest Available Estimates from 2012)

Total U.S. GHG Emissions From All Sources	6,501,500,000 metric tons	100.00 %
Total U.S. GHG Emissions From Oil & Gas Field Production	95,500,000 metric tons	1.47%
Total New Mexico Emissions From Oil & Gas Field Production	4,208,400 metric tons	.06%
Total Federal Mineral Estate San Juan Basin Emissions From Oil & Gas Field Production (14,995 wells)	1,476,440 metric tons	.02%
Total Federal Mineral Estate Permian Basin Emissions	582,660 metric tons	.0009%

From Oil & Gas Field Production (12,443 wells)		
Total Potential GHG Emissions From Oil & Gas Field Production at Full Development (118 Wells)	11,611 metric tons	0.00003%

The table above shows estimated annual emissions from 2 San Juan Basin federal leases at 1,476,440 metric tons CO₂e. Therefore, the estimate of emission per well in the San Juan Basin is 98.4 metric tons CO₂e annually. The maximum number of wells to be drilled on the 5 parcels would be 20. In the event that 20 separate wells were drilled on the proposed leases, the maximum emissions resulting from the lease sale would be 11,611 metric tons CO₂e per year.

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

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, carbon monoxide emissions from natural gas production increased significantly due to increases in flaring (U.S. Environmental Protection Agency, 2014). The Field Office will work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy.

In addition to the above, the following would apply to the proposed action:

A new lease stipulation was developed to require modeling to determine “near-field” air quality impacts (See Appendix 2). Due to the close proximity of occupied buildings and residences to potential well sites on these 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 will be developed to accurately determine the near-field air quality impacts. Exact locations and equipment specifications are known at the APD stage, so the APD EA needs to contain the disclosure of the near-field air impacts from the development of these leases. The BLM will determine the near-field air impacts based on air dispersion modeling that conforms to EPA and New Mexico Environment Department guidelines. This stipulation is consistent with BLM policy to make mineral resources available for disposal and to encourage development of mineral resources while striving to ensure that mineral development is carried out in a manner that minimizes environmental damage.

Due to occupied residences located within the 5 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. Additionally, the BIA has required that a stipulation of No Surface Occupancy be added to each parcel for the purpose of lessening the impacts caused by mineral resource development on a place of residence and the occupants within.

Heritage Resources

Cultural Resources

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

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

Conversely, cultural resource investigations associated with development add to an understanding of the prehistory/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.

The BLM has applied the criteria of adverse effect as defined in 36 CFR 800.5(1) to the proposed action and will propose to the SHPO and other consulting parties 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.

Cultural Landscapes

The action alternatives would not be expected to threaten or diminish the integrity or adversely affect the capability of considering any identified landscape characteristics of human use or activity in the APE (National Park Service 1999, Birnbaum and Peters 1996), nor would it compound the inherent problems associated with landscape approaches to archaeological remains (Zvelebil et al. 1992).

Native American Religious Concerns

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

World Heritage Sites

None of the parcels are physically or visibly within 15 miles of any World Heritage Site. All the parcels are approximately 15+ miles from the Pueblo Pintado unit of Chaco Culture NHP.

Chaco Culture Archaeological Protection Sites

None of the parcels physically intrude upon the lands or waters of any Protection Site. All of the parcels are over 15 miles from any Protection Site.

Night Sky Resources

Light sources associated with drilling an oil and gas well 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 in Table 24. Flaring could occur in locations where pipelines are not available to transport gas to sale; however, the necessity for flaring and the duration of flaring varies widely from well to well and is difficult to predict.

Table 18: Light Sources by Lease Parcel under the Proposed 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
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 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.

Water Resources

Hydraulic fracturing is a common process in the San Juan Basin and applied to nearly all wells drilled. There are no verified instances of hydraulic fracturing adversely affecting groundwater in the San Juan Basin (USDI/BLM 2011a, page 54). The producing zone targeted by both action alternatives is well below any underground sources of drinking water. Typical depth of water wells in the San Juan Basin is 500 feet or less. The Mancos Shale formation is also overlain by a continuous confining layer. On average, total depth of each well bore would be 6,700 feet below the ground surface. Fracturing in the Basin Mancos formation is not expected to occur above depths above 5,700 feet below the ground surface. Fracturing could possibly extend into the Mesaverde formation overlying the Basin Mancos; however, the formation has not been

identified as an underground source of drinking water based on its depth and relative high levels of TDS.

Hydraulic fracturing fluid is roughly 99 percent water but also contains numerous chemical additives as well as propping agents, such as sands. Chemicals added to stimulation fluids include friction reducers, surfactants, gelling agents, scale inhibitors, acids, corrosion inhibitors, antibacterial agents, and clay stabilizers. Stimulation techniques have been used in the United States since 1949 and in the San Juan Basin since the 1950s. Over the last 10 years, advances in multi-stage and multi-zone hydraulic fracturing has allowed development of gas fields that previously were uneconomic, including the San Juan Basin.

The water used for hydraulic fracturing in the Farmington Field Office generally comes from permitted groundwater wells, although surface water sources may occasionally be used. Because large volumes of water are needed for hydraulic fracturing, the use of groundwater for this purpose might contribute to the drawdown of groundwater aquifer levels. Groundwater use is permitted and managed by the New Mexico Office of the State Engineer, and these water rights have already been designated. In addition, the use of water for hydraulic fracturing is one of many uses of groundwater in the Farmington Field Office. Other uses include irrigation, industrial mining operations, and domestic livestock use.

Contamination of groundwater could occur without adequate cementing and casing of the proposed well bore. Casing specifications are designed and submitted to the BLM. The BLM independently verifies the casing program, and the installation of the casing and cementing operations are witnessed by certified Petroleum Engineering Technicians. Surface casing setting depth is determined by regulation. Adherence to APD COAs and other design measures would minimize potential effects to groundwater quality. The potential for impacts to groundwater from the well bores would be long term for the life of the wells.

There would be the potential for accidental spills or releases of these materials, which could impact local water quality. The potential for surface water quality impacts from accidental spills or releases of hazardous materials on the well pads would be long term for the life of the wells.

Soil

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

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

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

The impact to the soil would be remedied upon reclamation of well pads when the stockpiled soil that was specifically conserved to establish a seed bed is spread over well pads and vegetation re-establishes.

Fragile soils may be difficult for the project proponent to stabilize and establish vegetation. The proponent is required to follow the FFO Bare Soil Reclamation Procedure (procedure) for all projects that result in bare soil in areas of 0.1 acre or more that have an onsite visit after February 5, 2013. The procedure utilizes 8 habitat community descriptions; each community description contains recommendations for effective reclamation. Some additional recommendations for fragile soils include:

- Provide temporary stabilization of disturbed areas that are not actively under construction.
- Apply erosion controls such as excelsior netting, geotextile materials, silt fences, and silt traps to prevent/minimize soil erosion from vehicular traffic and during construction activities.
- Minimize the amount of land disturbed as much as possible and minimize vegetation removal.
- Design runoff control features to minimize soil erosion.

Regulations and policy require a project proponent to submit a plan for surface reclamation, and the FFO Bare Soil Reclamation Procedure requires a revegetation plan to be incorporated into the site specific project EA. FFO reviews permit applications and site specific project EAs for adequate plans for soil stabilization and revegetation for all proposed projects, including proposed projects located on fragile soils.

Special Status Species

USFWS Threatened or Endangered Species

Consultation under ESA with the USFWS may be required at the Application to Drill stage. Any parcels that may impact federally-listed plant species or their habitat would likely require a biological assessment and consultation of the Endangered Species Act. Biological surveys will be required prior to any proposed project that may affect a federally-listed species. The results of the biological survey will determine if a biological assessment and consultation with USFWS is required.

Other Special Status Species

A review of the GIS data indicates there may be some concern with SMS plant species and other special status species relative to the proposed lease sale parcels. In 2012, a new habitat area for

Brack's cactus was discovered in the southern portion of the BLM/FFO management area near Counselor, NM, within the nacimiento geological formation. The BLM/FFO is planning to collect data to thoroughly map this new habitat area. Currently, biological surveys, including plant surveys, are required within this nacimiento habitat for ground disturbing projects. Management prescriptions for this new Brack's cactus habitat area are applied to occupied habitat, as written within the BLM/FFO Interim Guidance (IM-NMF000-20014-010). The proposed action has eleven (11) proposed parcels that may fall within Brack's cactus habitat; Parcels 17-19, 25-31 and 33. The BLM/FFO requires specific plant surveys within these parcels for ground-disturbing projects and will apply mitigation to reduce impacts to this species. Aztec gilia has been known to occur within the same habitats. To date, no Aztec gilia has been found within this new habitat area. Surveys for Aztec gilia are currently required within nacimiento habitat (new habitat area).

No other special status species is expected to be directly impacted by the action alternatives. The proposed parcels may include undocumented Gunnison's prairie dog towns, burrowing owls, golden eagles, prairie and peregrine falcons and ferruginous hawks, all SMS and BLM Sensitive Species. Prairie dog towns are nesting habitat for burrowing owls, as well as, important foraging areas for raptors and other predator species. Project specific analysis will be conducted on any new ground disturbing activity to eliminate or minimize impacts to these species. Management measures, as written in the FFO Special Management Species policy, will apply to the proposed new lease parcels.

In addition, special status species may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. However, these impacts would be reduced significantly with BLM/FFO's timing stipulations that protect raptors (including burrowing owls) during the nesting season. No proposed project activity can negatively impact the breeding and nesting activities of any raptors.

Wildlife

The types and extent of impacts expected from oil and gas development to wildlife species and habitats from development are similar to those described in the 4.9 Special Status Species Section. Although reclamation and restoration efforts for surface disturbance could provide for the integrity of other resources, these efforts may not always provide the same habitat values (e.g. structure, composition, cover, etc.) in the short or in some instance, the long-term in complex vegetative community types (e.g., shrub oak communities). The short-term negative impact to wildlife would occur during the construction phase of the operation due to noise and habitat destruction under the action alternatives. In addition, wildlife may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig. These impacts would be limited to the timeframe during which drilling operations associated with hydraulic fracturing occur, typically several weeks.

In general, most wildlife species would become habituated to the new facilities. For other wildlife species with a low tolerance to activities, the operations on the well pad would continue to displace wildlife from the area due to ongoing disturbances such as vehicle traffic, noise and

equipment maintenance. The conditions of approval would alleviate most losses of wildlife species, such as; fencing the reserve pits, netting storage tanks, installation or other modifications of cones on separator stacks, and timing stipulations. The magnitude of above effects would be dependent on the rate and location of the oil and gas development, but populations could likely not recover to pre-disturbance levels until the activity was completed and the vegetative community restored.

Migratory Birds

Potential effects on birds from the action alternatives are difficult to predict. Ongoing studies have shown mixed effects of oil and gas development, including compressor noise on nesting migratory birds. Frances and Ortega (2006 unpublished report to BLM/FFO) found no significant difference in nest density or nest success between sites with or without wellhead compressors. Some species, such as black-chinned hummingbird (*Archilocus alexandri*) and house finch (*Carpodacus erythrinus*), were more common on sites with compressors while others, such as mourning dove (*Zenaida macroura*) and spotted towhee (*Pipilo erythrophthalmus*), appeared to either avoid or nest further from compressors. Holmes *et al.* (2003) found that sage sparrow had lower nest survival in an area with ongoing gas development, while Brewer's sparrow (*Spizella breweri*) had higher survival rates when compared with populations in an undeveloped control area.

Site-specific analysis will 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 that exceeds 4.0 acres. The bird policy also has other protective measures to reduce bird risks once a project is completed (Instruction Memorandum No. 2013-033). Impacts to migratory birds will be reduced significantly with these management measures in place. However, not all impacts will be eliminated. Impacts such as habitat fragmentation and habitat loss will continue to impact birds and their habitat. The BLM/FFO will apply Best Management Practices (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 (DOI 2010a).

Environmental Justice

While the act of leasing federal minerals itself would result in no social impacts, subsequent development of a lease may generate impacts to people living near or using the area in the vicinity of the lease. 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. This could be especially noticeable in rural areas where oil and gas development has been minimal. 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.

Employment and associated population increases would be more likely to occur in the larger communities where the social effects would be less noticeable. Any new employment and population would probably be welcomed in the very small communities that are currently losing population. There would also be an increase in revenues that accrue to the counties where production occurs. Depending on where production actually occurs, these revenues would benefit any receiving county but would be more notable in counties with smaller populations and lower current property and tax revenue.

A new lease stipulation was developed to require modeling to determine “near-field” air quality impacts (See Appendix 2). Due to the close proximity of occupied buildings and residences to potential well sites on these 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 will be developed to accurately determine the near-field air quality impacts. Exact locations and equipment specifications are known at the APD stage, so the APD EA needs to contain the disclosure of the near-field air impacts from the development of these leases. The BLM will determine the near-field air impacts based on air dispersion modeling that conforms to EPA and New Mexico Environment Department guidelines. This stipulation is consistent with BLM policy to make mineral resources available for disposal and to encourage development of mineral resources while striving to ensure that mineral development is carried out in a manner that minimizes environmental damage.

Due to occupied residences located within the 5 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. Additionally, the BIA has required that a stipulation of No Surface Occupancy be added to each parcel for the purpose of lessening the impacts caused by mineral resource development on a place of residence and the occupants within

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 17% of the 35 million acres is currently leased (73% of the leases are in production and 63% of the lease acres are in production). The NMSO received 5 parcel nominations (2802.56acres) for consideration in the January 2015 Oil & Gas Lease Sale, and is proposing to lease 5 (2802.56acres) of the 5 parcels. If these 5 parcels were leased, the percentage of Federal minerals leased would not change.

Table 19: Actual - Acres of Federal Minerals/Acres Available/Acres Leased

State	Federal O&G Mineral Ownership	Acres Available	Acres Leased	Percent Leased
-------	-------------------------------	-----------------	--------------	----------------

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

Table 20: Parcels Nominated & Offered in the January 2015 Oil & Gas Lease Sale:

Field Office	No. of Nominated Parcels	Acres of Nominated Parcels	No. of Parcels to be Offered	Acres of Parcels to be Offered
Farmington	5	2802.56	5	2802.56

Table 21: Foreseeable - Acres of Federal Minerals/Acres Available/Acres Leased:

State	Federal O&G Mineral Ownership	Acres Available	Acres Leased	Percent Leased
KS	744,000	614,586	125,091	20%
NM	34,774,457	29,751,242	4,842,058	16%
OK	1,998,932	1,668,132	324,072	19%
TX	3,404,298	3,013,207	425,511	14%
Totals/Average	40,921,687	35,058,167	5,741,061	16%

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 restoration of abandonments and creating new disturbances for drilling new wells gradually accumulates as the minerals are extracted from the land. Preserving as much land as possible and applying appropriate mitigation measures will alleviate the cumulative impacts.

Effects on Air Resources

The following analysis of cumulative impacts of the proposed action on air quality will be limited to the Four Corners area of New Mexico. The cumulative impacts of GHG emissions and their relationship to climate change are evaluated at the national and global levels in the Air Resources Technical Report (U.S. Department of Interior Bureau of Land Management, 2014).

Effects of Other Past, Present, and Reasonably Foreseeable Actions on Air Resources

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.

Cumulative Effects of the Proposed Action on Air Quality

The very small increase in emissions that could result from approval of the action alternatives would not result in any county in the FFO area exceeding the NAAQS for any criteria pollutants.

The applicable regulatory threshold for HAPs is the oil and gas industry National Emissions Standards for Hazardous Air Pollutants, which are currently under review by the EPA. The emissions from any wells drilled in the leased areas are not expected to impact the 8-hour average ozone concentrations, or any other criteria pollutants in the Southern San Juan Basin.

Cumulative Effects of the Proposed Action on Climate Change

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

The Air Resources Technical Report discusses the relationship of past, present and future predicted emissions to climate change and the limitations in predicting local and regional impacts related to emissions. It is currently not feasible to know with certainty the net impacts from particular emissions associated with activities on public lands.

CONSULTATION/COORDINATION

This section includes individuals or organizations from the public, external agencies, the interdisciplinary (ID) team that was contacted during the development of this document.

Table 22: List of Preparers

ID Team Member	Title	Organization
Jim Copeland	Archaeologist	BLM
John Kendall	T & E Biologist	BLM
Sarah Scott	Natural Resource Specialist	BLM
Dave Mankiewicz	Assistant Field Manager, Minerals	BLM
Jeff Tafoya	Range Management Specialist	BLM
Lindsey Eoff	Project Manager	BLM
Janelle Alleman	Outdoor Planner	BLM
John Hansen	Wildlife Biologist	BLM
Amanda Nisula	Planning & Environmental Coordinator	BLM
Dale Wirth	Range & Multiple Resource-Branch Chief	BLM
Stan Dykes	Weeds	BLM
Sherrie Landon	Paleontologist	BLM
Mary Uhl	Air Quality Specialist- New Mexico State Office	BLM
Dave Goodman	Planning and Environmental Coordinator- New Mexico SO	BLM
Rebecca Hunt	Natural Resource Specialist- New Mexico State Office	BLM

Agencies, Persons and Organizations Consulted

Agencies

Michael Davis, US Forest Service

New Mexico State Historic Preservation Officer, State of New Mexico Department of Cultural
Affairs Historic Preservation Division

Bureau of Indian Affairs – Navajo Region

On March 18, 2014 a briefing for the BLM NM State Director was held at the New Mexico State Office to review Field Office recommendations for the nominated parcels that were considered in the October 2014 Competitive Oil and Gas Lease Sale. The 5 parcels were reviewed by the State Director at that time.

Tribes

Navajo Nation Historic Preservation Officer and potentially affected chapters: Nageezi and
Counselor

Zia

Zuni

Jemez

Acoma

Hopi

NGOs

National Trust for Historic Preservation

Chaco Alliance

Public Involvement

The parcels and applicable stipulations were originally posted online for a two week public scoping period starting on March 10, 2014 and a 30-day public review and comment period starting on May 1, 2014. Comments were received. These 5 parcels are being reconsidered for sale, and the EA was made available for public review and comment for 30 days beginning August 26, 2014. Comment letters were received from Marshall Keetso, a member of the Navajo Tribe and a resident in the community of the Eastern Agency, on September 22, 2014 and from the Western Environmental Law Center (WELC), along with Amigos Bravos, Chaco Alliance, Dine Citizens Against Ruining our Environment, Earthworks, Natural Resources Defense Council, Rio Arriba Concerned Citizens, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians (“Conservation Groups”), on September 23, 2014.

REFERENCES

Birnbaum, Charles A. 1994. Preservation Brief 36. Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes. U.S. Department of the Interior. National Park Service.

Birnbaum, Charles A. and Christine Capelle Peters. 1996. Guidelines for the Treatment of Cultural Landscapes. U.S. Department of the Interior. National Park Service.

Brugge, David M. 1986. Tsegai: An Archaeological Ethnohistory of the Chaco Region. U.S. Department of the Interior.

Brugge, David M. 1993. An Investigation of AIRFA Concerns Relating to the Fruitland Coal Gas Development Area. Office of Contract Archaeology, University of New Mexico. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

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

Clement, Dorene. 1999. General Guidelines for Identifying and Evaluating Historic Landscapes. Environmental Program, California Department of Transportation, Sacramento.

Condie, Carol J. and Ruthan Knudson (editors). 1982. The Cultural Resources of the Proposed New Mexico Generating Station Study Area, San Juan Basin, New Mexico. Quivira Research Center Publication 39. Albuquerque.

Council on Environmental Quality. 1997. Environmental Justice Guidance under the National 1281 Environmental Policy Act. December 10, 1997.

de la Torre, Marta, Margaret G. H. MacLean, and David Myers. 2003. Chaco Culture National Historical Park, U.S. National Park Service: A Case Study. The Getty Conservation Institute. Los Angeles, CA.

Environmental Protection Agency. 2011. Technology Transfer Network: Clearinghouse for Inventories and Emissions Factors. <http://www.epa.gov/ttn/chief/eiinformation.html>.

EPA (2010). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008. EPA 430-R-10-006, <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>.

EPA. (2010). FACT SHEET--PROPOSAL TO REVISE THE NATIONAL AMBIENT AIR QUALITY STANDARDS. Retrieved August 9, 2010, from <http://www.epa.gov/air/ozonepollution/pdfs/fs20100106std.pdf>

Environmental Protection Agency. 2010a. The Green Book Non Attainment Areas for Criteria Pollutants. <http://www.epa.gov/airquality/greenbk/> (Accessed 3/03/2011).

Environmental Protection Agency, 2010b. Air Trends. <http://www.epa.gov/airtrends/> (Accessed 3/14/11).

Environmental Protection Agency. 2011a. 2005 National-Scale Air Toxics Assessment. Summary of Results. <http://www.epa.gov/ttn/atw/nata2005>.

EPA. 2011b. 2008 National Emissions Inventory. <http://www.epa.gov/ttn/chief/net/2008inventory.html>.

EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006. Environmental Protection Agency, Washington, D.C.

EPA, Natural Gas Star Program (2006 data) at: <http://www.epa.gov/gasstar/accomplish.htm>. Environmental Protection Agency, Washington, D.C.

Enquist, Carolyn and Gori, Dave. Implications of Recent Climate Change on Conservation Priorities in New Mexico. April 2008.

Fransted, Dennis. 1979. An Introduction to the Navajo Oral History of Anasazi Sites in the San Juan Basin Area. Unpublished manuscript, Navajo Aging Services, Fort Defiance, Arizona.

Fransted, Dennis and Oswald Werner. 1975. Ethnogeography of the Chaco Canyon Navajo. Unpublished manuscript, Northwestern University. On file at Division of Chaco Research, Albuquerque.

Freimund, Wayne and Douglas Dalenberg. Chaco Culture National Historical Park: 2009 Visitor Survey. The University of Montana. January 1, 2010.

Goddard Institute for Space Studies. 2007. Annual Mean Temperature Change for Three Latitude Bands. Datasets and Images. GISS Surface Temperature Analysis, Analysis Graphs and Plots. New York, New York. (Available on the Internet: <http://data.giss.nasa.gov/gistemp/graphs/fig.B.lrg.gif>.)

Hafen, Leroy R. and Antonio Armijo
1947 Armijo's Journal. Huntington Library Quarterly 11:87–101. San Marino, CA.

Holmes, A.L., D.C. Barton, and A. King. 2003. Sagebrush Bird Monitoring Handbook, Version 2.0. Point Reyes Conservation Science: Stinson Beach, CA.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Basis (Summary for Policymakers). Cambridge University Press. Cambridge, England and New York, New York. Available on the Internet: <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf>

Intergovernmental Panel on Climate Change (IPCC). Climate Change 2007, Synthesis Report. A Report of the Intergovernmental Panel on Climate Change.

Karl, Thomas L., Jerry M. Melillo, and Thomas C. Peterson, (eds.). Global Climate Change Impacts in the United States, Cambridge University Press, 2009.

Kelly, Klara, Rena Martin, Richard Begay, Ted Neff, and Clifford Werito. 2006. "We Will Help You With What We Know": Diné Traditional Cultural Places In Dinétah. Museum of Northern Arizona Environmental Solutions, Inc, Flagstaff. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

Merlin, Thomas, Michael P. Marshall and John Roney. 2011. The Old Spanish Trail Exploration, Trade, Colonization, and War. Carson National Forest, U.S. Department of Agriculture. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

National Academy of Sciences. 2006. Understanding and Responding to Climate Change: Highlights of National Academies Reports. Division on Earth and Life Studies. National Academy of Sciences. Washington, D.C. (Available on the Internet: <http://dels.nas.edu/basc/Climate-HIGH.pdf>.)

NRCS. 2013. <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/watersheds/dataset/>. Accessed July 30, 2013.

NPS. 1997. How to Apply the National Register Criteria for Evaluation. National Register Bulletin 15. Washington.

NPS. 1999. Guidelines for Evaluating and Documenting Rural Historic Landscapes. National Register Bulletin 30. Washington.

Parker, Patricia L. and Thomas F. King. 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties. National Park Service, National Register Bulletin 38. Washington.

Petroleum Recovery Research Center. (2014, January 30). All Wells Data. Retrieved January 30, 2014, from Go-Tech: http://octane.nmt.edu/gotech/Petroleum_Data/allwells.aspx

Science Applications International Corporation. 2002. Cultural Resources Technical Report: Background Information on Cultural Resources for the Farmington Draft RMP/EIS. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

UNESCO. 2008. Operational Guidelines for the Implementation of the World Heritage Convention. United Nations Educational, Scientific and Cultural Organization. Paris.

USA. 1987. Chaco Culture National Historical Park World Heritage List Nomination.

US Census Bureau 2012b. American Community Survey, 2012 American Community Survey 1367 5-Year Estimates,
1368 Tables DP-02, DP-03, DP-04, DP-05; generated by Lauren Zielinski; using American FactFinder;
1369 <http://factfinder2.census.gov>. Accessed February 17, 2014.

US Census Bureau 2014. US Census Bureau GIS data. Tiger Products. Internet Web Site: 1380 <http://www.census.gov/geo/maps-data/data/tiger.html>. Accessed on February 2014.

U.S. Department of Energy. (2008, November 26). Development of Baseline Data and Analysis of Life Cycle Greenhouse Gas Emissions of Petroleum-Based Fuels. Washington, D.C.: U.S. Department of Energy.

U.S. Department of Energy. (2011). Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production. Washington, D.C.: U.S. Department of Energy.

U.S. Department of Interior Bureau of Land Management. (2014). Air Resources Technical Report for Oil and Gas Development. Santa Fe: Bureau of Land Management, New Mexico State Office.

U.S. Environmental Protection Agency. (2012, May 21). 2005 National-Scale Air Toxics Assessment. Retrieved February 27, 2014, from U.S. Environmental Protection Agency: <http://www.epa.gov/ttn/atw/nata2005/>

U.S. Environmental Protection Agency. (2013, December 5). The Green Book Nonattainment Areas for Criteria Pollutants. Retrieved February 25, 2014, from U.S. Environmental Protection Agency: <http://www.epa.gov/airquality/greenbook/>

U.S. Environmental Protection Agency. (2013a, November 15). Air Quality Index Report. Retrieved March 12, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/airdata/ad_rep_aqi.html

U.S. Environmental Protection Agency. (2014, February 7). Air Trends: Design Values. Retrieved February 25, 2014, from U.S. Environmental Protection Agency: <http://www.epa.gov/airtrends/values.html>

U.S. Environmental Protection Agency. (2014). Draft Inventory of U. S. Greenhouse Gas Emissions and Sinks: 1990-2012. Washington, D.C.: U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency. (2014, February 3). The 2011 National Emissions Inventory. Retrieved February 27, 2014, from U.S. Environmental Protection Agency: <http://www.epa.gov/ttn/chief/net/2011inventory.html>

U.S. Department of Energy/National Energy Technology Laboratory (US DOE, NETL). 2008. Development of Baseline Data and Analysis of Life Cycle Greenhouse Gas Emissions of Petroleum Based Fuels. <http://www.netl.doe.gov/energy-analyses/pubs/NETL%20LCA%20Petroleum-Based%20Fuels%20Nov%202008.pdf>

U.S. Department of the Interior, Bureau of Land Management and U.S. Fish and Wildlife Service (DOI). 2010a. Memorandum of Understanding: To Promote the Conservation of Migratory Birds.

U.S. Department of the Interior, Bureau of Land Management. 2008. Manual 6840: Special Status Species Management.

U.S. Department of the Interior, Bureau of Land Management. 1986. Manual 8410: Visual Resource Inventory.

U.S. Department of the Interior, Bureau of Land Management, Farmington Field Office. 2010b. Instruction Memorandum No. NM-F00-2010-001. Migratory Bird Treaty Act – BLM/FFO Interim Management Policy. February 22, 2010.

U.S. Department of the Interior, Bureau of Land Management. September 2003a. Farmington Proposed Resource Management Plan and Final Environmental Impact Statement. Farmington, New Mexico.

U.S. Department of the Interior, Bureau of Land Management. September 2003. Farmington Approved Resource Management and Plan Record of Decision. Farmington, New Mexico.

USDI. BLM. 2011. Air Quality Technical Report. New Mexico State Office.
http://www.blm.gov/nm/st/en/prog/more/air_resources/air_resources_technical.html.

USGS. 2013. <http://water.usgs.gov/GIS/huc.html>. Accessed July 30, 2013.

Van Dyke, Ruth M. 2007. The Chaco Experience: Landscape and Ideology at the Center Place. School for Advanced Research, Santa Fe.

Van Valkenburgh, Richard F. 1941. Diné Bikeyah. Department of the Interior, Office of Indian Affairs, Navajo Services, Window Rock. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

Van Valkenburgh, Richard F. 1974. Navajo Sacred Places. Edited by Clyde Kluckhohn. Garland American Indian Ethnohistory Series, Navajo Indians, 3 Vols. Garland Publishing. New York.

York, Frederick F., Joseph C. Winter. 1988. Report of an Ethnographic Study and Archaeological Review of Proposed Coal Lease Tracts In Northwestern New Mexico. Office of Contract Archaeology, University of New Mexico

Zvelebil, Marek, Stanton W. Green, Mark G. Macklin. 1998. Archaeological Landscapes, Lithic Scatters, and Human Behavior. In, Space, Time, and Archaeological Landscapes, edited by Jacqueline Rossignol and LuAnn Wandsnider, pp. 193-226. Plenum Press, New York.

Authorities

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

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

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

For a map of the 5 proposed parcels see the following website:

http://www.blm.gov/pgdata/etc/medialib/blm/nm/programs/0/og_sale_notices_and/2015/january_2015.Par.96743.File.dat/NM_OG_DRAFT_Sale_Parcel_January_2015.pdf

Appendix 1: Phases of Oil and Gas Development

Construction Activities

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

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

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

Drilling Operations

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

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

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

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

Completion Operations

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

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

Hydraulic Fracturing

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

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

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

This process increases the flow rate and volume of reservoir fluids that move from the producing formation into the wellbore. The fracturing fluid is typically more than 99 percent water and sand, with

small amounts of readily available chemical additives used to control the chemical and mechanical properties of the water and sand mixture (see discussion about Hazardous and Solid Wastes below). Because the fluid is composed mostly of water, large volumes of water are usually needed to perform hydraulic fracturing. However, in some cases, water is recycled or produced water is used.

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

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

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

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

Production Operations

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

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

Hazardous or Solid Wastes Associated with Oil and Gas Development

Anticipated use or produced hazardous materials during the development may come from drilling materials; cementing and plugging materials; HF materials; production products (natural gas,

condensates, produced water); fuels and lubricants; pipeline materials; combustion emissions; and miscellaneous materials. Appendix 1, Table 1 includes some of the common wastes (hazardous and non-hazardous) that are produced during oil and gas development.

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

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

Hydraulic Fracturing

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

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

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 2

FARMINGTON FIELD OFFICE LEASE STIPULATION SUMMARY

<u>Stipulation</u>	<u>Description/Purpose</u>
NM-10-LN	<p>LEASE NOTICE- DRAINAGE</p> <p>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.</p>
NM-11- LN	<p>LEASE NOTICE – CULTURAL RESOUCES</p> <p>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.</p>
F-9-CSU Paleo	<p>CONTROLLED SURFACE USE STIPULATION PALEONTOLOGY</p> <p>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.</p>
F-15-POD	<p>PLAN OF DEVELOPMENT (POD) STIPULATION</p> <p>A plan of development (POD) for the entire lease must be submitted for review</p>

	and approval, including NEPA analysis, by the Bureau of Land Management (BLM) authorized officer, prior to approval of development (APD, Sundry Notices) actions. The POD must indicate planned access to well facilities (roads, pipelines, power lines), and the approximate location of well sites. Should it become necessary to amend the POD, the amendment must be approved prior to the approval of subsequent development action. Deviations from a current POD are not authorized until an amended POD has been approved by BLM.
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
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 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 U.S.C. § 1531 et seq., including completion of any required procedure for conference or consultation.

F-47-CSU: CONTROLLED SURFACE USE STIPULATION - AIR DISPERSION MODELING

Due to the close proximity of occupied dwellings to potential well sites on the lease parcel, information about the air quality impacts at the dwellings must be determined and disclosed as part of the NEPA analysis. In order to determine the impacts, the lessee will be responsible for conducting air dispersion modeling for all wells proposed and within one mile of occupied dwellings prior to BLM making a decision on any proposed wells and associated operations and infrastructure. The BLM will determine the near-field air impacts based on air dispersion modeling that conforms to EPA New Mexico Environment Department guidelines. Based on modeling results, the BLM may have mitigation requirements, with a potential for moving the

proposed well and associated operations and infrastructure away from the occupied dwelling(s). A Plan of Development (POD) will be required.

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 Resource Management Plan because it requires very specific information about how leases are developed and the locations of development. At the time of the lease sale, there is still not enough information available about how the lease will be developed to accurately determine the near-field air quality impacts. Exact locations and equipment specifications are known at the time of the Application for Permit (APD) to Drill, so the NEPA analysis associated with the APD must contain the disclosure of the near-field air impacts from the development of these leases.

For the purpose of:

(1) fulfilling the objective of the Farmington Resource Management Plan (2003) to “ensure that mineral development is carried out in a manner that minimizes environmental damage and provides for the rehabilitation of affected lands”;

(2) comply with the requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1701-1785 to “provide for compliance with applicable pollution control laws, including State and Federal air, water, noise or other pollution standards”;

(3) ensuring that federal agency activities and actions comply with all applicable air quality laws, regulations, standards and implementation plans, per the 1990 Clean Air Act Amendments Section 118; and

(4) to promote efforts which will prevent damage to the environment and promote human health and welfare (NEPA Section 2). Any changes to this stipulation, will be made in accordance with the land use plan and/or regulatory provisions for such changes.

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.

BIA-5 - NAVAJO AREA, BUREAU OF INDIAN AFFAIRS SURFACE MANAGEMENT AGENCY – NO SURFACE OCCUPANCY OR USE

All or a portion of the lease contains dwellings or structures occupied by one or more persons. No Surface Occupancy or use is allowed on the portion of the lease described. These restricted lands may be developed by directional drilling from outside the restricted area. This No Surface Occupancy or use restriction may be waived if written consent of such waiver is received from the Navajo Nation with concurrence from the Navajo Regional Director. This stipulation was added for the purpose of lessening the impacts caused by mineral resource development on a place of residence and the occupants within.

Appendix 3

8 Potential Drainage Situations (PDS) -4 Producing Offending Wells -3 Offended Parcels

To: Unleased Federal (25) File
Offending Well: Lybrook H36-2307 #1H S/2 N/2 sec 36, 23N, 7W Mancos
Producing Unleased Parcel#33
Unleased Federal (26) File
Offending Well: Lybrook M31-2306 #2H N/2 S/2 sec 36, 23N, 7W Mancos
Producing Unleased Parcel#33
Offending Well: Lybrook H36A-2307 #1H N/2 N/2 sec 36, 23N, 7W Mancos APD
Unleased Parcel#33

Unleased Federal (27) File
Offending Well: Chaco 2206 16A #221H N/2 N/2 sec 16, 22N, 6W Mancos
Producing Unleased Parcel#21
Offending Well: Chaco 2206 16A #222H S/2 N/2 sec 16, 22N, 6W Mancos APD
Unleased Parcel#21

Unleased Federal (28) File
Offending Well: Chaco 2408 36P#143H S/2 sec 36, 24N, 8W Mancos
Producing Unleased Parcel#32
Offending Well: Chaco 2308 #274H S/2 NE/4 sec 1, 23N, 8W Mancos No
Prod NOS Unleased Parcel#32
Offending Well: Chaco 2308 1B#161H N/2 NE/4 sec1, 23N, 8W Mancos No
Prod NOS Unleased Parcel#32

From: Joe Hewitt
June 24, 2014

Subject: Potential drainage of unleased Federal Minerals with Navajo Nation surface lands by the above eight wells. Four of them are producing, two are APD's and two are NOS's.

INTRODUCTION

This drainage review was triggered by a request from David Mankiewicz, AFM Minerals Farmington to BLM NM State Office to make available for leasing as soon as possible 35 tracts identified as having Federal minerals with Navajo Nation Surface and located within a rapidly developing horizontally drilled Mancos shale oil trend. Three (3) of these split-estate parcels have been identified as potential drainage situations where producing Mancos offending wells are within the 320 acre adjoining unleased Federal spacing unit. There is a total of 8 Potential Drainage Situations against 3 unleased parcels number 21, 32 & 33.

The offending wells to this point are located on State lands in an expanding and developing Mancos lease trend in the southern portion of the San Juan Basin referred to as the Chaco Slope.

Mr. Paul Bougeant, BLM Physical Science Technician, has constructed several maps to help

identify these PDS and setup drainage case folders on those cases which pass an initial screening so to identify the best cases. The four (4) wells that were identified above represent the only producing wells along with 2 wells which have APD's and 2 with NOS stage of development.

OBJECTIVE

The objective of this review is to determine the offending wells cumulative production (tables 1 & 2 below) to date and the distance these wells are from the unleased Federal lands. A straight line distances from the offending well to the edge of the unleased Federal minerals is calculated see (listing below).

Oil Production to March of 2014 (table 1)

Wells & API#	Cumulative & Dates	*EUR	Current Avg.
Lybrook H36-2307 #1H 3004321117	63,050 bo 3/12 to 4/14	166,465 bo	50 bod
Lybrook M31-2306 #2H 3004321146	28,254 bo 9/13 to 4/14	469,601 bo	110 bod
Chaco 2206 16A #221H 3004321148	21,769 bo 10/13 to 3/14	40,113 bo	80 bod
Chaco 2408 36P#143H 3004535474	18,462 bo 12/13 to 3/14	29,105 bo	85 bod

Gas Production to March of 2014 (table 2)

Wells	Cumulative & Dates	*EUR	Current Avg.
Lybrook H36-2307 #1H	181,568 mcf 3/12 to 4/14	2,500,000 mcf	700 mcf/d
Lybrook M31-2303 #2H	1,992 mcf 9/13 to 4/14	6,300,000 mcf	1,500 mcf/d
Chaco 2206 16A #221H	14,320 mcf 10/13 to 3/14	15,950 mcf	25 mcf
Chaco 2408 36P#143H	24,504 mcf 12/13 to 3/14	761,277 mcf	220fd

*EUR's are only estimates with very little production

Approximate Distances from Offending Well to Unleased Parcel #33 NE/4 sec 35, 23N,7W

Lybrook H36-2307 1H well's horizontal wellbore toe is 330 ft. from lease line

Lybrook M31-2303 2H well's horizontal wellbore toe is 803.24 ft. from southeast corner of unleased parcel

Approximate Distances from Offending Well to Unleased Parcel #21 S/2 sec 9, 22N, 6W

Chaco 2206 16A #221H well's horizontal wellbore toe is 363 ft. from lease line

Approximate Distances from Offending Well to Unleased Parcel #32 W/2 sec 6, 23N, 7W

Chaco 2408 36P#143H well's horizontal wellbore toe is 2,139.2 ft. from lease line

Parcel No. 33

Potential Drainage (PDS) of Unleased Federal Minerals from Navajo Tribal Surface Lands
Parcel #33

Parcel #33 contains 160 acres and is located in: T23N, R7W sec.35 NE/4

There are currently 2 producing offending wells located in section State section 36 which potentially drain Federal minerals from parcel 33. This is the very first horizontal well drilled in late 2011 by Encana Oil & Gas Co., the Lybrook H36 2307 #1H, is only 330 ft. from the lease line of Parcel 33. This well has produced 63,050 bo and 181,568 mcf for 2 yrs from 3/12 to 3/14 or 2 years of production. The other offending well, the Lybrook M31 2306 #2H has produced 28,254 bo and 198,803 mcf from 9/13 to 3/14 and it's bottom is located only 803 ft. from the lease line. Also, there is a APD submitted for the Lybrook H36A-2307 #1H to be drilled in the project area of the N/2 N/2 of section 36 which would put the toe of the well 330 ft. from the unleased parcel 33.

Parcel No. 32

Potential Drainage (PDS) of Unleased Federal Minerals from Navajo Tribal Surface Lands
Parcel #32

Parcel #32 contains 441.5 acres and is located in: T23N, R7W sec. 6 (SW/4, S/2 NW/4 & SWSW) and T23N, R7W sec. 7 NE/4.

In addition Parcel #32 has one producing offending well, the Chaco 2408#143H and two other potentially offending wells which have not yet been drilled and are in the APD/NOS stage of development. There are 2 wells which could potentially drain the Federal unleased parcel. Both of these wells would have 50% of their production from Allotted minerals and are planned to be drilled by WPX Energy Prod. WPX's Chaco 2308-1H #274H horizontal well bore is planned to occupy the S/2 of the N/2 of section 1 which would place it approximately 380 ft. from the unleased parcel . WPX's Chaco 2308-1B #161H horizontal well bore is planned to occupy the N/2 of the N/2 of section 1 and also the N/2 of N/2 of section 6 which would place it approximately 2,260 ft. from the unleased parcel.

Parcel No. 21

Potential Drainage (PDS) of Unleased Federal Minerals from Navajo Tribal Surface Lands
Parcel #21

Parcel #33 contains 1521.16 acres and is located in: T22N, R6W sec 4 SE, sec 5 SW, sec 6 S/2, sec 8 N2, sec 9 N/2 & W/2 SW

There is currently 1 producing offending well located in section State section 16 which potentially drain Federal minerals from parcel 21. The toe of the horizontally drilled Chaco 2206 16A #221H well is only 363 ft. from the lease line of Parcel 21. This well has produced 21,769 bo and 14,320 mcf from 10/13 to 3/14. The other offending well, the Chaco 2206 16A#222H has not been drilled but is planned parallel the #221H from east to west.

Parcels 22, 23, 30 and 31

A review of parcels 22, 23 30 and 31 has determined there is currently no drainage as the adjacent producing or proposed wells as is noted by either an APD or NOS are also located on

Federal Minerals and as such there would be no loss of royalty by their production.

Encana's	Lybrook H36A-2307 #1H	3004321183
WPX's	Chaco 2206 16A #221H	3004321148
WPX's	Chaco 2308 #274H	no API# yet
WPX's	Chaco 2308 1B#161H	no API# yet

Available by request at the FFO:

Exhibit 1 Large 36x36 inch wall map by Paul Bougeant identifying unleased Federal mineral

Exhibit 2 Smaller 15x15 inch maps located in Unleased Files 25-28

Joe Hewitt Geologist Petroleum Mgt. Team 6-24-14

Appendix 4

Addendum to Update Original Potential Drainage Assessment (PDS)

To:

Unleased Federal (25) File

*Offending Well: Lybrook H36-2307 #1H S/2 N/2 sec 36, 23N, 7W Mancos Producing
Unleased Parcel#5

Unleased Federal (26) File

*Offending Well: Lybrook M31-2306 #2H N/2 S/2 sec 36, 23N, 7W Mancos Producing
Unleased Parcel#5

*Offending Well: Lybrook H36A-2307 #1H N/2 N/2 sec 36, 23N, 7W Mancos APD
Unleased Parcel#5

Offending Well: Chaco_2307 35P #339H N/2 S/2 sec 35, 23N, 7W Mancos NOS
Unleased Parcel#5

Unleased Federal (27) File

*Offending Well: Chaco 2206 16A #221H N/2 N/2 sec 16, 22N, 6W Mancos Producing
Unleased Parcel#1

*Offending Well: Chaco 2206 16A #222H S/2 N/2 sec 16, 22N, 6W Mancos APD
Unleased Parcel#1

Offending Well: Lybrook P03-226#2H NE/4 sec 10, 22N, 6W Mancos APD
Unleased Parcel #1

Offending Well: Aztec Oil Syndicate#2H S/2 NE/4 sec 6, 22N, 6W Mancos APD
Unleased Parcel #1

Offending Well: Lybrook P28-2306#1H NE/4 sec 4, 22N, 6W Mancos APD
Unleased Parcel #1

Offending Well: Lybrook P28-2306#2H NE/4 sec 4, 22N, 6W Mancos APD
Unleased Parcel #1

Offending Well: Lybrook P28-2306#3H NE/4 sec 4, 22N, 6W Mancos APD
Unleased Parcel #1

Offending Well: Lybrook P28-2306#4H NE/4 sec 4, 22N, 6W Mancos APD
Unleased Parcel #1

Offending Well: Lybrook H03-2206#1H S/2 NW/4 sec 3, 22N, 6W Mancos APD
Unleased Parcel #1

Unleased Federal (28) File

*Offending Well: Chaco 2408 36P#143H S/2 sec 36, 24N, 8W Mancos Producing
Unleased Parcel#4

*Offending Well: Chaco 2308 #274H S/2 N/2 sec 1, 23N, 8W Mancos NOS
Unleased Parcel#4

*Offending Well: Chaco 2308 1B#161H N/2 NW/4 6 23N, 8W Mancos NOS
Unleased Parcel#4

Offending Well: Lybrook I2-2308#2H_ N/2 S/2 sec 1 23N, 8W Mancos Producing
Unleased Parcel#4

Unleased Federal (29) File

Offending Well: Lybrook P03-226#1H Unleased Parcel #2	NE4 sec 15, 22N, 6W	Mancos	APD
Offending Well: Lybrook P03-226#2H Unleased Parcel #2	NE/4 sec 15, 22N, 6W	Mancos	APD
Offending Well: Lybrook B14-226#2H Unleased Parcel #2	S/2 NE/4 sec 15, 22N, 6W	Mancos	APD
Offending Well: Lybrook N02-226#1H Unleased Parcel #2	NW/4 sec 14, 22N, 6W	Mancos	NOS
Offending Well: Lybrook N11-226#1H Unleased Parcel #2	W/2 sec 14, 22N, 6W	Mancos	NOS

Unleased Federal (30) File

Offending Well: Lybrook P24-226#1H Unleased Parcel #3	SW/4 sec 24, 22N, 6W	Mancos	Drilled 4/14
Offending Well: Lybrook P12-226#1H Unleased Parcel #3	W/2 NE/4 sec 24, 22N, 6W	Mancos	NOS
Offending Well: Lybrook H11-226#1H Unleased Parcel #3	SE/4 sec 14, 22N, 6W	Mancos	NOS
Offending Well: Lybrook H11-226#2H Unleased Parcel #3	SE/4 sec 14, 22N, 6W	Mancos	NOS
Offending Well: Lybrook H11-226#3H Unleased Parcel #3	SE/4 sec 14, 22N, 6W	Mancos	NOS
Offending Well: Lybrook H11-226#4H Unleased Parcel #3	SE/4 sec 14, 22N, 6W	Mancos	NOS
Offending Well: Lybrook M12-226#1H Unleased Parcel #3	SW/4 sec 13, 22N, 6W	Mancos	NOS
Offending Well: Lybrook N12-226#2H Unleased Parcel #3	SW/4 sec 13, 22N, 6W	Mancos	NOS
Offending Well: Lybrook N12-226#3H Unleased Parcel #3	SW/4 sec 13, 22N, 6W	Mancos	NOS
Offending Well: Lybrook N12-226#4H Unleased Parcel #3	SW/4 sec 13, 22N, 6W	Mancos	NOS

* Initial PDS royalty drainage

From: Joe Hewitt
September 12, 2014

Subject: Addendum to the original potential drainage assessment of unleased Federal Minerals with Navajo Nation surface located in an area of active and competitive Mancos shale well development.

The purpose of this addendum is to update the original drainage review assessment made June 24, 2014 by changing the parcel numbers to reflect those used for the upcoming January 2015 lease sale and to augment the list of PDS's. The initial identification was based on royalty and this is on decreased lease value because of drainage. Where Federal leases with multiple wells

surround and potentially drain unleased Federal minerals the value of them is degraded.

This addendum also requests that the BLM NM State Office make available for leasing as soon as possible these 5 tracts and to place a drainage stipulation on each requiring the potential lessee to submit plans to develop within a reasonable period of time. Also, the BIA should place whatever surface stipulations they feel are appropriate concerning numerous home site leases on these lands.

All five (5) of these split-estate parcels have been identified as PDS's where adjacent Mancos wells are within the 320 acre adjoining spacing unit. Some the wells are producing as noted above and others are in the NOS/APD stage of development. There are a total of 32 PDS's against the 5 unleased parcels (see attached maps).

Enclosures: Exhibit 1 Drainage Identification Map.PDF

Joe Hewitt Geologist Petroleum Mgt. Team 9-12-14

Exhibit 1 Drainage Identification Map

