

U.S. Department of the Interior

Bureau of Land Management

Finding of No Significant Impact
Environmental Assessment
DOI-BLM-NM-040-2013-57-EA
February 2014

February 2014 Competitive Oil and Gas Lease Sale

Lane County, Kansas

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

Project: February 2014 Competitive Oil and Gas Lease Sale

EA Log Number: DOI-BLM-NM-040-2013-57-EA

Location: Lane County, Kansas

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 is not expected to have significant impacts on the environment.

The impacts of leasing the fluid minerals estate in the areas described within this EA have been previously analyzed in the Kansas Resource Management Plan (RMP), 1991, as amended 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 (EIS) is not warranted.

Prepared by:

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Date

Reviewed by:

Stephen G. Tryon, Oklahoma Field Office Manager

Date

Approved by:

Jesse J. Juen, State Director

Date

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1.0 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 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 parcels in New Mexico, Oklahoma, Texas, and Kansas. A Notice of Competitive Lease Sale (NCLS), which lists lease parcels 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 are specified in the Sale Notice. The decision as to which public land 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 parcels are located. Field office staff then review the legal descriptions of the parcels to determine if they are in areas open to leasing; if new information has become available which might change any analysis conducted during the planning process; if appropriate consultations have been conducted of which potential bidders should be made aware. The parcels nominated for this sale, along with the appropriate stipulations from the Resource Management Plan (RMP), as 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 parcels with specific, applicable stipulations is made available online to the public through the NCLS. On rare occasions, additional information obtained after the publication of the NCLS may result in deferral of certain parcels prior to the lease sale.

This EA documents the review of one (1) parcel nominated for the February 2014 Competitive Oil and Gas Lease Sale that involved Federal minerals administered by the Oklahoma Field Office (OFO). It serves to verify conformance with the approved land use plan as well as demonstrates the effectiveness of attaching the lease stipulations to the specific parcel.

The parcel and applicable stipulations were posted online for a two-week public scoping period beginning on July 22, 2013. No comments were received. In addition, this EA is made available for public review and comment for 30 days beginning on September 3, 2013. No comments were received. .

1.1 Purpose and Need

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

The need for 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 parcels and, if so, under what terms and conditions.

1.2 Land Use Plan Conformance

The applicable land use plan for this action is the Kansas Resources Management Plan (RMP) (BLM 1991), as amended. The RMP, as amended, described specific split estate tracts in Kansas and the stipulations that would be attached to each tract if they were offered for lease. These stipulations which include seasonal timing limitations and other controlled surface use stipulations were designed to minimize or alleviate potential impacts to special resource values. Since the parcel under consideration fall within this area and the applicable stipulations identified in the RMP would be attached to each parcel, if leased, leasing the parcel would be in conformance with the Kansas RMP. Leasing the parcels would also be consistent with the RMPs goals and objectives for natural and cultural resources.

Pursuant to 40 CFR 1508.28 and 1502.21, this EA is tiered to and incorporates by reference the information and analysis contained in the RMP (1991), as amended. 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 RMP. 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 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 US, the BLM has no authority over use of the surface by the surface owner; however, the BLM is required to declare how the federal mineral estate will be managed in the RMP including identification of all appropriate lease stipulations (43 CFR 3101.1 and 43 CFR 1601.0-7(b); BLM Manual Handbook 1601.009 and 1621-1).

1.3 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.

OFO biologists reviewed the proposed action and determined it would be in compliance with threatened and endangered species management and consultation guidelines outlined in the Kansas RMP biological assessments (BA). No further consultation with US Fish and Wildlife (USFWS) is required at this leasing stage.

Compliance with National Historic Preservation Act (NHPA) Section 106 responsibilities are adhered to by following the BLM Manual 8100, 36 CFR Part 800, 43 CFR Part 7, and the Cultural Resources Handbook H-8100-1 (for New Mexico, Oklahoma, Kansas, and Texas). When draft parcels locations are received by the OFO, cultural resource staff reviews the location for any known cultural resources on BLM records.

Tribal consultations would be completed when specific locations for proposed projects are received, reviewed by the State Historic Preservation Office (SHPO), the Bureau of Indian Affairs (BIA), and specific Tribes. When particular Tribes respond during consultation, that tribe would be directly involved in negotiations with the BLM to determine if the project should be moved, or other mitigation required.

In Section 1835 of the Energy Policy Act of 2005 (43 USC 1508), 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 privately owned surface. The Split Estate Report, submitted in December 2006, documents the findings resulting from consultation on the split estate issue with affected private surface owners, the oil and gas industry, and other interested parties.

NMSO contacts the surface owners and notifies 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, 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 would remain on the lease sale. However, the BLM would resolve any protest prior to issuing an oil and gas lease for that parcel. If the protest is upheld, the BLM would return the payments received from the successful bidder for that parcel. 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.

1.4 Identification of Issues

An internal review of the Proposed Action was conducted by an interdisciplinary team of OFO resource specialists on July 8, 2013, to identify and consider potentially affected resources and associated issues.

During the meeting, the interdisciplinary team also identified and subsequently addressed any unresolved issues or conflicts related to the Proposed Action.

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

- What effect *will* the proposed action have on atmospheric pollutants and contaminants?
- What effect *will* the proposed action have on climate change?
- What effect *will* the proposed action have on the watershed condition?
- What effect *will* the proposed action have on soil loss and contamination?
- What effect *will* the proposed action have on water quality in stream systems?
- What effect *will* the proposed action have on wetland and riparian areas?
- What effect *will* the proposed action have on known and newly discovered artifacts or areas of cultural, paleontological, and archeological significance?
- What effect *will* the proposed action have on the spread of non-native species?
- What effect *will* the proposed action have on vegetation loss, fragmentation, and regrowth?
- What effect *will* the proposed action have on federally listed and state-listed species that have the potential to be located on the proposed lease tracts?
- What effect *will* the proposed action have on Migratory Bird species?
- What effect *will* the proposed action have on wildlife and their habitat in general?
- What effect *will* the proposed action have on the management of fluid mineral drilling wastes produced and the potential for contamination in the proposed lease area?
- What effect *will* the proposed action have on locatable minerals management?
- What effect *will* the proposed action have on visual quality?
- What effect *will* the proposed action have on state and local economies?
- What effect *will* the proposed action have on minority and low income populations?

Several issues were considered during internal 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. The following elements are determined by the IDT, following onsite visits, review of the Kansas RMP (1991), as amended, and other data sources, to not be present:

- | | |
|----------------------------------|----------------------------|
| • Areas of Environmental Concern | • Wild and Scenic Rivers |
| • Livestock Grazing | • Wilderness |
| • Wild Horse and Burros | • Cave and Karst |
| • Public Health and Safety | • Rights-of-way |
| • Farmland – Prime or Unique | • Floodplains ¹ |

¹ Lane County enrolled in the Emergency Program of the Federal Emergency Management Agency (FEMA) in 2011. The community has not completed a Flood Insurance Study or issued a Flood Insurance Rate Map.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Alternative A—No Action

The BLM NEPA Handbook (H-1790-1) states that for EAs on externally initiated proposed actions, the no action alternative generally means that the action would not take place. In the case of a lease sale, this would mean that an expression of interest to lease (parcel nomination) would be deferred, and the one (1) parcel would not be offered for lease during the February 2014 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. The selection of the no action alternative would not prevent these parcels from being nominated in a future lease sale.

2.2 Alternative B—Proposed Action

The Proposed Action would be to lease one (1) nominated parcel of federal minerals covering 120.000 acres administered by OFO. The one (1) proposed lease parcel is located on private surface in Lane County, Kansas. Standard terms and conditions as well as stipulations listed in the Kansas RMP (1991), as amended, would apply. A complete description of the parcel, including any stipulations, is provided in Table 1.

The proposed lease parcel would have ORA-2 Wetland/Riparian Protection stipulations added. ORA-2 is intended for the protection of wetland and/or riparian areas and states that “Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the BLM. Impacts or disturbance to wetlands and riparian habitats which occur on this lease must be avoided or mitigated.”

Two lease notices, WO-ESA-7 and WO-NHPH, would also be attached to the parcel. These notices would notify the lease holder that the BLM reserves direction to modify, if necessary, any action proposed on the lease to ensure:

- Threatened, endangered, or other special status species, and their habitats (WO-ESA-7) and
- Historic properties and/or resources protected under the National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders (WO-NHPH)

would not be adversely affected. Under the Endangered Species Act (ESA) of 1973, as amended, Section 7 Consultation with the USFWS would occur if development is proposed on a lease containing habitat suitable for these special status species. Under the National Historic Preservation Act (NHPA) and other authorities, the BLM would undergo consultation with the State Historic Preservation Officer and any interested or affected tribes prior to approving any development activities.

Once sold, the lease purchaser would have the exclusive right to use as much of the leased lands as would be necessary to explore and drill for oil and gas within the lease boundaries, subject to stipulations attached to the lease; restrictions deriving from specific, nondiscretionary statutes; and such reasonable measures as may be required by the authorized officer to minimize adverse impacts to other resource values, land uses or users not addressed in the lease stipulations at the time operations

are proposed (43 CFR 3101). 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 lease holder 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 lease sale.

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 Oklahoma and Texas, 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 3 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 Oklahoma and Texas RMPs, 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.

Table 1. Alternative B—Proposed Action

Parcel	Comments	Acres
<p><u>NM-201401-001</u></p> <p>T. 0160S, R. 0280W, 06TH PM, KS Sec. 011 SENW, E2SW</p> <p>Lane County, KS</p>	<p><u>Lease with the following Stipulations:</u></p> <p>ORA-2: Wetland/Riparian Protection WO-ESA-7: Threatened and Endangered Species Consultation WO-NHPA: Tribal and Cultural Consultation</p>	<p>120.000</p>

3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

This section describes the environment that would be affected by implementation of the alternatives described in Section 2.0. Aspects of the affected environment described in this section focus on the relevant resources and issues. Only those elements of the affected environment that have potential to be significantly impacted are described in detail.

The proposed lease parcel is in the northwest part of Lane County, near the county line at an elevation of 2,540 to 2,575 feet above sea level. Lane County is in the western part of Kansas bounded on the north by Gove County, on the east by Ness County, on the West by Scott County and by Finney County to the south. Lane County has an area of 717.46 miles (459,183.8 acres).

3.1 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. 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, USDI BLM 2013). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

3.1.1 Air Quality

The Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality nationwide, including six “criteria” air pollutants. These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM₁₀ & PM_{2.5}), sulfur dioxide (SO₂) and lead (Pb). EPA has established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The NAAQS are protective of human health and the environment. EPA has approved Kansas’ State Implementation Plan and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands. The EPA has not designated any non-attainment areas within Kansas; however, two metropolitan areas (Kansas City and Wichita Metropolitan Areas) have been considered for non-attainment designation since both places have histories of exceedance violations or levels that could violate standards as a result of minor changes in the area (KDHE 2007).

The proposed lease parcel is within a Class II air quality area as designated by EPA. There are three classifications of areas that attain NAAQS, Class I, Class II and Class III. Congress established certain national parks and wilderness areas as mandatory Class I areas where only a small amount of air quality degradation is allowed. All other areas of the US are designated as Class II, which allow a moderate amount of air quality degradation. No areas of the US have been designated Class III, which would allow more air quality degradation. The primary sources of air pollution are dust from blowing wind on disturbed or exposed soil; exhaust emissions from motorized equipment; oil and gas development, production and distribution; agriculture; and industrial sources.

There are no designated Class I areas in Kansas. The nearest designated area is in Colorado, which is >350 miles to the west of the proposed parcel. Class I areas are afforded the highest level of protection by the Clean Air Act and include all international parks, national wilderness areas and national memorial parks >5,000 acres, and national parks >6,000 acres in size which were in existence on August 7, 1977.

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.

Current Pollution concentrations

Lane County is classified as an attainment area for all criteria pollutants, indicating that the area satisfies all NAAQS. The nearest air monitoring site is about 40 miles east of the proposed parcel at Cedar Bluff Reservoir. At Cedar Bluff Reservoir, ozone and SO₂ are monitored. The nearest PM₁₀ monitoring occurs in Dodge City, KS about 85 miles south of the proposed parcel. PM₁₀ data at Dodge City can be used as an indicator of PM_{2.5} concentrations. These monitors provide some indication of air quality in the region, especially for ozone, which is a regional air pollutant. Although there is no monitoring conducted for lead and carbon monoxide concentrations of these pollutants, they are expected to be low in rural areas and are therefore not monitored. In 2008, the total anthropogenic emission densities for NO_x, VOC, and HAP were estimated for each county in Kansas. NO_x levels in Lane County were estimated at the lowest level of 0.2 to 5.0 tons/mi²; VOC levels were estimated at 2.1 to 5.0 tons/mi² or in the second lowest range when compared to the rest of the state. HAP levels were estimated at the lowest level of 0.0 to 0.5 tons/mi² (KDHE 2008).

“Design Concentrations” are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2011 design concentrations of criteria pollutants are listed below.

For western Kansas, no lead monitoring data is available, however, lead concentrations are expected to be low in rural areas and are therefore not monitored. “Design Concentrations” are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2011 design concentrations of criteria pollutants are listed in Table 2.

Table 2. 2011 Design Concentrations of Criteria Pollutants in Kansas (EPA 2012)

Pollutant	Design Value	Averaging period	NAAQS
O3	0.071 ppm	8-hour	0.075 ppm ¹
SO2	3 ppb	1-hour	75 ppb ²
PM10	No exceedances	24-hour	150 µg/m ^{3,3}

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

² Annual mean, averaged over 3 years

³98th percentile, averaged over 3 years

Mean AQI values for western Kansas were generally in the good range (AQI<50) in 2011, with 302 days classified as “good”, 57 days classified as “moderate” and 6 days classified as “unhealthy for sensitive groups.” The median AQI for the region was 38 and the maximum AQI was 111. Although the AQI in the region has reached the level considered unhealthy for sensitive groups several times in the last decade, there are no patterns or trends to the occurrences (Table 3). There were zero days classified as “unhealthy for sensitive groups” in all years not listed in Table 3.

Table 3. Number of Days classified as “unhealthy for sensitive groups” (EPA 2012a)

	2002	2006	2009	2011	2012
Trego	1	4	1	6	2
Ford	0	0	0	0	0

3.1.2 Climate

Kansas has what is typically described as a continental climate—meaning without the influence of any major bodies of water. Summers are warm, with the majority of the annual precipitation occurring during this period. Winters tend to be cold with an occasional mild spell and moderate snowfall amounts. Table 4 summarizes components unique of climate that could affect air quality in the region.

Table 4. Summary of climate components that could affect air quality in the region.

Climate Component	Lane County
Mean maximum summer temperatures	89.5°F
Mean minimum winter temperatures	17.7°F
Mean annual temperature	53.5°F
Total annual precipitation	21.79 inches
Total annual snowfall	3.27 inches

In addition to the air quality information in the Kansas RMP, new information about greenhouse gases (GHGs) and their effects on national and global climate conditions has emerged since the RMP was prepared. Global mean surface temperatures have increased nearly 0.8°C (1.4°F) from 1880 to 2012 (Goddard Institute for Space Studies, 2013). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Without additional meteorological monitoring and modeling systems, 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.

GHGs that are included in the US GHG Inventory are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). CO₂ and CH₄ are typically emitted from combustion activities or are directly emitted into the atmosphere. On-going scientific research has identified the potential impacts of GHG emissions (including CO₂; CH₄, N₂O; and

several trace gases) on global climate. Through complex interactions on regional and global scales, these GHG emissions cause a net warming effect of the atmosphere (which make surface temperatures suitable for life on Earth), primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO₂ concentrations to increase dramatically, and are likely to contribute to overall climatic changes. Increasing CO₂ concentrations may also lead to preferential fertilization and growth of specific plant species.

In 2007, the Intergovernmental Panel on Climate Change (IPCC) predicted that by the year 2100, global average surface temperatures would increase 1.4°C to 5.8°C (2.5°F to 10.4°F) above 1990 levels. The National Academy of Sciences (2006) supports these predictions, but has acknowledged that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increase in daily minimum temperatures are more likely than increases in daily maximum temperatures. It is not, however, possible at this time to predict with any certainty the causal connection of site specific emissions from sources to impacts on the global/regional climate relative to the proposed lease parcel and subsequent actions of oil and gas development.

A 2007 US Government Accountability Office (GAO) Report on Climate Change found that, “federal land and water resources are vulnerable to a wide range of effects from climate change, some of which are already occurring. These effects include, among others: 1) physical effects such as droughts, floods, glacial melting, and sea level rise; 2) biological effects, such as increases in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events; and 3) economic and social effects, such as adverse impacts on tourism, infrastructure, fishing, and other resource uses.”

A number of activities contribute to the phenomenon of climate change, including emissions of GHGs (especially CO₂ and CH₄) from fossil fuel development, large wildfires, activities using combustion engines, changes to the natural carbon cycle, and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs will have a sustained climatic impact over different temporal scales due to their differences in global warming potential (described above) and life span of the atmosphere.

3.2 Soils

Kansas' varied climate and topography have combined to produce loamy fertile soils suitable for agricultural use. Generally, the soils of the state can be described by color. The black or dark brown soils of the northeastern part of the state are recognized as the most productive while a gradual shading change to light brown and reddish brown are found in the southwest. Soil depths vary throughout the state but generally correspond to the color with the darker soils generally being the deepest.

The Natural Resource Conservation Service (NRCS) has surveyed the soils in the proposed parcel area. One soil type and water was identified across the proposed parcel (Table 5).

Table 5. NRCS identified soils in the proposed parcel.

Map Unit	Name	Description	Acres	%
1691	Manvel-Badland complex	6-40%; well drained; calcareous fine-silty colluvium derived from chalk; >80"; High water capacity; no frequency of flooding or ponding	104.9	87.3
9999	Water		15.3	12.7

The NRCS has also assigned a wind erodibility index value of 86 tons per acre per year for the Manvel-Badland complex soil type. The value indicates moderate susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion. The higher the value indicates higher susceptibility and more tons per acre lost per year from wind, with the highest value being 330.

The NRCS has also assigned an erosion Factor K of 0.37, which indicates moderate susceptibility of the soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised USLE to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

3.3 Water Resources

3.3.1 Surface water

Kansas has five river systems and more than 50,000 streams large enough to be named. The Missouri, Kansas (commonly known as the Kaw) and Arkansas rivers are considered navigable by the state of Kansas, none of which are in the proposed lease area. Approximately 0.03% of the land in Lane County is water. Factors that currently affect surface water resources include drought, groundwater pumping, agricultural and recreational use, and oil and gas development.

Lane County has no permanently flowing streams, but contains the headwater areas of Walnut Creek and also is drained by tributaries to Smoky Hill River on the north and tributaries to Pawnee River on the south. The main streams in the county are Hackberry Creek and the South, Middle, and North Forks of Walnut Creek. Hackberry Creek drains the southeast corner of the county. The forks of Walnut Creek drain the central half. They originate in the western part and drain east into Ness County. The deeply entrenched drainageways along the north border of the county drain north into Grove County and join the Smoky Hill River.

The proposed parcel lies within Upper Smokey Hill (HUC 8 #102003) watershed of the Smokey River Basin. The watershed has undergone water quality assessments, which begins with water quality

standards that were adopted by the State and approved by EPA under the Clean Water Act. Where possible, state, tribes and other jurisdictions identify pollutants or stressors causing water quality impairment that prevent the water from meeting the criteria adopted by the states to protect designated uses. Causes of impairment include chemical contaminants (such as PCBs, metals, and oxygen-depleting substances), physical conditions (such as elevated temperature, excessive siltation, or alterations of habitat), and biological contaminants (such as bacteria and noxious aquatic weeds). The nearest impaired water is >3.8 miles to the south of the proposed parcel and outside the Upper Smokey Hill Watershed. Within the watershed, the nearest impaired water (Smokey Hills River) is >4.8 miles to the north. The section of river nearest the parcel is impaired as a result of *Escherichia Coli* (E. Coli) pathogens.

Approximately 15.3 acres of the proposed parcel are covered by unnamed waterbodies and a portion of a tributary of the Smoky Hill River.

3.3.2 Groundwater

Groundwater, developed from large subterranean sand and gravel deposits, can be found throughout most of the state. This water source is responsible for the economic importance of agriculture to a significant portion of Kansas. Groundwater yields of greater than 500 gallons per minute cover a large area. There are nine significant developed aquifers in the state including: the Ogallala, Dakota, Great Bend Prairie alluvium, and the "Equus Beds" alluvium, which are located in the west and central parts of the state; the Glacial Drift,, Chase-Council Grove, Douglas, and Arbuckle Group (Ozark), located in the east.

The proposed parcel does not overlie any mapped aquifers; however, the proposed parcel is within 0.3 miles of the Ogallala High Plains Aquifer. If development were to occur, water would likely come from this aquifer. Water extraction from the Ogallala is far greater than the rate of recharge; the water table is declining. As water levels fall in the Ogallala, some irrigators have sought water in underlying aquifers. Although these aquifers show some promise, their yields are small compared to the Ogallala and in some cases the quality is so poor as to be unusable. On average the general availability of ground water yields 100 to 500+ gallons per minute. Ground-water levels have been declining during the last few decades in the Ogallala-High Plains aquifer. The storage decline rate started to increase in the 1950s, accelerated in the 1960s to mid-1970s, and then approximately leveled from the late 1970s to 2007, although it varied substantially each year depending on pumping.

The groundwater reservoir in the county is recharged principally by precipitation that falls within the area and from precipitation that falls in adjacent areas to the west and enters Lane County as underflow. Groundwater is discharged from the groundwater reservoir by transpiration and evaporation in areas of shallow water table, by movement into adjacent areas, by springs, and by wells. Most of the domestic, stock, public, and irrigation supplies are obtained from groundwater wells. The groundwater in Lane County, though generally hard, is suitable for most purposes. Some waters from the Ogallala aquifer are higher in fluoride content.

3.4 Wetlands, Riparian Areas

Wetland habitats provide important wintering and migration habitat for several species of Migratory Birds. Wetlands also provide a link between land and water and are some of the most productive ecosystems in the world. Executive Order (EO) 11990 on the Protection of Wetlands provides opportunity for early review of Federal agency plans regarding new construction in wetland areas. Under EO 11990, each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for conduction federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating and licensing activities.

The proposed parcel is contains wetlands formed by the headwaters of two intermittent unnamed tributaries of the Smoky Hill River.

3.5 Heritage Resources

3.5.1 Cultural Resources

Kansas has a rich and diverse archaeological record. There are thousands of currently recorded archaeological and historical sites scattered throughout the state.

To comply with Section 106 of the National Historic Preservation Act (NHPA), as amended, a cultural resources background review was conducted. A Class I cultural resource review was done on each parcel and no historic properties were identified. No properties of concern were within the area of potential effect (APE). A section 106 review at the lease sale stage is helpful in that it is a first look at parcels to see if concerns about historic properties are warranted, and possibly to determine if a parcel should be withdrawn from the lease sale process due to concerns about historic properties.

3.5.2 Paleontology

The extent, if any, of paleontological resources within the APE are unknown. During the APD phase, site-specific surveys would be completed and includes with the cultural resource report and include statements on any new paleontological material discovered during inventory. These reports are reviewed and new fossil material is reported to paleontologists.

3.5.3 Native American Religious Concerns

Traditional Cultural Properties (TCPs) are places that have cultural values that transcend the values of scientific importance that are normally ascribed to cultural resources such as 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.

There are several pieces of legislation or Executive Orders that should be 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).
- Executive Order 13007 (24 May 1996).
- The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 USC 3001, P.L. 101-601).
- The Archaeological Resources Protection Act of 1979 (ARPA; 16 USC 470, Public Law 96-95).

For the Proposed Action, identification of TCPs were limited to reviewing existing published and unpublished literature, and BLM tribal consultation efforts specific to this proposed. Notification of the lease sale was sent to the Iowa Tribe of Kansas and Nebraska. The tribe and a literature review did not indicate any TCPs. No TCPs are known to exist within the APE.

3.6 Invasive, Non-native Species

Noxious weeds can have a disastrous impact on biodiversity and natural ecosystems. Noxious weeds affect native plant species by out-competing native vegetation for light, water and soil nutrients. Noxious weeds cause \$2 to \$3 million in estimated losses to producers annually. These losses are attributed to: (1) decreased quality of agricultural products due to high levels of competition from noxious weeds; (2) decreased quantity of agricultural products due to noxious weed infestations; and (3) costs to control and/or prevent the spread of noxious weeds.

The Kansas Noxious Weed Law designated 12 plants as noxious weeds with an additional two species as county option weeds. Of the 14 species, three have been documented in Lane County (Table 6). (EDDMaps 2013).

Table 6. Kansas Noxious weeds documented as occurring in Lane County.

Species	Description	Suitable Habitat
Field bindweed <i>Convolvulus arvensis</i>	Perennial vine with white to pale pink, funnel-shaped flowers, light brown fruit, and round to arrow-shaped leaves. It typically inhabits roadsides, grasslands and along streams.	Yes
Johnsongrass <i>Sorghum halepense</i>	Tall, rhizomatous, perennial grass invades open areas throughout the US. Adapted to a wide variety of habitats including open forests, old fields, ditches and wetlands. Aggressively spreads and can form dense colonies	Yes
Bull thistle <i>Cirsium vulgare</i>	Biennial, and sometimes annual or monocarpic perennial, forb. Most troublesome in recently or repeatedly disturbed areas such as pastures, overgrazed rangelands, forest clearcuts, and waste places; and along roads, ditches, and fences.	Yes

3.7 Vegetation

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. A Roman numeral hierarchical scheme has been adopted for different levels of ecological regions. Level I is the coarsest level, dividing North American into 15 ecological regions. Level II divided the continent into 52 regions. At level III, the continental U.S. contains 104 regions whereas the conterminous U.S. has 48. Level IV ecoregions are further subdivisions of level III ecoregions. In Kansas, there are six level III ecoregions and 19 level IV ecoregions.

The proposed project area is within the Rolling Plains and Breaks ecoregion (EPA 25b), which characterizes approximately 24,739 square miles (15,833,023 acres) of dissected plains with broad undulating to rolling ridge tops and hilly to steep valley sides. Historically, the native range included mixedgrass prairies of big bluestem, little bluestem, blue grama, needle and thread, side oats grama, and western wheatgrass, with floodplain forests along major riparian corridors.

Over the last 100 years, the ecosystems once found in Kansas have been drastically altered due to the large scale private agriculture industry. The agriculture industry has developed intensive areas of cultivation and livestock grazing. Native range is typically only found in areas too sandy or too steep for farming. Currently, the ecoregion consists of a mosaic of predominantly cropland and rangeland. Winter wheat and grain sorghum are the major crops with large areas of corn growing in the north. Irrigated areas along the major rivers are planted with corn, alfalfa, and small grains, while rangelands are typically found on the breaks.

3.8 Wildlife

3.8.1 Threatened and Endangered Species

The purpose of the Endangered Species Act (ESA) is to ensure that federal agencies and departments use their authorities to protect and conserve endangered and threatened species. Section 7 of the ESA requires that federal agencies prevent or modify any projects authorized, funded, or carried out by the agencies that are "likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of critical habitat of such species."

According to the US Fish and Wildlife Service, Kansas Ecological Services office the following Federally-listed endangered, threatened, proposed, and candidate species occur or have the potential to occur in Lane County, Kansas: lesser prairie-chicken (*Tympanuchus pallidicinctus*), Sprague's pipit (*Anthus spragueii*) and the whooping crane (*Grus Americana*).

3.8.2 Special Status Species

The Kansas Department of Wildlife, Parks and Tourism has no threatened and endangered species listed for Lane County, Kansas.

3.8.3 Migratory Birds

Executive Order (EO) 13186, 66 Fed. Reg. 3853, (January 17, 2001) identifies the responsibility of federal agencies to protect migratory birds and their habitats, and directs executive departments and agencies to undertake actions that will further implement the Migratory Bird Treaty Act (MBTA). Under the MBTA, incidental, unintentional, and accidental take, killing, or possession of a migratory bird or its parts, nests, eggs or products, manufactured or not, without a permit is unlawful. The MBTA has no provisions for a permitting process which allows for regulated “take” of migratory birds. EO 13186 includes a directive for federal agencies to develop a memorandum of understanding (MOU) with the Service to promote the conservation of migratory bird populations, including their habitats, when their actions have, or are likely to have, a measurable negative effect on migratory bird populations.

Twenty-seven Birds of Conservation Concern are listed for the Central Mixed-Grass Prairie (Bird Conservation Region 19) BCC 2008 list, where the proposed parcel occurs including: the lesser prairie-chicken, little blue heron, Mississippi kite, Bald Eagle, Swainson's hawk, black rail, snowy plover, mountain plover, solitary sandpiper, upland sandpiper, long-billed curlew, hudsonian godwit, marbled godwit, buff-breasted sandpiper, short-billed dowitcher, red-headed woodpecker, scissor-tailed flycatcher, loggerhead shrike, Bell's vireo, Sprague's pipit, Cassin's sparrow, lark bunting, Henslow's sparrow, Harris's sparrow, McCown's longspur, Smith's longspur and the chestnut-collared longspur. The North American Breeding Bird Survey Results and Analysis 1966-2010, breeding bird surveys conducted near the site (Gove Route) found seven (7) species from the BCR 19 list that are known to nest in or near the proposed project area including: the Mississippi kite, Swainson's hawk, upland sandpiper, red-headed woodpecker, loggerhead shrike, Bell's vireo, Cassin's sparrow and the lark bunting.

3.8.4 Wildlife

Many species of animals utilize the habitat associated within this lease sale parcel.

3.9 Wastes – Hazardous or Solid

The Resource Conservation and Recovery Act (RCRA) of 1976 established a comprehensive program for managing hazardous wastes from the time they are produced until their disposal. The EPA regulations define solid wastes as any “discarded materials” subject to a number of exclusions. On January 6, 1988, EPA determined that oil and gas exploration, development and production wastes would not be regulated as hazardous wastes under RCRA. The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, deals with the release (spillage, leaking, dumping, accumulation, etc.), or threat of a release of hazardous substances into the environment. Despite many oil and gas constituent wastes being exempt from hazardous waste regulations, certain RCRA exempt contaminants could be subject to regulations as hazardous substances under CERCLA.

No hazardous or solid waste materials are currently known to be present on any of the proposed lease parcels. However, hazardous and/or solid wastes may be used during the development phase. See Appendix 3—Phases of Oil and Gas Development for a description of anticipated wastes.

3.10 Mineral Resources

Minerals occurring in commercial quantities in Kansas include oil, gas, coal, gypsum, salt, zinc, lead, chalk, pumice, commercial quality clays, helium, building stone, limestone, sand and gravel. Petroleum and natural gas are the state's most economically important minerals. Lane County contains approximately 1,160 acres of split-estate minerals within ten tracts. Half have these have been identified as possessing values warranting protection greater than afforded by Standard Terms and Conditions.

There are approximately 241 oil fields in Lane County. Oil exploration and development is largely driven by the price of oil. In the last 10 years the production of oil in the County has doubled as a result of the increasing value of oil. In 2012, 963,064 barrels (bbls) of oil were produced from 422 oil wells in Lane County. About 12,365,131 bbls have been cumulatively produced since the Kansas Corporation Commission began tracking production in 1995. No gas wells have been developed in the county (KGS 2012).

No additional mineral resources (i.e. helium, coal, gravel, sand, salt) are identified within the county.

3.11 Visual Resources

BLM Manual H-8410-1 lays out the visual resource inventory process for determining visual values. The inventory consists of scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. The purpose of the analysis is to determine the area's Visual Resource Management Class (VRM), which defines the degree of acceptable visual change within a characteristic landscape on BLM lands. Because the proposed parcels are on private surface a VRM class has not been established for the areas.

The existing landscape throughout all of the proposed parcel counties include oil and gas development visual impacts from facilities, lease roads, pipelines, utility lines, and above ground components such as tanks, pumpjacks, wellheads, fences, and signs. Visual impacts from agricultural/farming activities include croplands, pastures, outbuildings (i.e. barns, storage sheds, and chicken coups), irrigation pipes/ditches/pivots, and improved and unimproved roads to access outbuildings, crops, pastures, etc. Oil/gas development and agriculture/farming production facilities are readily visible from residences, highways, and country roads in all of the counties, including each proposed parcel.

Proposed parcel is >2.8 miles from State Route 4 and >25 miles to Interstate 70, neither of which are classified as scenic byways.

3.12 Socioeconomics and Environmental Justice

3.12.1 Socioeconomics

In 2011, 1,091 citizens of Lane County were employed, while 44 were unemployed resulting in a 3.9 percent unemployment rate. Businesses in Lane County employ 404 employees in farm related jobs and 1,227 employees in non-farm related jobs. Most of the non-farm jobs are in the government or retail industry (KU 2012).

In 2007 there were 284 farms in Lane County, spanning over 401,399 acres. An additional 137,761 acres were harvested croplands and 113,755 acres were pasture. There are 73,000 call and calves in the county. Table 7 lists the crops grown in Lane County and their production in 2011.

Table 7. 2011 Crop Production in Lane County, KS (NASS 2013).

	Acres Planted	Harvested	Production
Wheat	99,000	53,500	1,685,000 bushels
Sorghum	70,000	44,000	1,165,000 bushels
Soybeans	2,000	1,400	29,000 bushels
Alfalfa Hay	NA	1,000	3,100 tons
Other Hay	NA	3,900	4,000 tons

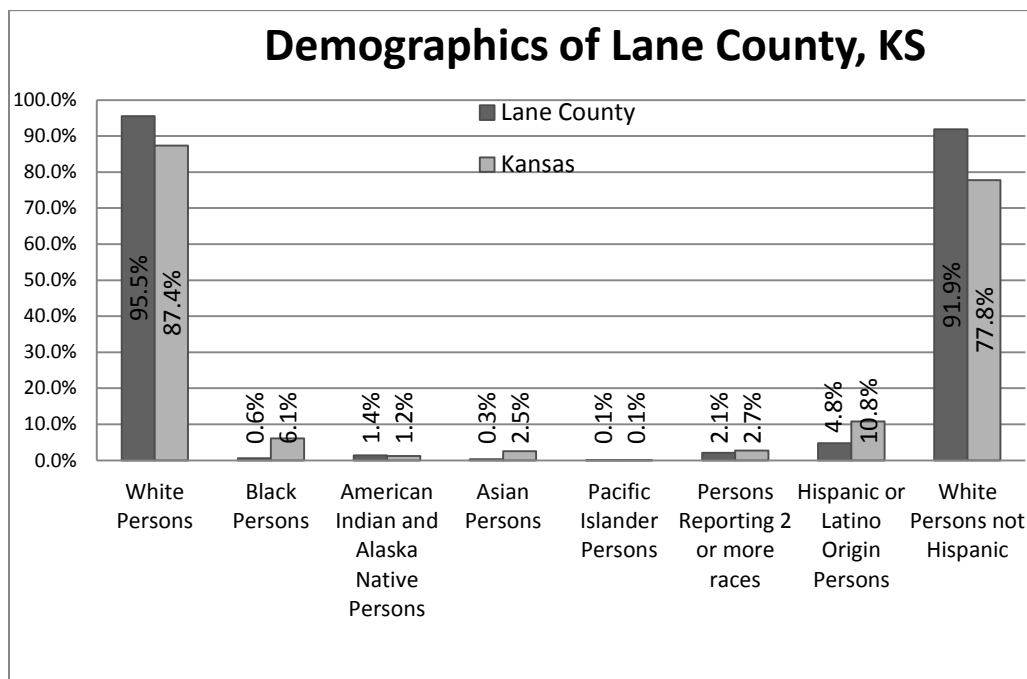
NA: Data not available

3.12.2 Environmental Justice

Executive Order 12989, issued on 11 February 1994, addresses concerns over disproportionate environmental and human health impacts on minority and low-income populations. The impetus behind environmental justice is to ensure that all communities, including minority, low-income or federally recognized tribes, live in a safe and healthful environment.

In 2012, the estimated population of Lane County was 1,704 people, which makes up 0.06 percent of the State of Kansas' total population. The demographics of the county are shown in Figure 1. The median household income in Lane County is \$41,536 about 17.9 percent below the state average of \$50,594. Approximately 15.8 percent of the population lives at or below the poverty level, which is higher than the 12.6 percent state-wide average.

Figure 1. Demographics of the proposed lease parcel county.



4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Assumptions for Analysis

The act of leasing parcels would, by itself, have no impact on any resources in the OFO. All impacts would be linked to as yet undetermined future levels of lease development. The effects of oil and gas leasing in Kansas are analyzed in the Kansa RMP (1991), as amended (Chapter 4). That analysis, which assumes that the impacts from an average well, pipeline and access road would total 4.25 acres of surface disturbance in Kansa is incorporated by reference into this document.

If 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 these leases. Potential cumulative effects may occur should an oil and gas field be discovered if these parcels are drilled and other infield wells are drilled within these leases or if these leases become part of a new unit. All actions, not just oil and gas development may occur in the area, including foreseeable non-federal actions.

4.2 Effects from the No Action Alternative

Under the No Action Alternative, the proposed parcels would be deferred and not offered for sale. Analysis of the No Action alternative is presented in the following sections. There would be no subsequent impacts from oil and/or gas construction, drilling, and production activities. The No Action Alternative would result in the continuation of the current land and resource uses in the proposed lease areas.

4.2.1 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. Oil and gas consumption is driven by a variety of complex interacting factors including energy costs, energy efficiency, availability of other energy sources, economics, demography, and weather or climate. If the BLM were to forego leasing and potential development of the proposed parcels, the assumption is that the public's demand for the resource would not be expected to change. Instead, the mineral resource foregone would be replaced in the short- and long-term by other sources that may include a combination of imports, using alternative energy sources (e.g. wind, solar), and other domestic production.

This offset in supply would result in a no net gain for oil and gas domestic production.

4.2.2 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 increase in activity and noise associated with these proposed leases unless the land is used for other purposes.

4.2.3 All Other Resources

No other resources would be affected under the No Action Alternative, as there would be no 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. 4.3 Effects from the Proposed Action

4.3.1 Air Resources

4.3.1.1 Air Quality

While the act of leasing Federal minerals would produce no impacts to air quality, subsequent exploration/development of the proposed lease could increase air borne soil particles blown from new well pads or roads, exhaust emissions from drilling equipment, compressor engines, vehicles, dehydration and separation facilities coupled with volatile organic compounds during drilling or production activities.

In order to reasonably quantify emissions associated with well exploration and production activities, certain types of information are needed. Such information includes a combination of activity data such as the types of equipment needed if a well were to be completed successfully (e.g. compressor, separator, dehydrator), the technologies which may be employed by a given company for drilling any new wells, area of disturbance for each type of activity (e.g. roads, pads, electrical lines compressor station), number of days to complete each kind of construction, number of days for each phase of the drilling process, type(s), size, number of heavy equipment used for each type of construction (backhoe, dozer, etc.), number of wells of all types (shallow, deep, exploratory, etc.), compression per well (sales, field booster), or average horsepower for each type of compressor. The degree of impact will also vary according to the characteristics of the geological formations from which production occurs. Currently, it is not feasible to directly quantify emissions. What can be said is that emissions associated with oil and gas exploration and production would incrementally contribute to increases in air quality emissions into the atmosphere.

During drilling and completion, the following source of emissions are anticipated during any oil and gas exploration or development: combustion engines (i.e. fossil fuel fired internal combustion engines used to supply electrical or hydraulic power for hydraulic fracturing to drive the pumps and rigs used drill the well, drill out the hydraulic stage plugs and run the production tubing in the well; generators to power drill rigs, pumps, and other equipment; compressors used to increase the pressure of the oil or gas for transport and use; tailpipe emissions from vehicles transporting equipment to the site), venting (i.e. fuel storage tanks vents and pressure control equipment), mobile emissions (i.e. vehicle bringing equipment, personnel, or supplies to the location) and fugitive sources (i.e. pneumatic valves, tank leaks, dust). A number of pollutants associated with combustion of fossil fuels are anticipated to be released during drilling including: CO, NO_x, SO₂, Pb, PM, CO₂, CH₄, and N₂O. Venting may release VOC/HAP, H₂S, and CH₄. Mobile source emissions are likely to include fugitive particulate matter from dust or inordinate idling. The actual emissions of each pollutant will be entirely dependent on the factors described in the previous paragraph.

During the completion phase, the most significant emissions of criteria pollutants emitted by oil and gas operations in general are VOCs, particulate matter and NO₂. VOCs and NO_x contribute to the formation of ozone, which is a pollutant of concern in Oklahoma. Data provided to EPA's Natural Gas STAR Program show that some of the largest air emissions in the natural gas industry occur as natural gas wells that have been fractured are being prepared for production. During well completion, "flowback", fracturing fluids, water, and reservoir gas come to the surface at high velocity and volume. This mixture includes a high volume of VOCs and methane, along with air toxics such as benzene, ethylbenzene, and n-hexane. The typical flowback process lasts from three to 10 days. Pollution also is emitted from other processes and equipment in during production and transportation of the oil and gas from the well to a processing facility.

The additional NO_x and VOCs emitted from any new oil and gas development on these leases are likely too small to have a significant effect on the overall ozone levels of the area.

Although the hydraulic fracturing 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 hydraulically fractured and completed. There is a higher probability of emissions in the atmosphere from hydraulic fracturing over a well that is not hydraulically fractured.

Mitigation

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, flared 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; collocate 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 reclaim areas of the pad not required for production facilities and to reduce the amount of dust from the pads. In addition, the BLM encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions.

In October 2012, EPA 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. Mitigation includes a process known as “Green Completion” in which natural gas brought up during flowback must be recaptured and reroute into the gathering line.

4.3.1.2 Climate

The assessment of GHG emissions, their relationship to global climatic patterns, and the resulting impacts is an ongoing scientific process. It is currently not feasible to know with certainty the net impacts from the proposed action on climate—that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. The BLM does not have the ability to associate a BLM action’s contribution to climate change with impacts in any particular area. The science to be able to do so is not yet available. The inconsistency in results of scientific models used to predict climate change at the global scale coupled with the lack of scientific models designed to predict climate change on regional or local scales, limits the ability to quantify potential future impacts of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing science. When further information on the impacts to climate change is known, such information would be incorporated into the BLM’s planning and NEPA documents as appropriate.

Leasing the subject tract would have no direct impact on climate as a result of GHG emissions. There is an assumption, however, that leasing the parcels would have indirect effects on global climate through GHG emissions. However, those effects on global climate change cannot be determined (See cumulative effects section, 4.2.14.3 for additional information). It is unknown whether the petroleum resources specific to these leases in the Proposed Action are gas or oil or a combination thereof.

BLM’s Automated Fluid Minerals Support System (AFMSS) provides information about federal mineral estate in Kansas for 2010 (Table 8).

Table 8. 2010 Oil and Gas Production

Location	Oil (bbl)	% U.S. Total	Gas (MMcf)	% U.S. Total
United States	1,999,731,000	100	26,836,353	100
Kansas	40,467	0.002	325,591	1.2
Federal leases in Kansas	245	0.00001	6,559	0.02

In order to estimate the contribution of Federal oil and gas leases to greenhouse gases in Kansas, it is assumed that the percentage of total U.S. production is comparable to the percentage of total

emissions. Therefore, emissions are estimated based on production starting with total emissions for the United States from EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010* (EPA, 2012b), and applying production percentages to estimate emissions for Kansas. It is understood that this is a rather simplistic technique and assumes similar emissions in basins that may have very different characteristics and operational procedures, which could be reflected in total emissions. This assumption is adequate for this level of analysis due to the unknown factors associated with eventual exploration and development of the leases. However, the emissions estimates derived in this way, while not precise, will give some insight into the order of magnitude of emissions from federal oil and gas leases administered by the BLM and allow for comparison with other sources in a broad sense.

Table 9. 2010 Oil and Gas Field Production Potential Emissions

Location	Oil (Metric tons of CO ₂ ^e)		Gas (Metric tons of CO ₂ ^e)		Total O&G Production (Metric tons CO ₂ e)	%U.S. Total GHG emissions
	CO ₂	CH ₄	CO ₂	CH ₄		
United States	300,000	30,600,000	10,800,000	126,000,000	167,700,000	2.6
Kansas	6	612	129,600	1,512,000	1,642,218	0.03
Federal leases in Kansas	0.03	3.06	2,160	25,200	27,363	0.0004

Table 9 shows the estimated greenhouse gas emissions for oil and gas field production for the U.S., Kansas, and Federal leases in Kansas. The table illustrates the small percentage of total U.S. greenhouse gas emissions that federal leases generate. 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 phase 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. The estimates are only for operations, not for construction and reclamation of the facilities, which may have a higher portion of a project's GHG contribution. CO₂^e is the concentration of CO₂ that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas.

Table 9 provides an estimate of direct emissions that occur during production of oil and gas. This phase of emissions represents a small fraction of overall emissions of CO₂^e from the life cycle of oil and gas. For example, acquisition (drilling and development) for petroleum is responsible for only 8% of the total CO₂^e 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.DOE, NETL, 2008).

To estimate the potential emissions from the proposed lease sale, an estimate of emission per well is useful (Table 10). To establish the exact number of Federal wells in Kansas 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.

Table 10. Potential Greenhouse Gas Emissions Resulting from the Proposed Lease Sale based on the latest available 2010 estimates.

GHG Emission Source	Total Emissions (metric tons)	Percent
U.S. GHG Emissions From All Sources	6,372,900,000	100.00 %
U.S. GHG Emissions From Oil & Gas Field Production	167,700,000	2.6%
Kansas Emissions From Oil & Gas Field Production	1,642,218	0.03%
Kansas Federal lease Oil & Gas Field Production (639 wells)	27,363	0.0004%
Oil & Gas Field Production at Full Development For Proposed Action (1 Well)	42.8	0.0000007%

The table above estimates that the total emissions from Federal leases in Kansas in 2010 were 27,363 metric tons CO₂^e. Therefore, the estimate of emission per well is 42.81 metric tons CO₂^e annually.

Environmental impacts of GHG emissions from oil and gas consumption are not effects of the proposed action as defined by the Council on Environmental Quality (CEQ), and thus are not required to be analyzed under NEPA. GHG emissions from consumption of oil and gas are not direct effects under NEPA because they do not occur at the same time and place as the action. They are also not indirect effects because oil and gas leasing and production would not be a proximate cause of GHG emissions resulting from consumption.

Mitigation

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

The EPA data show that improved practices and technology and changing economics have reduced emissions from oil and gas exploration and development (Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2010 (EPA 2012b)). One of the factors in this improvement is the adoption by industry of the BMPs proposed by the EPA's Natural Gas Energy Star program. The OFO 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. While EPA data shows that methane emissions increased from oil and gas exploration and development from 1990-2010, reductions in methane emissions from oil and gas exploration and development should occur in future years as a result of EPA's recently finalized oil and gas air emissions regulations.

4.3.2 Soils

While the act of leasing Federal minerals would produce no impacts to soils, subsequent exploration/development of the proposed lease may produce impacts by physically disturbing the topsoil and exposing 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 topsoil 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 during all phases of development. Vehicle traffic related wind erosion would be limited to approved travel routes in which the surface has not been paved or dressed in a material to prevent soil movement. The extent of wind erosion related to vehicle traffic will be dependent on a number of factors including: length of well bore; whether hydraulic fracturing is used during completion; whether telemetry is used during production; whether the well is gas, oil, condensate, or a combination thereof. 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 on well sites, access roads, gas pipelines and facilities.

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.

Contamination of soil from drilling, hydraulic fracturing, and production wastes mixed into soil or spilled on the soil surfaces could cause a long-term reduction in site productivity. Contaminants spilled on soil would have the potential to pollute and/or change the soil chemistry. See section 4.3.11 – Wastes, Hazardous or Solid for a more in-depth analysis of spill contamination. These direct impacts can be reduced or avoided through proper design, construction, maintenance and implementation of BMPs.

Mitigation

The operator would stockpile the topsoil from the surface of well pads which would be used for surface reclamation of the well pads. 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.

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. Upon abandonment of wells and/or when access roads are no longer in service final reclamation would be implemented. Earthwork for interim and final reclamation must be completed within 6 months of well completion or well plugging (weather permitting).

Road construction requirements and regular maintenance would alleviate potential impacts to access roads from water erosion damage.

Fluid impermeable containment systems (i.e. liners, dikes, berms) would be placed in, under and/or around any tank, pit, drilling cellar, ditches associated with the drilling process, or other equipment that use or has the potential to leak/spill hazardous and non-hazardous fluids, to completely prevent soil contamination (e.g. liners) at the site or to prevent the spill from going beyond the immediate site (e.g. dikes, berms).

4.3.3 Water Resources

While the act of leasing Federal minerals would produce no impacts to water resources, subsequent exploration/development of the proposed lease may produce impacts. Surface disturbance from the construction of well pads, access roads, pipelines, and utility lines can result in degradation of surface water and groundwater quality from non-point source pollution, increased soil losses, and increased gully erosion.

Quality

Potential impacts that would occur due to construction of well pads, access roads, fracturing ponds, pipelines, and utility lines include increased surface runoff and off-site sedimentation brought about by soil disturbance; increased salt loading and water quality impairment of surface waters; channel morphology changes due to road and pipeline crossings; and possible contamination of surface waters by produced water. The magnitude of these impacts to water resources would depend on the proximity of the disturbance to the drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration and time within which construction activity would occur, and the timely implementation and success or failure of mitigation measures.

Direct impacts would likely be greatest shortly after the start of construction activities and would decrease in time due to natural stabilization, and reclamation efforts. Construction activities would occur over a relatively short period; therefore, the majority of the disturbance would be intense but short lived. Direct impacts to surface water quality would be minor, short-term impacts which may occur during storm flow events.

Contamination of groundwater could occur without adequate cementing and casing of the proposed well bore. For fracturing fluid to escape the wellbore and affect the usable quality water or contaminate or cross contaminate aquifers, the fluid would have to breach several layers of steel casing and cement. Failure of the cement or casing surrounding the wellbore is a possible risk to water supplies. If the annulus is improperly sealed, natural gas, fracturing fluids, and formation water containing high concentrations of dissolved solids may be transferred directly along the outside of the wellbore among the target formation, drinking water aquifers, and layers of rock in between. Complying with BLM and state regulations regarding casing and cementing, implementing BMPs, testing casings and cement prior to continuing to drill or introducing additional fluids and continual monitoring during drilling and

hydraulic fracturing allow producers and regulators to check the integrity of casing and cement jobs and greatly reduce the chance of aquifer contamination.

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.

An expressed public concern about subsurface hydraulic fracturing operations in deep shale formations is that the process might create fractures that extend well beyond the target formation to water aquifers, allowing methane, contaminants naturally occurring in formation water, and fracturing fluids to migrate from the target formation into drinking water supplies (Zoback et al 2010). Typically, many thousands of feet of rock separate most major formation in the U.S. from the base of aquifers that contain drinkable water (GWPC 2009). The direct contamination of underground sources of drinking water from fractures created by hydraulic fracturing would require hydrofractures to propagate several thousand feet beyond the upward boundary of the target formations through many layers of rock. It is extremely unlikely that the fractures would ever reach fresh water zones and contaminate freshwater aquifers (Zoback et al 2010, RRC 2013). During the APD review, the exact difference between the base of treatable water and the top of the target formation for the specific site would be reviewed to determine the potential for direct contamination of underground sources.

Typically flowback is hauled away to be injected into disposal wells. It is estimated that approximately 30 percent of the injected water returns without too much of a quality decrease, whereas the remaining 40 percent is more degraded. Since the flowback would be disposed of at a regulated and permitted facility, it is assumed that they would ensure all water quality regulations and laws are followed and that BMPs are in place to prevent contamination of aquifers, thus having no impact on water quality in the aquifers from flowback.

Petroleum products and other chemicals used during drilling or hydraulic fracturing, accidentally spilled, could result in surface and groundwater contamination. Similarly, possible leaks from reserve and evaporation pits could degrade surface and groundwater quality. Authorization of the proposed projects would require full compliance with BLM directives and stipulations that relate to surface and groundwater protection.

Quantity

Impacts of water use for oil and gas development and production depend on local water availability and competition for water from other users. Overall, impacts range from declining water levels at the regional or local scales and related decreases in base flow to streams (Nicot and Scanlon 2012). Water supplied for hydraulic fracturing could come from surface or groundwater sources. If surface water is used, there would be a temporary decrease in the source's water levels. The time it takes to return to baseline conditions is dependent on the amount of rainfall received and other competing uses of the resource.

Typically when groundwater is used, impacts to the aquifer would be minimal due to the size of the aquifers impacted and recharge potential across the entire aquifer. However, localized aquifer effects are expected. A cone of depression may occur in the immediate vicinity of the existing water well used to supply the fracturing water. With each rain event, the aquifer is expected to recharge to some degree, but it is unknown if or when it would recharge to baseline conditions after pumping ceases. The time it takes depends greatly on rainfall events, drought conditions, and frequency of pumping that has already occurred and will continue to occur into the future.

The amount of water actually used for development is highly dependent on a number of factors including: length of well bore, closed-loop or reserve pit drilling system, type of mud, whether hydraulic fracturing would be used during stimulation, whether recycled water would be used, dust abatement needs, type and extent of construction, to name a few. The impacts of water use on water quality and quantity would be analyzed in more detail during the APD review.

Proposed lease parcel -192 would have a stipulation attached (OSU #1), which does not permit surface occupancy in or near Lake Carl Blackwell and associated facilities owned by OSU. This would reduce the potential for lake contamination as it would be unlikely that contaminants could move >2,000 feet provided BMPs/COAs were properly implemented. Constructing a well pad, with the intention of accessing the leased parcel's associated minerals, outside of the parcel boundaries could have the same impacts as described above.

Mitigation

Fluid impermeable containment systems (i.e. liners, dikes, berms) would be placed in, under and/or around any tank, pit, drilling cellar, ditches associated with the drilling process, or other equipment that use or has the potential to leak/spill hazardous and non-hazardous fluids, to prevent chemicals from penetrating the soil and impacting the aquifer or from moving off-site to a surface water source.

Complying with BLM and state regulations regarding casing and cementing, implementing BMPs, testing casings and cement prior to continuing to drill or introducing additional fluids and continual monitoring during drilling and hydraulic fracturing allow producers and regulators to check the integrity of casing and cement jobs and greatly reduce the chance of aquifer contamination.

4.3.4 Wetlands, Riparian Areas

Leasing and development of Federal minerals is not anticipated to produce any direct impacts to wetlands or riparian areas as a result of the ORA-2 lease stipulation being attached to the parcel.

Mitigation

Potential mitigation is deferred to site-specific development at the APD stage. Protective stipulation ORA-2 would be attached to the lease of a tract which falls within a wetland/riparian. ORA-2 states that, "All or portions of the lands under this lease contain wetland and/or riparian areas. Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the Bureau of Land

Management. Impacts or disturbance to wetlands and riparian habitats which occur on this lease must be avoided or mitigated. The mitigation shall be developed during the application for permit to drill.”

4.3.5 Heritage Resources

4.3.5.1 Cultural Resources

No previously recorded historic properties have been documented within the APE. A determination of No Historic Properties Affected has been made and none of the proposed parcels have been recommended for withdrawal from the sale. The Kansas State Historic Preservation Office has requested that the BLM not consult them at the leasing stage but rather wait until formal plans for lease development are submitted via an APD.

While the act of leasing Federal minerals would produce no direct impacts to cultural resources, subsequent development of a lease could. To comply with Section 106, a cultural resources survey will need to be conducted for all surface disturbance activities related to development of the lease. Direct and indirect effects cannot be predicted without analysis of site-specific development at the APD stage of development. Potential impacts at that stage could include increased human activity in the area increasing the possibility of removal of, or damage to, heritage artifacts. The increase in human activity in the area increases the possibility of irretrievable loss of information pertaining to the heritage of the project region. Conversely, the benefits to heritage resources derived from the future development are the heritage and historic survey that adds to literature, information, and knowledge of cultural resources.

Many cultural resource issues exist beyond the NHPA, such as state and municipal registers of historic sites, National Heritage Areas, National Trails, or other heritage designations. Leasing the proposed parcels would have no effect on any of these types of cultural resources.

Please refer to the Cultural and Paleontological Resources Summary and BLM Cultural Determination in Appendix 5 for more information.

4.3.5.2 Paleontology

While the act of leasing Federal minerals would produce no direct impacts to paleontological resources, subsequent development of a lease could. Direct and indirect effects cannot be predicted without analysis of site-specific development at the APD stage of development. Potential impacts at that stage could include increased human activity in the area increasing the possibility of removal of, or damage to, paleontology resources. The increase in human activity in the area increases the possibility of irretrievable loss of information pertaining to the paleontology of the project region. Conversely, the benefits to paleontology resources derived from the future development are the paleontology survey that adds to literature, information, and knowledge of cultural resources.

Protection and preservation of significant fossil materials in specific locations would be required for any BLM permitted project.

4.3.5.3 Native American Religious Concerns

The proposed action is not known to physically threaten any 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.

Please refer to the Cultural and Paleontological Resources Summary and BLM Cultural Determination in Appendix 5 for more information.

Mitigation Common to ALL Cultural Resources

Specific mitigation measures, including but not limited to, site avoidance or excavation and data recovery would be determined when site-specific APDs and cultural surveys are received. As well, a second NHPA section 106 evaluation would be completed. The Kansas State Historic Preservation Office confirmed that studies will need to be done at the APD stage.

Standard Conditions of Approval are attached to each APD including:

- In the event that lease development practices are found in the future to have an adverse effect on significant cultural resources, the operator and the BLM, in consultation with the affected tribe(s), and Kansas State Historic Preservation Office will 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.
- If additional ground disturbance is required outside of the currently proposed APE, the Bureau of Land Management archaeologist must be notified prior to any work. If archeological material such as chipped stone tools, pottery, bone, historic ceramics, glass, metal, or building structures are exposed; stop work at that spot immediately and contact the BLM archeologist at (918) 621-4100.
- If archeological material such as chipped stone tools, pottery, bone, historic ceramics, glass, metal, or building structures are exposed; stop work at that spot immediately and contact the BLM, and the Kansas State Historic Preservation Office.

4.3.6 Invasive, Non-native Species

Noxious and invasive weeds can occur from oil and gas development activities that cause disturbance. Weeds and weed seed can be transported and spread by any vehicles, equipment/tools, or earthen materials used during all phases of well development, production, and reclamation that are transported to the site. Weeds and weed seed can be attached to equipment and vehicles thus having the potential to spread over large areas and introduce seed to new sites where they could establish a new population.

Mitigation

Mitigation is deferred to site-specific development at the APD stage. BMPs require that all actions on public lands that involve surface disturbance or reclamation take reasonable steps to prevent the introduction or spread of noxious weeds, including requirements to use weed-free hay, mulch and straw.

4.3.7 Vegetation

While the act of leasing Federal minerals would produce no impacts to vegetative resources, subsequent exploration/development of the proposed lease would have impacts to vegetation. The level of impact depends on the vegetation type, the vegetative community composition, soil type, hydrology, and the topography of the parcels. Surface-disturbing activities could affect vegetation by removing, trampling, or killing the vegetation; churning soils; losing substrates for plant growth; impacting biological crusts; disrupting seedbanks; burying individual plants; reducing germination rates; covering plants with fugitive dust; and generating sites for undesirable weedy species. In addition, development could reduce available forage or alter livestock distribution leading to overgrazing or other localized excess grazing impacts to palatable plant species. If these impacts occurred after seed germination but prior to seed establishment, both current and future generations could be affected.

Vegetation would be lost within the construction areas of pads, roads, and rights of ways. Those areas covered in compacted native substrates, such as pads and roads, would have no vegetation for the life of the well. Interim and final reclamation should result in vegetation establishment in three to five growing season (one to two years) with appropriate techniques used and adequate precipitation. Inadequate precipitation over several growing seasons could result in loss of vegetative cover, leading to weed invasion and deterioration of native vegetation.

Mitigation

Mitigation is primarily deferred to site-specific development at the APD stage. If potential wells are productive disturbed areas not needed for the production facility would be reclaimed. In the case of non-productive wells, all disturbed areas should be reclaimed through reseeding or vegetative cover reestablishment. BMPs identified in BLM guidance documents, such as the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development: The Gold Book (USDI, 2007), recommend areas to be restored with native vegetation in regards to both species and structure. This recommendation is contingent upon the wishes of the surface owner.

4.3.8 Wildlife

4.3.8.1 Threatened and Endangered Species

While the act of leasing Federal minerals produces no impacts to Threatened and Endangered Species, subsequent exploration/development of the proposed parcel may produce impacts. Surface disturbance from the development of well pads, access roads, pipelines, and utility lines can cause an increase in habitat fragmentation, noise, or other disturbance during development.

In addition, Threatened and Endangered Species may be disturbed during construction, drilling, or hydraulic fracturing operations, as these activities involve many vehicles, mobile and non-mobile heavy equipment, and numerous noise-producing equipment (i.e. generators, compressors). The most significant impacts would be limited to the construction, drilling, and completion/stimulation phases, which can span from several weeks to several months and is entirely dependent on the size and extent of new surface disturbance, length of the well bore, formations encountered during drilling, or whether hydraulic fracturing is used just to name a few. During production, impacts from noise and human disturbance would greatly diminish. In general, most wildlife species would become habituated to the disturbances. 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 from inspectors and semi-trucks hauling produced fluids, noise from compressors and/or a pump-jack if needed, and equipment maintenance. These impacts would last for the life of the well.

Mitigation

Protective stipulation WO-ESA-7 would be attached to any lease which falls within an area of potential wildlife habitat. WO-ESA-7 states “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.”

All proposed parcels, except for -184, would have stipulation ORA-3: Season of Use attached to the lease. All parcels would have WO-ESA-7: Threatened and Endangered Species protection attached to the lease.

4.3.8.2 Special Status Species

No State listed species or their critical habitat is present in the proposed lease sale parcels resulting in no effects to state listed species.

4.3.8.3 Migratory Birds

The Service estimates that many migratory birds are killed annually throughout the United States in oil field production skim pits, reserve pits, and centralized oilfield wastewater disposal facilities. Numerous grasshoppers, moths, June bugs, and the like become trapped on the surface in tanks and on pits, and become bait for many species of migratory birds. Open tanks and pits then become traps to many species of birds protected under the MBTA. Properly covered tanks and pits (and regularly inspected covered tanks and pits) is imperative to continued protection of migratory birds in the well pad area.

Mitigation

Per the MOU between BLM and the Service, entitled “To Promote the Conservation of Migratory Birds,” the following temporal and spatial conservation measures must be implemented as part of the Conditions of Approval with a permit to drill:

1. Avoid any take of migratory birds and/or minimize the loss, destruction, or degradation of migratory bird habitat while completing the proposed project or action.
2. If the proposed project or action includes a reasonable likelihood that take of migratory birds will occur, then complete actions that could take migratory birds outside of their nesting season. This includes clearing or cutting of vegetation, grubbing, etc. The primary nesting season for migratory birds varies greatly between species and geographic location, but generally extends from early April to mid-July. However, the maximum time period for the migratory bird nesting season can extend from early February through late August.

Strive to complete all disruptive activities outside the peak of migratory bird nesting season to the greatest extent possible. If no migratory birds are found nesting in proposed project or action areas immediately prior to the time when construction and associated activities are to occur, then the project activity may proceed as planned.

4.3.8.4 Wildlife

Impacts from developing the lease could result in increased habitat fragmentation, noise, or other disturbance during development. 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).

In addition, Threatened and Endangered Species may be disturbed during construction, drilling, or hydraulic fracturing operations, as these activities involve many vehicles, mobile and non-mobile heavy equipment, and numerous noise-producing equipment (i.e. generators, compressors). The most significant impacts would be limited to the construction, drilling, and completion/stimulation phases, which can span from several weeks to several months and is entirely dependent on the size and extent of new surface disturbance, length of the well bore, formations encountered during drilling, or whether hydraulic fracturing is used just to name a few. During production, impacts from noise and human disturbance would greatly diminish. In general, most wildlife species would become habituated to the disturbances. 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 from inspectors and semi-trucks hauling produced fluids, noise from compressors and/or a pump-jack if needed, and equipment maintenance. These impacts would last for the life of the well.

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.

Mitigation Common to ALL Species

The BLM will require oil and gas lessees to operate in a manner that will minimize adverse impacts to wildlife and apply reasonable measures to all oil and gas exploration/development activities. Measures would be taken to prevent, minimize, or mitigate impacts to fish and wildlife animal species from exploration and development activities, including specific mitigation measures (i.e. rapid revegetation, noise restriction, project relocation, pre-disturbance surveys, etc.) unique to the proposed development site, but would be deferred until the APD process.

The Wildlife Resource General Conditions of Approval (WRGCOAs) are included in all approved APDs and use standard BMPs to provide extra measures of protection to wildlife populations and habitats in the area. Impacts to the wildlife resource component of the environment can be avoided or minimized by adopting the WRGCOAs and BMPs.

4.2.9 Wastes – Hazardous or Solid

Exploration/development of the proposed lease could have result in the introduction of hazardous and non-hazardous substances to the site. Hazardous substances may be produced, used, stored, transported or disposed of as a result of the project. Properly used, stored, and disposed of hazardous and non-hazardous substances greatly decreases the potential for any impact on any environmental resources. One way operators and the BLM ensure hazardous and non-hazardous substances are properly managed in through the preparation of a Spill Prevention, Control, and Countermeasure (SPCC) plan.

In hydraulic fracturing, chemical substances other than water make up a small percentage of the fluid composition; however, the very large volumes used require correspondingly large volumes of a variety of compounds. These substances range from the relatively benign to the highly toxic at certain concentrations. In addition to these added chemicals, naturally occurring toxicants such as heavy metals, volatile organics, and radioactive compounds are mobilized during extraction and return to the surface with the produced water. Of the millions of gallons of water used to hydraulically fracture a well one time, less than 30 percent to more than 70 percent may remain underground (Bamberger and Oswald 2012). Although the risk is low, the potential exists for unplanned releases that could have serious effects on human health and environment. A number of chemical additives are used that could be hazardous, but are safe when properly handled according to requirements and long-standing industry practices. In addition, many of these additives are common chemicals which people regularly encounter in everyday life (GWPC 2009).

Surface spills of drilling mud and additives, hydraulic fracturing fluids and additives, flowback water, and other produced water can happen at a variety of points in the development and production phases. Spills that occur can span a range of different spill sizes and causes of failure at any point in the process. For example, small spills often happen as the result of poor pipe connections or leaks; large spills

sometimes occur as the result of a major well blowout, but such blowouts rarely occur. Additionally, spills from some parts of the phases may be the result of human error (i.e. vehicle collisions, improper handling, improper equipment operation or installation, etc.), while others stem from equipment failure (i.e. broken pipes, torn pit liners, leaking tanks, etc.) or acts of nature (Fletcher 2012). The most common cause of spills comes from equipment failure and corrosion (Wenzel 2012).

The cause of the spill, the spill size, the hazard rating of the spilled material, response time to clean up the spill and the effectiveness of the cleanup, all play a critical role in determining the overall impact on the environment. The volume of a spill can significantly vary with spill types. Pipe spills are not expected to release more than 1,000 gallons into the environment; retaining pit spills and truck spills are not expected to release more than 10,000 gallons of fluid; and blowouts are expected to cause the largest spills, with the potential to release tens of thousands of gallons into the environment. Small spills occur with greater frequency than large spills. Secondary containment or recovery for small spills would likely minimize if not eliminate any potential release into the environment. However, for spills on the order of several thousands of gallons of fluid, it is expected that less than half the fluid may be captured by secondary containment or recovery. The vast majority of shale gas operations do not incur reportable spills (5 gallons or more), indicating the fluid management process can be, and usually is managed safely and effectively (Fletcher 2012).

Mitigation

Specific mitigation is deferred to the APD process. The following measures are common to most projects: all trash would be placed in a portable trash cage and hauled to an approved landfill, with no burial or burning of trash permitted; chemical toilets would be provided for human waste; fresh water zones encountered during drilling operations would be isolated by using casing and cementing procedures; a berm or dike would enclose all production facilities if a well is productive; and all waste from all waste streams on site would be removed to an approved disposal site.

4.2.10 Mineral Resources

Exploration/development of the proposed lease could impact the production horizons and reservoir pressures. If production wells are established, the resources allotted to the wells would eventually be depleted. The amount and location of direct and indirect effects cannot be predicted until site-specific development information is available typically during the APD stage.

Other mineral resources could be impacted as a result of exploration/development through the loss of available surface or subsurface area needed to develop or access the other mineral resource overlapping the proposed lease parcel. The extent of the impacts, if any cannot be predicted until site-specific development information is available typically during the APD stage.

Mitigation

Mitigation is deferred to site-specific development at the APD stage. Spacing orders and allowable production orders are designed to conserve the oil and/or gas resource and provide maximum recovery.

4.2.11 Visual Resources

Exploration/development of the proposed lease could impact visual quality through: increased visibility of constructed features such as roads, well pads, pipelines, tank batteries; road degeneration from heavy trucks and vehicles following rain and snow; dust and exhaust from construction, drilling, and production vehicles and equipment; vegetation removal and construction of steep slopes; unreclaimed sites; and discarded equipment. Well pads, power lines, access roads, and associated production facilities and storage tanks have the greatest potential to alter visual conditions for the life of the well. Vegetation removal would present an obvious contrast in color with the surrounding vegetation and affect foreground and middle ground distance zones for more than a decade. These impacts would be most obvious immediately after construction. Impacts would decrease as the disturbed surface began to blend in color, form, and texture, when interim or final reclamation occurs. Long-term visual impacts could persist as long as the well is producing, which could be a couple of years to more than 50 years. Long-term impacts may include vegetation removal, alteration of the landscape, and installation of equipment and facilities.

Mitigation

Mitigation is deferred to site-specific development at the APD stage.

4.2.12 Socioeconomics and Environmental Justice

No minority or low income populations would be directly affected in the vicinity of the proposed lease parcel. Indirect impacts could include an increase in overall employment opportunities related to the oil and gas and service support industry in the region, as well as the economic benefits to State and County governments related to royalty payments and severance taxes. Other impacts could include a small increase in activity and noise disturbance in areas used for agriculture and recreational activities. However, these impacts would apply to all land users in the area.

Oil and gas development, especially during drilling and hydraulic fracturing, can create short-term increases in traffic volume, dust and noise and negatively impact nearby residents or businesses. These nuisance impacts are usually limited to the construction, drilling, completion and/or hydraulic fracturing phases of the well. These impacts would be significantly reduced during production, when the site would be visited periodically for inspection and/or to haul produced fluids.

Mitigation

Mitigation is deferred to site-specific development at the APD stage.

4.2.13 Cumulative Effects

4.2.13.1 Cumulative Effects Common to All Resources

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 16 percent 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 236 parcel nominations (178,793 acres) for consideration in the February 2013 Oil & Gas Lease Sale, and is proposing to lease 106 (73,642 acres) of the 236 parcels. If these 106 parcels were leased, the percentage of Federal minerals leased would change by 1 percent. The Carlsbad, Farmington, Las Cruces, Oklahoma (Kansas, Texas and Oklahoma) Rio Puerco and Roswell Field Office parcels are analyzed under separate EAs.

Table11. 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%

Table12. Parcels Nominated and Offered in the February 2014 Oil and 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
Carlsbad	34	12,302	20	4,981
Farmington	38	19,103	4	1,200
Kansas	1	120	1	120
Las Cruces	27	31,743	23	27,779
Oklahoma	11	657	10	617
Rio Puerco	76	74,650	0	0
Roswell	5	4,926	5	4,926
Texas	44	35,292	43	34,019
Totals	236	178,793	106	73,642

Table13. Foreseeable – Acres of Federal Minerals/Acres Available/Acres Leases

State	Federal O&G Mineral Ownership	Acres Available	Acres Leased	Percent Leased
KS	744,000	614,586	125,211	20%
NM	34,774,457	29,751,242	4,878,141	16%
OK	1,998,932	1,668,132	324,689	19%
TX	3,404,298	3,013,207	459,530	15%
Totals/Average	40,921,687	35,067,167	5,787,571	17%

Analysis of cumulative impacts for reasonably foreseeable development of oil and gas wells in Kansas was analyzed in the Kansas RMP (1991), as amended (pg. 105-118). Potential development of all available federal minerals in Kansas including those in the proposed lease parcels was included as part of

the analysis. Total surface disturbance projected by the plan was based on an estimated 20 Federal wells being drilled annually in Kansas with an estimated 85 acres of disturbance. Over the last 10 years there have only been two to three Federal wells drilled each year.

More than 100 years of oil and gas development and agriculture practices in Kansas has resulted in an extensive infrastructure of existing roads and pipelines. Kansas has approximately 32,000 active wells (639 on Federal leases). Kansas has 65,531 farms, spanning over 46,345,827 acres. Impacts from both developments would remain on the landscape until final plugging, abandonment and reclamation of well facilities or until crop production and agriculture activities cease.

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.

4.2.13.2 Cumulative Effects on Air Quality

The following analysis of cumulative impacts of the proposed action on air quality will be limited to the eight counties in which the proposed lease parcels occur.

The primary activities that contribute to levels of air pollutants in the county are predominately combustible engines of road and non-road, diesel and gasoline vehicles and equipment. 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 (USDI BLM 2013). 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.

The very small increase in emissions that could result from approval of the proposed action would not result in western Kansas exceeding the NAAQS for any criteria pollutant. In October 2012, EPA regulations that require control of VOC emissions from oil and gas development became effective. These regulations will reduce VOC emissions from oil and gas exploration and production emissions that contribute to the formation of ozone. Emissions from any development of the lease are not expected to impact the 8-hour average ozone concentrations, or any other criteria pollutants in western Kansas.

4.2.13.3 Cumulative Effects on Climate Change

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 (USDI 2013). The very small increase in GHG emissions that could result from approval of the proposed action 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 particular emissions associated with Federal actions on global or regional climate; however, EPA's recently finalized oil and gas air quality regulations have a co-benefit of methane reduction that will reduce greenhouse gas emissions from any oil and gas development that would occur on this lease.

5.0 CONSULTATION/COORDINATION

This section includes the resource specialists located within the OFO that specifically participated and provided input in the lease parcel review process and the development of this EA document.

ID Team Member	Title	Organization
Ryan Howell	Archaeologist	BLM
Becky Peters	Wildlife Biologist	BLM
Pat Stong	Geologist	BLM
Melinda Fisher	Natural Resource Specialist	BLM
Galen Schwertfeger	Environmental Specialist	BLM
Gary McDonald	Environmental Specialist	BLM
Larry Levesque	Planning and Environmental Coordinator	BLM

The BLM NM State Director, along with several New Mexico State Office resource leads, parcel review was held on 30 August 2013 to review Field Office recommendations for nominated parcels.

5.1 Public Involvement

The parcel and applicable stipulations were posted online for a two-week public scoping period beginning on July 22, 2013. No comments were received. In addition, this EA is made available for public review and comment for 30 days beginning on September 3, 2013. No comments were received.

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7.0 AUTHORITIES

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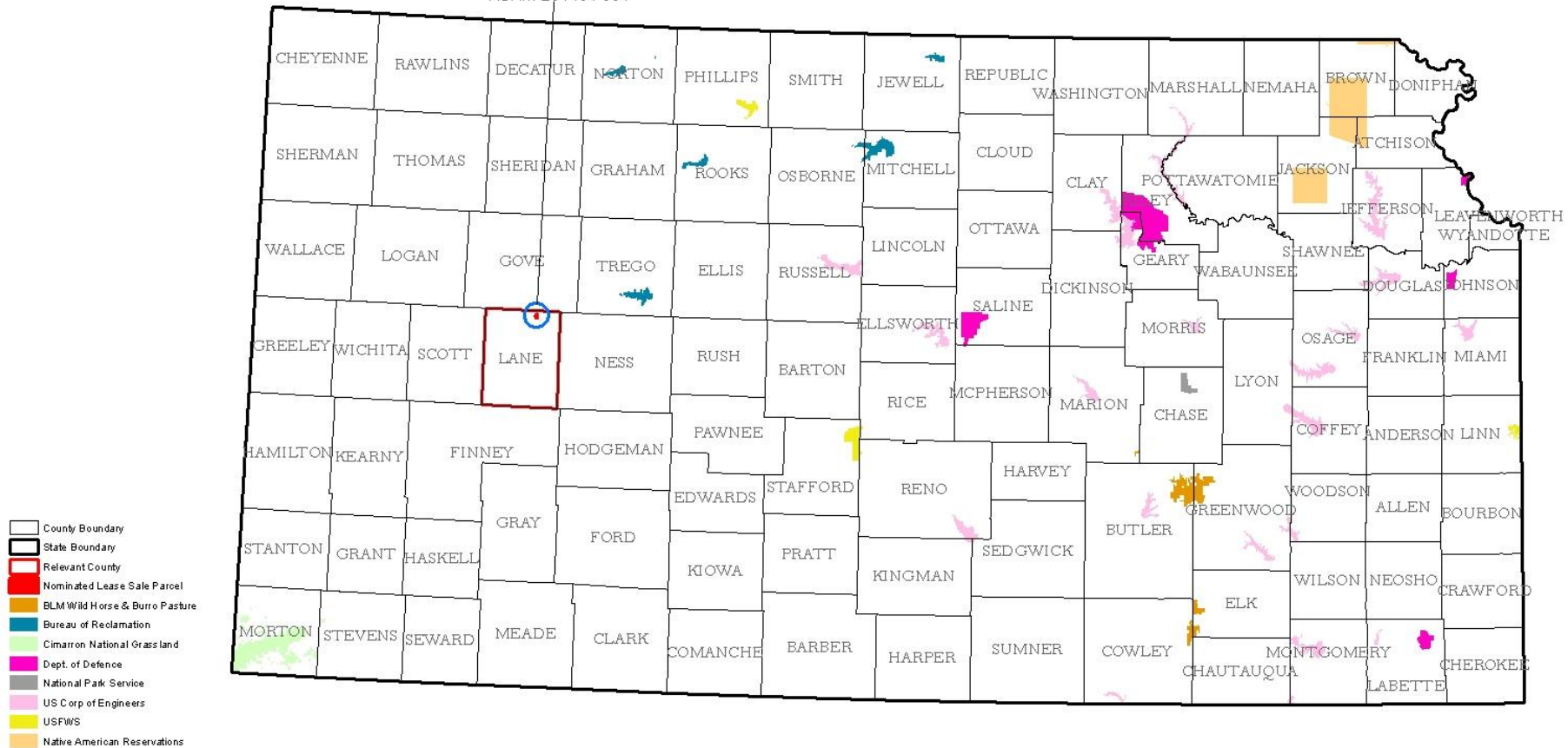
APPENDIX 1. OKLAHOMA FIELD OFFICE LEASE STIPULATION SUMMARY

Stipulation	Description/Purpose
ORA-2 KS	WETLAND/RIPARIAN: Mandated by EO 11990 Protection of Wetlands of May 24, 1977. All or portions of the lands under this lease contain wetland and/or riparian areas. Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the Bureau of Land Management. Impacts or disturbance to wetlands and riparian habitats which occur on this lease, must be avoided or mitigated. The mitigation shall be developed during the application for permit to drill.
WO-ESA-7 TX,OK,KS	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 <u>et seq.</u> , including completion of any required procedure for conference or consultation.
WO-NHPA TX, OK,KS	CULTURAL RESOURCES AND TRIBAL CONSULTATION STIPULATION: This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer (SHPO) and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.

APPENDIX 2. KANSAS NOMINATED LEASE SALE PARCELS

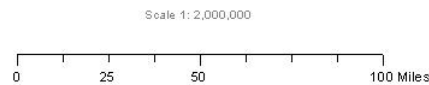
BLM Competitive Oil and Gas Lease Sale January 22, 2014 Kansas Nominated Lease Sale Parcel

KSNM 201401 001



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by BLM. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

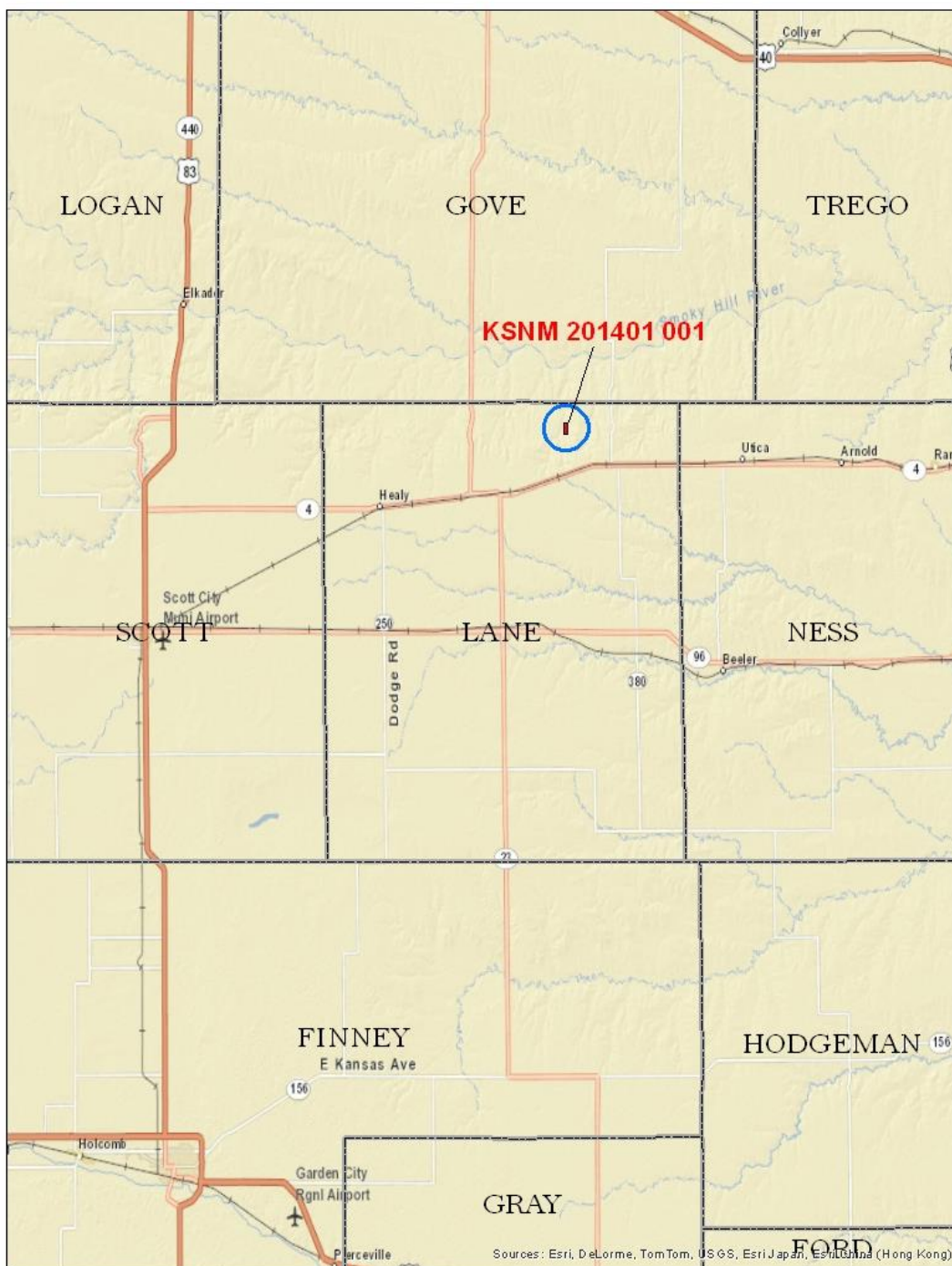
Oil & Gas Field Office
GIS Team
6/27/2013



USA Contiguous Albers Equal Area Conic



Figure 2. Lane County, KS Proposed Parcel -001



APPENDIX 3: 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, but in Oklahoma, Texas, and Kansas, the most common are commercial. 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 3, Table 1 includes some of the common wastes (hazardous and non-hazardous) that are produced during oil and gas development.

Appendix 3, 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

Phase	Waste
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)
Abandonment/ Reclamation	<ul style="list-style-type: none"> Tank or pit bottoms Contaminated soil Scrap metal 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).

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

Figure 3. Typical Chemical Additives Used In Fracturing Fluids (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



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 4. BIOLOGICAL EVALUATION.

APPENDIX 5. CULTURAL RESOURCES REPORT
