

# U.S. Department of the Interior

---

## Bureau of Land Management

---

Finding of No Significant Impact  
Environmental Assessment  
DOI-BLM-NM-040-2013-58-EA  
February, 2014

---

### February 2014 Competitive Oil and Gas Lease Sale

*Beaver, Jackson, Ellis, Roger Mills and Payne Counties, Oklahoma*

---

U.S. Department of the Interior  
Bureau of Land Management  
Oklahoma Field Office  
7906 E. 33<sup>rd</sup> Street  
Tulsa, Oklahoma 74145  
Phone: 918.621.4100  
Fax: 918.621.4130



**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-040-2013-58-EA**

**Location: Beaver, Jackson, Ellis Roger Mills, and Payne Counties, Oklahoma**

**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 Oklahoma Resource Management Plan (RMP), 1994, 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:

---

Melinda Fisher, Natural Resource Specialist

---

Date

Reviewed by:

---

Stephen G. Tryon, Oklahoma Field Office Manager

---

Date

Approved by:

---

Jesse J. Juen, State Director

---

Date

**Environmental Assessment**  
**February 2014 Competitive Oil and Gas Lease Sale**  
**DOI-BLM-NM-040-2013-58-EA**

## **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 eleven (11) parcels nominated for the February 2014 Competitive Oil and Gas Lease Sale. One (1) parcel is located on federal surface estate administered by the Black Kettle National Grasslands. The remaining ten (10) parcels are located on split-estate private surface with Federal mineral estate under each 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 specific parcels. Where the surface is administered by the Forest Service and the

mineral estate is also federally owned, the Forest Service and BLM share the responsibility for enforcing mineral leasing policies and regulations. Forest Service regulations under 36 CFR 228.102(e) allow the agency to authorize the BLM to lease individual, specified areas of land administratively available for lease and include the stipulations determined to be necessary. The Forest Service is responsible for reviewing the effects of leasing the proposed parcels, although the final decision is made by the BLM authorizing official.

The BLM issues and administers oil and gas leases on Forest Service lands only after the agency authorizes leasing for specific lands. Once a Federal lease is issued on Forest Service lands, the Forest Service has the full responsibility and authority to approve and regulate all surface disturbing activities associated with oil and gas exploration and development through analysis and approval of the surface use plan of operation (SUPO) component of an Application for Permit to Drill (APD). The BLM has the authority and responsibility to provide final approval of all APDs including those for operations on Federal leases on Forest Service lands. Each APD includes a Surface Use Plan of Operations and a drilling plan. The BLM has the authority and responsibility to regulate all downhole operations and directly related surface activities and use, and provide approval of the drilling plan and final approval of the APD on Forest Service lands (USDA/USDI 2006).

The parcels and applicable stipulations were posted online for a two-week public scoping period beginning on July 22, 2013. Two comments were received from private individuals. One comment did not have substantial comments for the purposes of the EA analysis and will be addressed in this EA. The second comment letter contained three substantial comments, all of which are addressed within the EA. The comment letter and BLM response can be found in Appendix 6. In addition, this EA was 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 Oklahoma Resources Management Plan (RMP) (January 1994), as amended. The RMP, as amended, described specific split estate tracts in Oklahoma

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. All but two parcels under consideration fall within these areas 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 Oklahoma RMP. Leasing the parcels would also be consistent with the RMPs goals and objectives for natural and cultural resources. One parcel is recommended for deferral because concurrence from the surface managing agency was not received.

For Surface Management Agency (SMA) parcels, the RMP states “the SMA is contacted for consent to lease and also for identification of specific agency surface protection stipulations”. The Forest Service was not contacted regarding the parcel in their jurisdiction. A letter of Consent to Lease, along with specific stipulations to attach to each parcel has not been received from the Forest Service. Leasing the SMA parcel would not be consistent with the Oklahoma RMP.

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 (1994), 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 Oklahoma 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 floodplains and the integrity of the floodplains?
- What effect *will* the proposed action have on wetland and riparian areas?

- What effect *will* the proposed action have on prime or unique farmlands?
- 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 Oklahoma RMP (1994), as amended, and other data sources, to not be present:

- |   |   |
|---|---|
| • Areas of Critical Environmental Concern | • Wild and Scenic Rivers                |
| • Livestock Grazing                       | • Wilderness and Wilderness Study Areas |
| • Wild Horse and Burros                   | • Cave and Karst                        |
| • Public Health and Safety                | • Rights-of-way                         |
|   | • Lands with Wilderness Characteristics |
|   | • Recreation Use                        |

## 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 ten (10) parcels 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 ten (10) nominated parcels of federal minerals covering 616.52 acres administered by OFO. The ten (10) proposed lease parcels are located on private surface in Beaver, Jackson, Ellis, Roger Mills and Payne Counties, Oklahoma. Standard terms and conditions as well as stipulations listed in the Oklahoma RMP (1994), as amended, would apply. A complete description of these parcels, including any stipulations, is provided in Table 1.

Three of the proposed parcels occur within floodplains. Lease stipulation LN-3 for Floodplain Protection and ORA-1 Floodplain Protection would be attached to parcels -184, -185 and -188. The Floodplain Protection Lease Notice informs the lessee and operator that surface occupancy of these areas and surface disturbance within up to 200 meters of the outer edge of the floodplain may not be allowed in order to protect the integrity and functionality of the floodplain and associated watercourse. Furthermore, controlled surface use requiring special mitigation measures may be required and will be developed during the application for permit to drill.

Proposed lease parcels -184, -185, -186 and -188 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.”

Eight proposed parcels are within Lesser Prairie Chicken Habitat (-182, -183, -185 – -188, -190, and -191) and one proposed parcel is within Greater Prairie Chicken Habitat (-192). The nine parcels would have ORA-3 stipulations added to them. ORA-3 states that no surface occupancy of the lease would occur from February 15 to May 15.

Two lease notices, WO-ESA-7 and WO-NHPH, would also be attached to each parcel except for proposed parcel -189. 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.

Proposed parcel -182 and -183 would have NM-10: Drainage attached. NM-10 informs the lessee that the lease is subject to drainage by well(s) located adjacent to the lease. Additional requirements are required by the lessee to show how they intend to protect the lease from drainage or be assessed a compensatory royalty.

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.

The following table describes lease parcels that are in conformance with the applicable land use plan and amendments.

**Table 1. Alternative B—Proposed Action**

<b>Parcel</b>	<b>Comments</b>	<b>Acres</b>
<p><b><u>NM-201401-182</u></b></p> <p>T. 0010S, R. 0210E, CM, PM, OK Sec. 001 Lots 1-3 Sec. 002 Lots 1-3</p> <p><b>Beaver County, OK</b></p>	<p><u>Lease with the following Stipulations:</u> ORA-3: Season of Use Stipulation Lesser Prairie Chicken NM-10: Drainage WO-ESA-7: Threatened &amp; Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	31.590
<p><b><u>NM-201401-183</u></b></p> <p>T. 0010S, R. 0210E, CM, PM, OK Sec. 004 Lots 1-3 Sec. 005 Lots 1-3 Sec. 006 Lots 1-3</p> <p><b>Beaver County, OK</b></p>	<p><u>Lease with the following Stipulations:</u> ORA-3: Season of Use Stipulation Lesser Prairie Chicken NM-10: Drainage WO-ESA-7: Threatened &amp; Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	47.200
<p><b><u>NM-201401-184</u></b></p> <p>T. 0020S, R. 0190W, IM, PM, OK Sec. 029 S2NW, NESW</p> <p><b>Jackson County, OK</b></p>	<p><u>Lease with the following Stipulations:</u> ORA-LN-3: Floodplain Management Notice ORA-1: Floodplain Protection ORA-2:Wetland/Riparian Protection WO-ESA-7: Threatened &amp; Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	31.590
<p><b><u>NM-201401-185</u></b></p> <p>T. 0180N, R. 0210W, IM, PM, OK Sec. 022 NWSE</p> <p><b>Ellis County, OK</b></p>	<p><u>Lease with the following Stipulations:</u> ORA-LN-3: Floodplain Management Notice ORA-1: Floodplain Protection ORA-2:Wetland/Riparian Protection ORA-3: Season of Use Stipulation Lesser Prairie Chicken WO-ESA-7: Threatened &amp; Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	40.000
<p><b><u>NM-201401-186</u></b></p> <p>T. 0120N, R. 0230W, IM, PM, OK Sec. 023 NENW</p> <p><b>Roger Mills County, OK</b></p>	<p><u>Lease with the following Stipulations:</u> ORA-2: Wetland/Riparian Protection ORA-3: Season of Use Stipulation Lesser Prairie Chicken WO-ESA-7: Threatened &amp; Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	40.000

Parcel	Comments	Acres
<b><u>NM-201401-187</u></b>  T. 0120N, R. 0230W, IM, PM, OK Sec. 024 NENW  <b>Roger Mills County, OK</b>	<u>Lease with the following Stipulations:</u> ORA-3: Season of Use Stipulation Lesser Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	40.000
<b><u>NM-201401-188</u></b>  T. 0160N, R. 0240W, IM, PM, OK Sec. 008 Lots 2; 008 ACCR & RIPR ACREAG TO L2 008 SEE EXH A FOR M&B W/MAP  <b>Roger Mills County, OK</b>	<u>Lease with the following Stipulations:</u> ORA-LN-3: Floodplain Management Notice ORA-1: Floodplain Protection ORA-2:Wetland/Riparian Protection ORA-3: Season of Use Stipulation Lesser Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	64.930
<b><u>NM-201401-190</u></b>  T. 0160N, R. 0260W, IM, PM, OK Sec. 002 NWSE  <b>Roger Mills County, OK</b>	<u>Lease with the following Stipulations:</u> ORA-3: Season of Use Stipulation Lesser Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	40.000
<b><u>NM-201401-191</u></b>  T. 0170N, R. 0260W, IM, PM, OK Sec. 029 NESW LESS 7.20 ACRES  <b>Ellis County, OK</b>	<u>Lease with the following Stipulations:</u> ORA-3: Season of Use Stipulation Lesser Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	32.800
<b><u>NM-201401-192</u></b>  T. 0190N, R. 0010W, IM, PM, OK Sec. 004 SE  <b>Payne County, OK</b>	<b><u>Other Surface Management Agency (SMA):</u></b> Oklahoma State University  <u>Lease with the following Stipulations:</u> OSU #1: NSO Lake Carl Blackwell OSU #2: Lake Carl Blackwell ORA-3: Season of Use Stipulation Greater Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	160.000

## 2.3 Alternatives Considered But Eliminated From Detailed Analysis

Leasing all eleven (11) parcels was a considered alternative but eliminated from further analysis as a result of one parcel (Table 2) not having concurrence from the surface managing agency to lease the parcel. The parcel will be deferred until a concurrence from and stipulations to attach to the lease are issued by the Black Kettle National Grasslands. This alternative was not analyzed in detail because it is not in conformance with the Oklahoma RMP (1994).

**Table 2. Parcel deferred.**

Parcel	Comment	Acres
<p><b><u>NM-201401-189</u></b></p> <p>T. 0150N, R. 0250W, IM, PM, OK Sec. 026 NWNE</p> <p><b>Roger Mills County, OK</b></p>	<p><b><u>Other Surface Management Agency (SMA):</u></b> Forest Service – Black Kettle National Forest</p> <p>Need concurrence from Surface Management Agency</p>	<p>40.000</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 (leasing the 10 nominated parcels). 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.

#### ***Beaver County (Parcels -182 and -183)***

The proposed lease parcels are in the extreme southern part of Beaver County, right on the county line at an elevation of 2,900 feet above sea level. Beaver County is in the eastern part of the Oklahoma Panhandle. The county is bounded on the north by Kansas and on the south by Texas. Adjacent counties in Oklahoma are Texas County on the west and Harper and Ellis Counties on the east. The county has an area of 1,817 square miles (1,162,829 acres).

Topography ranges from the nearly level flood plains along the Beaver and Cimarron Rivers to the broad, level high plains in the northwestern and southwestern parts of the county. Elevation ranges from about 2,000 feet along the Cimarron River near the northeast edge of the county to over 2,900 feet near the Texas State line in the southwestern part of the county.

The county is served by an airport facility located at Beaver. It is also served by four Federal highways (64, 83, 270, and 412), two State highways (3 and 23), and numerous county roads. Some of the county roads have been surfaced and are suitable for all-weather travel.

#### ***Jackson County (Parcel -184)***

The proposed lease parcel is in the extreme southeast corner of Jackson County, at an elevation of about 1,200 feet above sea level. Jackson County is along the Oklahoma/Texas Border in the southwest corner of Oklahoma. The county is bordered on the west by Harmon County, Oklahoma; on the north by Greer and Kiowa Counties, Oklahoma; on the east by Kiowa and Tillman Counties, Oklahoma; and on the south by Hardeman and Wilbarger Counties, Texas. The county has an area of 820 square miles (523,149 acres).

Elevation in the county ranges from approximately 1,190 to 1,710 feet. The highest point is in the northeastern part of the county, between Blair and Warren. The lowest point is at the confluence of the North Fork of the Red River and the Red River, in the southeast corner of the county. The western part of the county has gently rolling uplands with very gently sloping to moderately sloping hills. The eastern part of the county has nearly level or very gently sloping terraces and some low hills. A transitional zone between these areas is characterized by steep rock escarpments and badlands.

Jackson County is served by two U.S. Highways (62 and 283) and three State Highways (5, 6, and 34), and numerous county and private roads. Some of the county roads have been surfaced and are suitable for all-weather travel.

### ***Ellis County (Parcel -185 and -191)***

Proposed lease parcel -185 is in the southeast corner of the Ellis County at an elevation of about 2,100 feet above sea level, while proposed parcel -191 is in the southwest corner right on the county line bordering Texas at an elevation of about 2,400 feet. Ellis County is L-shaped, bounded on the north by Harper County; on the east by Woodward and Dewey Counties; on the south by Roger mills County (across the Canadian River); and on the west by the state of Texas. The county has a total area of 1,232 square miles (788,480 acres), of which 3 square miles (1,920 acres) is water.

The topography of Ellis County is mainly rolling, but throughout the county there are small areas that are gently sloping and small areas that are rough and broken where canyons have been cut by streams leading to the Canadian River in the south and to Wolf Creek, which flows from northeasterly across the center of the county. The general slope is from the northwest to the southeast. The elevation in the north in about 2,100 feet above sea level, 2,400 feet in the center of the county, and about 2,000 feet along the Canadian River in the south.

Ellis County is served by four U.S. Highways (60, 270, 283 and 412) and four State Highways (3, 15, 46, and 51), and numerous county and private roads. Some of the county roads have been surfaced and are suitable for all-weather travel.

### ***Roger Mills County (Parcels -186, -187, -188, and -190)***

Proposed parcels -186 and -187 are in the southern portion of Roger Mills County 0.5 and 1.5 miles from the county line, respectively, at about 2,000 feet above sea level. Proposed parcels -188 and -190 are <1.0 miles from the northern county line at an average elevation of 2,100 feet above sea level. Roger Mills County is a western border county, lying about midway between the northern and southern State lines. The Canadian River forms the northern boundary of the county, separating it from Ellis County. Dewey and Custer Counties adjoin it on the east, Beckham County on the south and on the west by Texas. The county is about 36 miles long from east to west, and averages about 32 miles wide from the north to south. It has an area of 1,135 square miles (726,400 acres).

Roger Mills County lies within the Great Plains and its topographic features are the result of erosion and grading. Its general slope is toward the east. It includes areas of smooth upland remnants of a former high plain which covered the entire region, and two areas of lowland, the products of erosion, lying along the two main streams.

Roger Mills County is served by one U.S. Highway (283) and seven State Highways (6, 30, 33, 34, 47, 47A, and 152), and numerous county and private roads. Some of the county roads have been surfaced and are suitable for all-weather travel.

### ***Payne County (Parcel -192)***

The proposed parcel is in the northwestern part of Payne County at an elevation of about 950 feet above sea level. Payne County is in north-central Oklahoma and has an area of about 700 square miles (448,000 acres). The county is bordered on the north by Noble and Pawnee Counties; on the east by

Creek County, on the west by Logan County, and on the south by Logan and Lincoln Counties. Payne County is rolling with small, nearly level upland plains. The average elevation is just under 1,000 feet.

Payne County is served by a network of federal, state, and interstate highways. The county is served by two U.S. Highways (U.S. 177 and the Cimarron Turnpike), one interstate (Interstate Highway 35), and six state highways (Oklahoma Highway 18, 33, 51, 86, 99, and 108). There are very few all-weather farm-to-market roads in the rural areas. However, dirt, gravel, and shale roads run on almost all section lines, providing access to state and federal highways and becoming inaccessible only during periods of prolonged wet weather or heavy snowfall. A railroad crosses the eastern part of the county and serves Cushing and Yale. A short spur line also runs north from Stillwater.

### **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 (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM<sub>10</sub> & PM<sub>2.5</sub>), sulfur dioxide (SO<sub>2</sub>) 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 Oklahoma’s 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 Oklahoma.

The proposed lease parcels are 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.

The Wichita Mountains Wilderness Area is the only designated Class I area in Oklahoma, which is about 35 miles from the nearest proposed parcel (-184). All other proposed parcels are >70 miles from the

Class I area. 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

For western Oklahoma, no lead monitoring data is available, however, lead concentrations are expected to be low in rural areas 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 3.

**Table 3. 2011 Design Concentrations of Criteria Pollutants in Western and Eastern Oklahoma (EPA 2012)**

Pollutant	Design Value	Averaging period	NAAQS
O <sub>3</sub>	0.070 ppm (western)	8-hour	0.075 ppm <sup>1</sup>
	0.077 ppm (eastern)		
PM <sub>2.5</sub>	9.5 µg/m <sup>3</sup> (western)	Annual	12.0 µg/m <sup>3,2</sup>
	10.8 µg/m <sup>3</sup> (eastern)		
PM <sub>2.5</sub>	20.0 µg/m <sup>3</sup> (western)	24-hour	35 µg/m <sup>3,3</sup>
	23.0 µg/m <sup>3</sup> (eastern)		
PM <sub>10</sub>	0 exceedances/year (western)	24-hour	150 µg/m <sup>3,5</sup>
	2 exceedances/year (eastern)		
Pb	No data available (western)	Rolling 3-month average	0.15 µg/m <sup>3</sup>
	0.01 µg/m <sup>3</sup> (eastern)		
NO <sub>2</sub>	10 ppb (western)	Annual	53 ppb
	9 ppb (eastern)		
NO <sub>2</sub>	49 ppb (western)	1-hour	100 ppb <sup>3</sup>
	No data available (eastern)		
SO <sub>2</sub>	5 ppb (western)	1-hour	75 ppb <sup>6</sup>
	65 ppb (eastern)		
CO	1.0 ppm (western)	8-hour	9 ppm <sup>4</sup>
	1.4 ppm (eastern)		
CO	1.3 ppm (western)	1-hour	35 ppm <sup>4</sup>

<sup>1</sup> Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years

<sup>2</sup> Annual mean, averaged over 3 years



<sup>3</sup> 98th percentile, averaged over 3 years

<sup>4</sup> Not to be exceeded more than once per year

<sup>5</sup> Not to be exceeded more than once per year on average over 3 years

<sup>6</sup> 99<sup>th</sup> percentile of 1-hour daily maximum concentrations, averaged over 3 years

Mean AQI values for western Oklahoma were generally in the good range (AQI<50) in 2011, with 73 percent of the days classified as “good,” 25 percent classified as “moderate,” and 2 percent classified as “unhealthy for sensitive groups.” For eastern Oklahoma, mean AQI values were generally in the moderate range (AQI =54) for 2011 with 45 percent of the days classified as “good,” 48 percent classified as “moderate,” 7 percent classified as “unhealthy for sensitive groups,” and 1 day was classified as “unhealthy” (Table 4).

**Table 4. Mean and Max AQI Values (EPA 2012a)**

	Median AQI	Max AQI
Western OK	42	119
Eastern OK	54	158

The air quality index in eastern Oklahoma annually reaches “unhealthy for sensitive groups” on a number of days, while in western Oklahoma the “unhealthy for sensitive groups” is less likely to occur. Over the past decade, there is no trend to the number of days that are classified “unhealthy for sensitive groups” and “unhealthy” (Table 5). In eastern Oklahoma, less than two days per year have been classified as “unhealthy,” while zero days have been classified as “unhealthy” in western Oklahoma.

**Table 5. Number of Days Classified as “Unhealthy for Sensitive Groups” and “Unhealthy” (EPA 2012a)**

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Western OK	0	4	0	4	3	0	0	0	0	7
Eastern OK	26	22	19	27	26	7	15	5	3	22

### 3.1.2 Climate

Oklahoma’s climate ranges from humid subtropical in the east to semi-arid in the west. Warm, moist air moving northward from the Gulf of Mexico often exerts much influence, particularly over the southern and eastern portions of the state, where humidity, cloudiness and precipitation are resultantly greater than in the western and northern sections. Summers are long and usually quite hot. Winters are short and less severe than those of the more northern Plains states. Periods of extreme cold are infrequent, and those lasting more than a few days are rare.

The mean annual temperature over the state ranges from 62°F along the Red River to about 58°F along the northern border. It then decreases westward to 56°F in Cimarron County. Temperatures of 90°F or greater occur, on average about 60-65 days per year in the western panhandle and the northeast corner of the state. The average is about 115 days in southwest Oklahoma and about 85 days in the southeast. Temperatures of 100°F or higher occur, frequently during some years, from May through September, but very rarely in April and October. With 30-40 days at or above 100°F, western Oklahoma experiences more extreme summer temperatures than elsewhere in the state. Both the Panhandle and eastern

Oklahoma average about 15 days above the century mark. The increased humidity in the east, however, adds to that section of the state's summertime misery.

Temperatures of 32°F or less occur an average of 60 days per year in the southeast. This value increases to about 110 days per year where the panhandle joins the rest of the state, and to about 140 days in the western panhandle.

The dominant feature of the spatial distribution of rainfall across Oklahoma is a sharp decrease in rainfall from east to west. Although precipitation is quite variable on a year-to-year basis, average annual precipitation ranges from about 17 inches in the far western panhandle to about 56 inches in the far southeast. Only the summer months of July and August see a substantial relaxation of this distribution. Average annual snowfall increases from less than two inches in the extreme southeast to nearly 30 inches in the western panhandle. The frequency of snow events also increases sharply along the same gradient.

Tornados are a particular hazard in Oklahoma. Since 1950, an average of 52 tornados have been observed annually within the state's borders. Tornados occur at any time of the year, but are most frequent during springtime.

The prevailing winds are from the south to southeast throughout most of the state from the spring through autumn months. These prevailing winds typically are from the south to southwest in far western Oklahoma including the panhandle. The winter wind regime is roughly equally split between northerly and southerly winds.

In addition to the air quality information in the Oklahoma 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 (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>). CO<sub>2</sub> and CH<sub>4</sub> 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 CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O; 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 CO<sub>2</sub> concentrations to increase dramatically, and are likely to contribute to overall climatic changes.

Increasing CO<sub>2</sub> 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 CO<sub>2</sub> and CH<sub>4</sub>) 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**

Oklahoma’s varied climate and topography have combined to produce broad differences in state soils. In the eastern part of the state soils have been developed where leaching is intense, and conditions are humid. These conditions have produced soils low in phosphorus and potassium, while at the same time being moderately to strongly acidic. Western soils, being developed in an area of lesser rainfall are usually light red in color, less leached than eastern soils, moderately acidic, and low in phosphorous and nitrogen. Soils in the panhandle of Oklahoma contain large amounts of lime, are neutral to alkaline at the surface, with accumulations of calcium carbonate found at shallow depths. Nitrogen levels tend to be low, but do not contribute to being as much of a limiting factor in production and management as wind erosion.

The Natural Resource Conservation Service (NRCS) has surveyed the soils in the proposed parcel areas. The soil map units represented in the proposed lease parcels are in Appendix 3. A total of 32 different soil types were identified.

The NRCS has also assigned a wind erodibility index value to each soil type. The value indicates the 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. Six index values were identified from the 11 proposed parcels ranging from 38 to 220 tons per year (Table 6). The higher the value indicates higher susceptibility and more tons per acre lost per year from wind, with the highest value being 330.

**Table 6. Wind erodibility index value for each soil type and associated parcels.**

Index Value	Soils	Parcels	Acres	Percent of Total Acreage
No rating	Water	-188	4.4	0.7
38	Darrouzett clay loam Grainola clay loam Grainola-Ashport-Mulhall Grainola-Lucien complex	-182, -183 -192 -192 -192	49.3	7.6
48	Pullman Clay Ulysses-Darrouzett complex Carey silt loam Coyle loam Norge loam Mulhall loam	-182, -183 -182 -186 -192 -192 -192	81.5	12.6
56	Quinlan-Woodward complex Quinlan-Woodward outcrop complex Port silt loam Teller loam Easpur loam Grainola-Lucien complex	-185 -185 -192 -192 -192 -192	166.4	25.7
86	Gracemont fine sandy loam Westola fine sandy loam Lincoln fine sandy loam Enterprise very fine sandy loam Pulaski fine sandy loam Masham silty clay loam	-184 -186, -188 -188 -190 -192 -192	192.2	29.6
134	Lincoln loamy sand Hardeman-Likes Devol complex Eda-Tivoli complex	-184 -188 -191	70.6	10.9
220	Jester fine sand Tivoli fine sand	-184 -191	84.0	13.0

The NRCS has also assigned an erosion Factor K, which indicates the susceptibility of a 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. Seven values were identified for the proposed lease parcels ranging from .15 to .43 (Table 7).

**Table 7. Factor K values of the soil types in the proposed lease parcels.**

Factor K	Soils	Parcels	Acres	Percent of Total Acreage
No rating	Water	-188	4.4	0.7
.15	Jester fine sand Eda-Tivoli complex Tivoli fine sand	-184 -191 -191	102.9	15.9
.17	Lincoln loamy sand	-184	0.7	0.1
.20	Gracemont fine sandy loam Westola fine sandy loam Lincoln fine sandy loam Pulaski fine sandy loam	-184 -186, -188 -188 -192	184.3	28.4
.24	Hardeman-Likes Devol complex	-188, -190	51.0	7.9
.32	Pullman clay loam Darrouzett clay loam Ulysses-Darrouzett complex	-182, -183 -182, -183 -182	115.0	17.7
.37	Quinlan-Woodward complex Quinlan-Rock outcrop complex Carey silt loam Woodward loam Coyle loam Norge loam Port silt loam Port-Oscar complex Teller loam Mulhall loam Grainola clay loam Easpur loam Grainola-Ashport-Mulhall complex Grainola-Lucien complex	-185, -186, -187 -185, -186 -186 -186 -192 -192 -192 -192 -192 -192 -192 -192 -192 -192 -192	174.6	26.9
.43	Enterprise very fine sandy loam Masham silty clay loam Grainola-Lucien complex	-190 -192 -192	15.5	2.3

### 3.3 Water Resources

#### 3.3.1 Surface water

Oklahoma's abundant surface water resources include rivers, streams, and man-made reservoirs.

Oklahoma has 11 major river basins: the Main Stem of the Arkansas, Salt Fork of the Arkansas, Cimarron, Verdigris, Neosho, Illinois, North Canadian, Deep Fork, Red-main stem, North Fork Red, and the Washita.

Precipitation is the source of virtually all surface water in the State. The entire state is drained by the Arkansas and Red Rivers and their tributaries. A large number of reservoirs, lakes, and ponds have been constructed on rivers and streams for flood control and to provide a dependable supply of surface water for municipalities, irrigation, recreation, and generation of electricity. About 80 percent of all water used by municipalities and industries is taken from surface water sources. The State reservoirs with the largest volume of water are Texoma, Eufaula, Grand, Broken Bow, Tenkiller, and Keystone Lakes. The

McLellan-Kerr Arkansas River Navigation System provides year round ocean access for barge traffic as far north as Tulsa's Port of Catoosa.

### ***Beaver County***

The county drains mainly eastward at a grade of about 10 to 20 feet per mile. The Beaver River accounts for about three-fourths of the drainage, and the Cimarron River accounts for the remaining one-fourth. The Beaver and Cimarron Rivers contain flowing water in wet periods but cease flowing in dry periods. Most of the streams that originate in the upland plains, such as the Kiowa, Camp, Duck Pond, Clear, Willow, and Jackson Creeks in the southern part of the county, are spring fed. These streams carry water for a considerable part of the year, but cease during dry periods.

Proposed parcels -182 and -183 are east of Fulton Creek about 4.5 and 0.6 miles, respectively. An unnamed stream drains into and terminates at proposed parcel -182. Both parcels are >15 miles south of the Beaver or Cimarron Rivers. There are two mapped water bodies <0.5 miles from -118 and two mapped water bodies greater than 0.5 miles but less than 1.0 mile from the proposed parcel. There are three mapped water bodies <0.5 miles from both proposed parcels and three mapped water bodies >0.5 miles but <1.0 mile from the proposed parcels.

### ***Jackson County***

The entire county is in the Red River Basin. The general drainage pattern is from northwest to southeast in the western part of the county and from north to south in the eastern part. The county has three major rivers and several smaller streams. The Red River is the southern boundary of the county. The North Fork of the Red River is the eastern boundary. It flows into the Red River at the southeast corner of the county. The Salt Fork of the Red River flows from north to south through the central part of the county. It flows into the Red River. Several smaller tributaries flow into the large rivers. Sand Creek, Gypsum Creek, and Turkey Creek drain most of the county west of the Salt Fork of the Red River. Bitter Creek and Stinking Creek drain most of the county east of the Salt Fork of the Red River.

The proposed parcel is approximately 0.25 miles north of the Red River and about 400 feet north of a tributary of the Red River. The proposed parcel is also 0.6 miles to 1.1 miles west of the North Fork of the Red River. There are five mapped water bodies <0.5 mile from the proposed parcel and five mapped water bodies greater than 0.5 miles but less than 1.0 mile from the proposed parcel.

### ***Ellis County***

The North Canadian (Beaver) River, the Canadian River, and Wolf Creek provide drainage and have shaped the relief in the county. The North Canadian River drains about one-fifth of the county. The Canadian River drains the southern two-fifth of the county. The only large stream in the region is Wolf Creek, which flows northeastward, uniting with the North Fork of Canadian River about 25 miles northeast of Gage. Wolf Creek is a typical stream of the semiarid plains of the West. Its channel is about 300 feet wide and is 5 to 10 feet below a nearly level valley floor, which ranges in width from half a mile to 2 miles. The stream is usually only about 100 feet wide, occupying but a small part of its wide channel, and it follows a meandering, braided course.

Several minor streams enter Wolf Creek; the largest is Twenty-five Mile Creek, which heads about 14 miles northwest of Gage. After heavy rains these streams rise rapidly and do considerable damage to roads and bridges. Most of them cease flowing in dry seasons, but water is said to stand in pools in their beds even in the driest years. An unnamed tributary of the Canadian River lies approximately 230 feet west of proposed parcel -185, while the mainstem of the Canadian River is about 500 feet south of the parcel. There are four mapped water bodies <0.5 mile from the proposed parcel and two mapped water bodies greater than 0.5 miles but less than 1.0 mile from proposed parcel -185. An unnamed stream begins in southwest quarter of proposed parcel -191 and flows for 268 feet south. A second unnamed stream lies about 0.25 miles to the east of the proposed parcel. There are no mapped waterbodies <1.0 miles from proposed parcel -191.

There are 81 known springs in Ellis County, with an average median discharge of 9.68 gallons per minute. The water quality at all springs was tested and none violated the water-quality standards for drinking water set by EPA (Osburn and Funkhouser 2002).

### ***Roger Mills County***

Approximately three-fourths of the county is drained by the easterly flowing Washita River, which flows through the central part. The Canadian River drains a strip averaging about 5-6 miles wide along the northern boundary. The Canadian River is about 0.7 miles north of proposed parcel -190. Sweetwater Creek drains a small tract in the southwestern part of the county, and small areas along the southern boundary are drained by other tributaries into the Red River.

Approximately 2.5 miles of an unnamed tributary of Current Creek flow through proposed parcel -186. Current Creek is <400 feet south of the proposed parcel. At least 10 unnamed tributaries of Current Creek are within 1.0 miles of the proposed parcel. There are six mapped water bodies <0.5 mile from the proposed parcel, one of which is Taylors Lake and has a surface area of about 40 acres, and five mapped water bodies greater than 0.5 miles but less than 1.0 mile from the proposed parcel.

Several intermittent and perennial streams surround proposed parcel -187, although none cross through the parcel. Most are tributaries of Sandstone and Current Creeks, which are about 0.6 and 0.25 miles south, southeast, and southwest of the proposed parcel. There are four mapped water bodies <0.5 mile from the proposed parcel, one of which has a surface area of about 25 acres, and five mapped water bodies greater than 0.5 miles but less than 1.0 mile from the proposed parcel.

Approximately 7.5 acres of proposed parcel -188 is within the floodplain of the Canadian River, while 0.3 miles of Bull Creek and 0.4 miles of unnamed tributaries of the Canadian River and Bull Creek flow through the proposed in the central and north portion of the parcel, respectively. An additional unnamed tributary begins in the parcel and flows south about 0.2 miles before leaving the parcel. Dugout Creek is about 0.5 miles northwest of -188 and Cornell Creek is about 1.5 miles to the southeast. There are three mapped water bodies <0.5 mile from the proposed parcel and five mapped water bodies greater than 0.5 miles but less than 1.0 mile from the proposed parcel.

One intermittent tributary of the Canadian River flows into and terminates within proposed parcel -190. A second intermittent stream is east of the parcel about 800 feet. A perennial tributary of the Canadian River is <500 feet east of the proposed parcel. There are two mapped water bodies <0.5 mile from the proposed parcel and three mapped water bodies greater than 0.5 miles but less than 1.0 mile from the proposed parcel.

### ***Payne County***

The Cimarron River flows through the southern part of Payne County and across the northwest corner of Creek County before joining the Arkansas River. The largest tributary of the Cimarron River in Payne County is Stillwater Creek. The major part of the county drains to the east-southeast into the Cimarron River, and a small area drains northeast to the Arkansas River. The smaller creeks cutting across sandstone ledges have produced the rough surface characteristics as seen in much of eastern Oklahoma. Springs are found in practically all parts of the county. Most of them, however, are nothing but small seeps, which issue from under limestone or sandstone ledges.

Approximately 0.99 miles of Stillwater Creek and an additional 1.11 miles of three unnamed tributaries of Stillwater Creek flow through proposed parcel -192. Six unnamed tributaries of Stillwater Creek flow within 0.5 miles of the proposed parcel. There is one mapped water body within the proposed parcel, twenty-three mapped water bodies <0.5 mile from the proposed parcel, and twenty-five mapped water bodies greater than 0.5 miles but less than 1.0 mile from the proposed parcel.

### ***Watersheds of the Proposed Parcels***

The eleven proposed parcels lie within seven HUC 8 watersheds (Table 8) as designated by EPA. Each 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 waters 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).

**Table 8. Watersheds of the proposed lease parcels.**

<b>Watershed</b>	<b>Parcel</b>	<b>Acres</b>	<b>Watershed Impairments</b>	<b>Nearest Impaired Water</b>
Lower Beaver (HUC 8 11100201)	-182 (20.2 acres) -183	67.4	Enterococcus Bacteria, Fish bioassessments, Sulfates, Thallium, Chloride, Fecal Coliform, Lead, E. Coli, Sedimentation/Siltation, TDS	>10.0 miles east of Duck Pond Creek
Middle Beaver (HUC 8 11100102)	-182 (11.57 acres)	11.57	Chloride, Enterococcus Bacteria, E. Coli, Fecal Coliform, Fish Bioassessments, Sedimentation/Siltation, Thallium, TDS	>12.0 miles southeast of Beaver River



Watershed	Parcel	Acres	Watershed Impairments	Nearest Impaired Water
Lower North Fork Red (HUC 8 11120303)	-184	44.59	Chloride, Enterococcus Bacteria, Selenium, Sulfates, Thallium, TDS, Turbidity	>11.5 miles south of Red River, North Fork
Groesbeck-Sandy (HUC 8 11130101)	-184	75.41	Enterococcus Bacteria, Fecal Coliform, Selenium, Thallium	>10 miles southwest of Red River, Salt Fork
Lower Canadian-Deer (HUC 8 11090201)	-185, -188, -190, -191	177.73	Canadian River: Chloride, Enterococcus Bacteria, Sulfates  Lloyd Vincent Lake: Dissolved Oxygen	-185 >500 feet north of Canadian River  -188, -190 and -191 >10.0 miles south of Lloyd Vincent Lake
Washita Headwaters (HUC 8 11130301)	-186, -187	80.0	Turbidity, <i>Enterococcus Bacteria</i> , <i>E. Coli</i> , <i>Sulfates</i>	-186 and -187 >0.9 miles northwest of Sandstone Creek
Lower Cimarron (HUC 8 11050003)	-192	160.0	Dissolved Oxygen, Turbidity	0.99 miles of Stillwater Creek and 0.15 miles of an unnamed tributary of Stillwater Creek flows through the proposed parcel

*Italicized words:* Previously impaired, but currently meeting standards

### 3.3.2 Groundwater

Groundwater can be found throughout most of the state and is considered one of the states' most valuable resources. Groundwater supplied 18 percent of the state's drinking water. About 14.7% of the state's fresh groundwater withdrawals were for public water supply system uses. Reported domestic groundwater withdrawals in 2000 accounted for 3.3 percent of total withdrawals from the state's aquifers. Irrigation accounted for 74.5 percent of groundwater withdrawal and is the largest single use of freshwater in the state in 2000. Industrial, mining, and power generation accounted for 1.6 percent of groundwater withdrawals in 2000 (EPA 2009).

The Oklahoma Water Resources Board (OWRB) lists twenty-one major aquifers in Oklahoma. There are two types: alluvial and terrace aquifers and bedrock aquifers. Alluvial and terrace aquifers consist of sand and gravel along major rivers, including the North Canadian and Cimarron Rivers. Bedrock aquifers, such as the Central Oklahoma, the Rush Springs, Ogallala, and the Ozark Plateau aquifers, cover large areas of the state and consist of hardened materials ranging from sandstone to limestone and gypsum. Large areas of the state generally contain local, low yield aquifers or do not produce groundwater (EPA 2009).

Naturally occurring saltwater is found at several localities in the alluvial and terrace aquifers, especially in the western part of the State, and saltwater has intruded from deeper layers into the aquifers along the Cimarron and Salt Fork of the Arkansas River. Nitrate is the most commonly reported contaminant in Oklahoma and is usually associated with land application of chemical fertilizers for crop production and the operation of animal feeding operations which produce large amounts of animal water. Alluvial and terrace aquifers tend to be high to very highly vulnerable to groundwater contamination from surface

sources of pollution. The alluvial and terrace deposits along the major rivers are especially vulnerable because they consist of coarse-grained sediments which allow easy infiltration of surface waters and because the availability of water makes them attractive sites for agriculture (EPA 2009). Bedrock aquifers have vulnerability that ranges from low to highly vulnerable. Highly vulnerable aquifers are basins composed of cavernous limestone or gypsum containing karst features, such as caves, sinkholes, and disappearing streams, which provide direct conduits for precipitation and runoff to transport contaminants to the water table. Moderately vulnerable aquifers all contain high-yielding water, while aquifers have low vulnerability if they have deep water tables. Six of the proposed parcels are within one of three major or minor aquifers, while four parcels are not within any aquifer (Table 9).

**Table 9. Aquifers underlying the proposed lease parcels.**

Aquifer	Parcel	Acres	Type	Vulnerability
Ogallala (major)*	-182, -183	78.79	Bedrock	Low
Canadian River (major)	-185, -188, -190	144.93	Terrace	Very High
Southwestern Oklahoma (minor)*	-184	120.0	Bedrock	Low
No Aquifer	-186, -187, -191, -192	272.8	--	--

\*Major aquifers: bedrock aquifers that can yield at least 50 gallons per minute; alluvium and terrace aquifers that can yield at least 150 gpm.

+Minor aquifers: yield less than 50 gpm

Freshwater stored in Oklahoma's aquifers results from downward movement of precipitation and surface waters that enter each aquifer at its recharge area. The system is dynamic; aquifers are recharged continually by percolation down to the water table. The rate of ground-water movement in the state's aquifers is highly variable, probably three to one hundred feet per year in most aquifers, and may reach one hundred to one thousand feet (or more) per year, where the rock is highly porous, cavernous, or fractured (EPA 2009).

Long term groundwater level declines have not been as serious in Oklahoma as in surrounding states. Severe drought conditions in recent years are affecting the state's aquifers' ability to recover from earlier and continuing declines. When there is an increase in rainfall water levels in most alluvial aquifers can recover more quickly from declines, while the bedrock aquifers do not respond as quickly to precipitation they can maintain or experience minimal increased water level changes. The greatest protection against overuse of groundwater has come from the permit system operated by OWRB to limit withdrawals (EPA 2009).

### 3.4 Floodplains, Wetlands, Riparian Areas

#### 3.4.1 Floodplains

For administrative purposes, the 100-year floodplain serves as the basis for floodplain management for Federal actions. These are in general relatively narrow areas along natural drainage ways that carry large quantities of runoff following periods of high precipitation.

Flooding does occur through the state and varies widely, but generally increases from west to east. Flood damages vary according to floodplain use and extent of development. Many towns and cities in Oklahoma are located in floodplains and have historically experienced flood damages.

Proposed lease parcels -184, -185 and -188 lie within a mapped floodplain. Parcel -182, -183, -186, -187, -189, -190, -191 and -192 are not within a mapped floodplain.

### 3.4.2 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. Table 10 describes wetlands in or near the proposed parcel.

**Table 10. Wetlands in or near the proposed parcel.**

Parcel	Wetland Area/Issues
-182, -183, -186, -187, -190, -191, -192	No Wetland Issues
-184, -185, -188	-184 located within the flood plain/bottom of the Prairie Dog Town Fork of the Red River from its confluence with the North Fork of the Red River and the Harmon county line.  -185 & -188 located in the South Canadian River bottom from the Texas State line east to the Dewey county line.

### 3.5 Farmlands, Prime or Unique

The Farmland Protection Policy Act (FPPA), Public Law 97-98, as amended, directs Federal agencies to identify and take into account the adverse effects of Federal programs on the preservation of farmland. The FPPA is intended to minimize the extent Federal programs have on the conversion of farmland to nonagricultural uses. Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, oilseed crops, and is also available for these uses. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yields of a specific crop.

The NRCS Web Soil Survey and Soils Data system identified 32 different soil types within the eleven proposed lease parcels. Sixteen soil types were identified as “Not Prime Farmland,” totaling 444.5 acres or 69.0 percent of the total acreage of all proposed lease parcels. Sixteen soil types were identified as “All areas are prime farmland,” totaling 199.4 acres or 31.0 percent of the total acreage of all proposed lease parcels. Water accounts for 4.4 acres of land. See Appendix 3 for soils classified as “Not prime farmland” or “All areas prime farmland” along with the associated parcels and acreages.

## **3.6 Heritage Resources**

### **3.6.1 Cultural Resources**

Approximately 19,000 archeological sites are recorded in Oklahoma and over 2,500 historic properties in the state are listed on the National Register of Historic Places.

To comply with Section 106 of the National Historic Preservation Act (NHPA), as amended, a cultural resources background review was conducted (BLM CRR# NM-040-2013-98). A Class I cultural resource review was done on each parcel and no historic properties were identified, although some parcels have known archeological sites within them. 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.

### **3.6.2 Paleontology**

The extent, if any, of paleontological resources within the APE are unknown. During the APD phase, site-specific surveys would be completed and included 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.

### **3.6.3 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 Apache Tribe, the Cheyenne-Arapaho Tribes, the Comanche Nation, the Iowa Tribe of Kansas and Nebraska, the Kiowa Tribe, the Osage Nation, the Pawnee Nation, the Sac and Fox Nation, the Seminole Nation, and the Wichita and Affiliated Tribes. The Comanche Nation replied with no concerns. A literature review did not indicate any TCPs within the proposed parcels. No TCPs are known to exist within the APE.

### 3.7 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 State of Oklahoma has listed three noxious weeds and has them as a public nuisance in all counties across the state and mandated that they be treated, controlled, and eradicated. The three plants are: musk thistle (*Carduus nutans*), Scotch thistle (*Onopordum acanthium*), and Canada thistle (*Cirsium arvense*).

- Musk thistle can be found on all types of land except deserts, dense forests, high mountains, coastal areas, and newly cultivated fields. It is most often described as occurring on disturbed sites and waste areas, and along roads.
- Scotch thistle prefers habitats with dry summers, growing best in sandy, sandy clay and calcareous soils which are rich in ammonium salts. It grows in newly disturbed places, such as wildfire burn scars, avalanche areas, flood zones, as well as dry pastures and disturbed fields. It prefers disturbed sites with fertile soils, agricultural areas range/grasslands, riparian zones, scrub/shrublands valleys and plains along with water courses.
- Canada thistle is most common in open, mesophytic areas and grows in a wide variety of soils, including sand dunes, but is most abundant in clayey soils. Disturbance is necessary for initial establishment, but once established it can rapidly spread by both rhizomes and seeds.

Suitable habitat, in the form of disturbed sites, roadsides, fields, and agricultural areas, occurs within all of the proposed lease parcels. There is potential that all three plants may be present on the proposed parcels, although the extent is unknown.

### 3.8 Vegetation

Oklahoma's ecological diversity is strongly related to its varied climate, terrain, geology, soil, and land use. In Oklahoma, forests cover most of the Ozark Plateau and the Ouachita Mountains; they become progressively more stunted and open westward. Southern pine forests, typical of Gulf Coastal Plains, occur in the southeast. Tall grass prairie, mixed grass prairie, and short grass prairie are native to central and western Oklahoma. Mesquite and other xeric plants characterize the dry southwest. Much of Oklahoma's natural vegetation has been lost to overgrazing, burning, logging, erosion, and cultivation. Today, the state is a mosaic of grazing land, cropland, woodland, forest, and abandoned farmland. Wheat and alfalfa are the main crops. Grain sorghum is well adapted to sandy soils. Soybeans are becoming increasingly common on eastern plains and on moister parts of the prairie. Cotton is now concentrated on irrigated farmland in the southwest. Corn, once a major Oklahoma crops, has declined in importance due to soil depletion and periodic droughts.

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 Oklahoma, there are 12 level III ecoregions and 46 level IV ecoregions; all but 12 of the level IV ecoregions continue into ecologically similar parts of adjacent states. Table 11 describes the level IV ecoregions covering the proposed lease parcels.

**Table 11. Ecoregions of the proposed lease parcels.**

Parcels	Level III Ecoregion (EPA region)	Level IV Ecoregion (EPA region)	Description of Level IV Ecoregion
-182, -183	High Plains (28)	Canadian/Cimarron High Plains (28a)	Natural vegetation is short grass prairie that is distinct from the mixed grass and tall grass prairies of moister ecoregions to the east; it is adapted to the ecoregion's limited, erratic precipitation and high evaporation rates. Today groundwater-irrigated cropland, mainly growing wheat and grain sorghum, is extensive. Rangeland is found on land that is too sandy or too rugged for farming; it has been widely overgrazed.
-184	Central Great Plains (27)	Red Prairie (27h)	Upland native vegetation is mostly mesquite-buffalograss, but shinnery is native on sandy areas. Gypsum ledges and escarpments occur and have distinctive flora. Today, cropland is extensive, but rangeland is found in less favorable areas. Wheat is the main crop, grain sorghum is found on sandier soils, and alfalfa is grown for use as winter feed.

Parcels	Level III Ecoregion (EPA region)	Level IV Ecoregion (EPA region)	Description of Level IV Ecoregion
-185, -186, -187, -188, -190	Central Great Plains (27)	Rolling Red Hills (27q)	Upland natural vegetation is mostly mixed grass prairie. In addition, shinnery grows on sand flats and hills in the west, and short grass prairie is found on high elevation, sandy sites in the northwest. Eastern redcedar is becoming increasingly widespread on uplands. Ravines are wooded. During the 1930s, drought and poor soil conservation practices contributed to widespread farm abandonment. Subsequently, many areas have been planted with introduced forage grasses and converted into managed grasslands. The ecoregion is mostly used as rangeland, but cropland occur on suitable, nearly level sites.
-191	Southwestern Tablelands (26)	Canadian/Cimarron Breaks (26a)	Mostly short grass prairie, but dunes along major streams support sand sagebrush-bluestem prairie.
-192	Central Great Plains (27)	Cross Timbers Transition (27o)	Rough plains that are covered by prairie grasses and eastern redcedar, scattered oaks and elms. Terrain and vegetation are transitional between the less rugged, grass-covered ecoregions to the west and the hilly, oak savanna regions to the east. The abundance of upland trees and the number of tree species have greatly increased due, in part, to fire suppression. Natural riparian forests and wetlands have been degraded or lost due to channelization and land use changes. Today, land use is a mixture of rangeland and cropland.

## 3.9 Wildlife

### 3.9.1 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."

Five birds and two fish species, federally listed as endangered, threatened, or as rare species of special concern occur or have the potential to occur within Beaver, Jackson, Ellis, Roger Mills, and Payne Counties, Oklahoma (Table 12).

**Table 12. Federally listed species found in or near the proposed lease parcel.**

Scientific Name	Federal Status	County	Habitat/Distribution
<b>Birds</b>			
<i>Charadrius melodus</i> Piping plover	Threatened	Beaver, Jackson, Ellis, Roger Mills, Payne	<p><i>Habitat:</i> Mudflats, sandy beaches and shallow wetlands with sparse vegetation. They may be found along the margins of lakes and large rivers where there is exposed (bare) sand or mud.</p> <p><i>Distribution:</i> Two nesting records for in the OK panhandle. Normally a spring (April - early May) and fall (last week of July – late September) migrant throughout the state occurring across the main body of the state with recent records from Woodward, Alfalfa, Oklahoma, Cleveland, Tulsa and Washington Counties.</p>
<i>Tympanuchus pallidicinctus</i> Lesser Prairie-Chicken (LPC)	Proposed Threatened	Beaver, Ellis, Roger Mills	<p><i>Habitat:</i> Sand shinnery and sand sagebrush native rangelands of northwest OK</p> <p><i>Distribution:</i> Found in southeastern CO, southwestern KS, northwestern OK, Eastern NM, and TX Panhandle.</p>
<i>Grus Americana</i> Whooping Crane	Endangered	Beaver, Jackson, Ellis, Roger Mills, Payne	<p><i>Habitat:</i> Typically found in shallow wetlands, marshes, the margins of ponds and lakes, sandbars and shorelines of shallow rivers, wet prairies, and crop fields near wetlands while passing through OK each spring and fall during migration.</p> <p><i>Distribution:</i> Pass through the western half of OK – most sightings occur west of I-35 and east of Guymon in the panhandle. The migratory population consists of approximately 270 birds nesting in northern Canada and winter along the Gulf Coast of Texas.</p> <p>Critical Habitat: Salt Plains National Wildlife Refuge, for use during the fall and spring migrations.</p>
<i>Sterna antillarum</i> Interior Least Tern	Endangered	Beaver, Jackson, Ellis, Roger Mills, Payne	<p><i>Habitat:</i> Sprague's Pipits use grasslands of intermediate height and sparse to intermediate vegetation density. Sprague's Pipits were found to be area sensitive, and the minimum area requirement was 190 ha.</p> <p><i>(Distribution:</i> Rare species found in OK during late spring and summer breeding seasons (mid-May - late August). In OK, they may be found on portions of the Arkansas, Cimarron, Canadian and Red Rivers. Colonies occur on salt flats such as the large one at Salt Plains National Wildlife Refuge.</p>



Scientific Name	Federal Status	County	Habitat/Distribution
<i>Anthus spragueii</i> Sprague's Pipit	Candidate	Payne	<p><i>Habitat:</i> Found in low brushy thickets of deciduous trees such as oaks, redbuds and plums. Thickets are often found on thin, rocky soils that slow or stunt the growth of trees maintaining the low thickets vireos prefer.</p> <p><i>Distribution:</i> It breeds in the northern Great Plains and southern Canada and winters in southern states including Oklahoma.</p>
<b>Fishes</b>			
<i>Etheostoma cragini</i> Arkansas Darter	Candidate	Beaver	<p><i>Habitat:</i> Shallow, clear, cool water, sand or silt bottom streams with spring-fed pools and abundant rooted aquatic vegetation. Persist in large, deep pools during low-water periods when streams become intermittent in late summer.</p> <p><i>Distribution:</i> Sites in extreme northwestern AR, southwestern MO, and northeastern OK, within the Neosho River watershed. Also occurs in watersheds and isolated streams in eastern CO, south-central and southwestern KS, and the Cimarron watershed in northwest OK.</p>
<i>Notropis girardi</i> Arkansas River Shiner	Threatened	Beaver, Ellis, Roger Mills, Payne	<p><i>Habitat:</i> Inhabits the shallow braided channels of wide sandy prairie rivers in the Arkansas River system. Schools of shiners gather on the lee side of sandbars and ridges of sand in the river channel. They spawn after heavy summer rains. Their eggs drift with the water current and develop as they are carried downstream.</p> <p><i>Distribution:</i> Nearly all of the remaining populations occur in the Canadian River in OK, western TX and eastern NM. A small population may persist in the Cimarron River in OK. An accidentally introduced, isolated population occurs in the Pecos River in southwest TX.</p> <p><i>Critical Habitat:</i> Approximately 532 linear miles of 2 river reaches, including 300 feet of adjacent riparian areas measured laterally from each bank. Areas eligible for designation as critical habitat include portions of the Canadian River (South Canadian River) in NM, TX, and OK; Beaver/North Canadian River of OK; Cimarron River in KS and OK, and the Arkansas River in KS.</p>

### 3.9.2 Special Status Species

Wildlife species may be classified as threatened or endangered at either the state or the federal level. Federally, a species is listed as threatened or endangered under ESA and protection of the species is

overseen by the Service. At a state level, Oklahoma has an endangered species statute that gives the state the authority to list a wildlife species as threatened or endangered within the state although it might not be classified as threatened or endangered federally through ESA. The Oklahoma Department of Wildlife Conservation (ODWC) is responsible for overseeing protection of the species. No State listed species or their critical habitat is present in the proposed lease sale parcels.

### 3.9.3 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. 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.

**Table 13. Migratory Birds known to Breed and/or nest in or near the proposed parcel.**

Parcel	BCC Region (Region)	BCC Within Region	Survey Route Near Proposed Parcel	BCC Known to Breed and/or Nest In or Near the Proposed Parcel*
-186, -187, -188, -190, -191	Central Mixed-Grass Prairie (19)	27	Grimes	Little blue heron, Mississippi kite, Red-headed woodpecker, Scissor-tld flycatcher, Loggerhead shrike, Bell's vireo
-182, -183	Shortgrass Prairie (18)	16	Twitchell	Burrowing owl, lark bunting
-192	Central Mixed-Grass Prairie (19)	27	Clear Creek	Mississippi kite, Swainson's hawk, Upland sandpiper, Red-headed woodpecker, Scissor-tld flycatcher, Loggerhead shrike, Cassin's sparrow
-184	Central Mixed-Grass Prairie (19)	27	Beaver Creek	Little blue heron, Mississippi kite, Swainson's hawk, Red-headed woodpecker, Scissor-tld flycatcher, Loggerhead shrike, Cassin's sparrow, Lark bunting
-185	Central Mixed-Grass Prairie (19)	27	Woodward	Little blue heron, Mississippi kite, Swainson's hawk, Red-headed woodpecker, scissor-tld flycatcher, Loggerhead shrike, Bell's vireo, Lark bunting, Cassin's sparrow

### 3.9.4 Wildlife

There is a variety of wildlife that occur or have the potential to occur in the proposed parcels including: turkey, white-tailed deer, squirrels, chipmunks, rabbits, cottontails, gophers, armadillos, coyotes, skunks, fox, bobcat, opossums, raccoon, free-tailed bats, cave myotis, several species of rats and mice, numerous bird species, and several species of lizards, and venomous and non-venomous snakes.

### 3.10 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.

### 3.11 Mineral Resources

Oklahoma’s mineral resources include: nonfuel minerals such as limestone, gypsum, salt, clays, iodine, and sand and gravel; coal; and petroleum. In recent years, the mineral industry has been the State’s greatest source of revenue. Although Oklahoma’s petroleum production accounts for about 95 percent of Oklahoma’s annual mineral output, nonfuel minerals and coal represent a significant part of the current economy and an important source of future wealth. Leading commodities produced include crushed stone, Portland cement, construction sand and gravel, industrial sand and gravel, iodine, and Grade A helium (USGS 2011). Other commodities now produced in Oklahoma, or for which there are current mining permits, include clays and shale, salt, lime, granite, rhyolite, dolomite, sandstone, volcanic ash, coal, and Tripoli. Deposits and resource that are not mined now, or with no current mining permits, include asphalt, lead, zinc, copper, iron, manganese, titanium, and uranium.

The Federal mineral estate (oil and gas) in Oklahoma totals 1,998,932 acres, with 330,800 (20%) acres currently leased. Most of the state is in a high oil and gas occurrence and development potential category (RMP 1993). Oil and natural gas production is high in the proposed parcels (Table 14), as well other major/economically profitable commodities occur within the parcel counties (Table 15).

Drainage has been identified as occurring or has the potential to occur within proposed parcels -182 and -183.

**Table 14. 2011 Oil and Natural Gas Production in the proposed lease parcel counties (OCC 2012).**

	<b>Oil (bbl)</b>	<b>Natural Gas (MCF)</b>
Beaver	1,779,984	28,956,078
Jackson	42,908	0
Ellis	4,448,698	42,554,687
Roger Mills	2,279,110	77,438,182
Payne	707,817	4,050,993

**Table 15. Mineral deposits and resources in the proposed lease parcel counties (USGS 2008).**

	Salt	Volcanic Ash Locations	Sand and/or Gravel	Bentonite	Gypsum	Limestone /Dolomite	Copper Occurrence	Granite and Related Rocks
Beaver	A	5 D; 1 Pt	3 Pt	--	--	--	--	--
Jackson	--	--	4Pt	--	P; 5Q	P	1	P
Ellis	A	3D	--	3D	--	--	--	--
Roger Mills	A	--	1Pt	2D	--	--	--	--
Payne	--	--	4Pt	--	--	P; 1Q	--	--

A: All of the County

P: Portions of the county

D: Deposit

Pt: Pit

Q: Quarry

### 3.12 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 coops), 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 parcels -184 and -188 are immediately adjacent to two major rivers, the Red River and the Canadian River, respectively. Proposed parcel -184 is within 2 miles of Great Western National Historic Trail. Proposed parcel -188 is across the Canadian River from the Packsaddle Wildlife Management Area. Proposed parcel -192 is adjacent to Lake Carl Blackwell Recreation Area. In these recreational areas water resources and bank vegetation is an important value that has not been drastically altered from the natural state. In the recreation areas, boat launches, buildings, camping spots, trails, and roads are common in addition to the increase in visitors as opposed to the proposed parcels not near a recreation area. Outside the recreation areas, the landscape described in the previous paragraph applies.

**Table 16. Distance of proposed parcels to nearest major roadways.**

<b>Parcel</b>	<b>Interstate/Distance</b>	<b>U.S. Highway/Distance</b>	<b>State Routes</b>
-182	40 / >90.0 miles	83 / ~1.75	15 / ~4.5 miles
-183	40 / >90.0 miles	83 / passes thru parcel	15 / ~5.5 miles
-184	44 / ~42.0 miles	283 / ~5.0 miles	5 / ~5.0 miles
-185	40 / ~40.5 miles	60 / ~ 8.5 miles	34 / ~7.5 miles
-186	40 / ~9.0 miles	283 / ~3.0 miles	6 / ~6.5 miles
-187	40 / ~9.0 miles	283 / ~ 4.0 miles	6 / ~6.5 miles
-188	40 / ~37.0 miles	283 / ~2.0 miles	33 / ~5.0 miles
-190	40 / ~43.0 miles	283 / ~10.0 miles	33 / ~5.5 miles
-191	40 / ~47.0 miles	60 / ~13.0 miles	33 / ~7.5 miles
-192	35 / <2.0 miles	77 / ~3.5 miles	86 / <1.0 mile

### **3.13 Socioeconomics and Environmental Justice**

#### **3.13.1 Socioeconomics**

Oklahoma's population of nearly 3.8 million is mostly urban, with almost 70 percent of the State's population residing in cities or towns. While over 90 percent of the State's land is in farms and ranches, the large size of typical Oklahoma farms and modern farming methods have resulted in relatively few people residing in rural areas.

Oklahoma's economy is based upon a combination of agriculture production, manufacturing, service industries and mineral extraction. Manufacturing contributes \$18.6 billion to Oklahoma's economy and has been the fastest growing industry in the state. The oil and gas industry is a major contributor to the Oklahoma economy bringing in \$15.9 billion through the extraction of more than 13 million barrels of oil and over 54 trillion cubic feet of natural gas (BEA 2012).

Oklahoma employed about 1,824,000 people in 2012, with 1,730,700 employed of which 1,600,500 were non-farm employees. The largest employer for the State is consistently the government, both state and local. Oklahoma's labor force participation rates have remained relatively constant. The unemployment rate in 2012 hovered around 5.2 percent (BLS 2013).

In 2011, Oklahoma's top commodities had a value of \$5,591 million with cattle and calves contributing to almost half of the value, followed by hogs and pigs, poultry and eggs, winter wheat, hay, corn, soybeans, cotton, peanuts, canola, pecans, grain sorghum, rye, watermelon, sunflowers, and oats, all of which had a production value of over \$1 million. Tables 14 and 15 describe the extent of farms/croplands and agriculture production within each of the proposed parcel counties.

The economy of Jackson County is based primarily on government and government enterprises. However, services and retail trade also serve an important role in the economy. Less than 15 percent of the population lived in rural areas. The economy of the additional four counties is primarily based on agriculture and oil and gas development.

**Table 17. Farms and Croplands in each of the proposed parcel counties during the 2007 census (USDA 2007).**

County	Farms			Cropland	
	Number	Total Acres	Average Size (acres)	Acres	Acres Harvested
Beaver	1,218	1,128,871	1,186	90,780	58,050
Jackson	745	474,502	637	300,961	244,780
Ellis	766	718,058	937	173,736	102,382
Roger Mills	693	719,356	1,038	186,444	57,679
Payne	1,567	356,765	228	117,667	63,642

**Table 18. Agriculture production in 2007 for the proposed parcel counties (USDA 2007).**

	Cattle/Calves		Corn for grain		Wheat		Sorghum		Hay	
	Number	Sold	Acres Planted	Bushels Sold	Acres Planted	Bushels Sold	Acres Planted	Bushels Sold	Acres Planted	Tons, dry Sold
Beaver	101,119	121,919	7,329	1,303,869	120,042	4,712,968	22,398	1,251,814	22,303	49,803
Jackson	41,434	32,254	5,258	212,342	161,028	5,238,473	6,845	424,093	18,035	39,950
Ellis	62,396	51,777	D	D	43,483	905,725	1,158	527,754	27,302	66,247
Roger Mills	63,216	42,652	--	--	28,933	804,608	767	21,818	26,372	68,087
Payne	54,224	36,182	586	72,167	5,381	89,363	D	D	54,603	100,507

D: Withheld to avoid disclosing data for individual farms

### 3.13.2 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. Table 19 describes the demographics of each proposed parcel county.

**Table 19. Demographics of proposed lease parcel counties.**

	Population	Identified as Hispanic or Latino Origin	Not Identified as White or of Hispanic or Latino Origin	Median Household Income	Living Below the Poverty Level
Oklahoma	3,814,820	9.3%	24.5%	\$44,287	16.3%
Beaver	5,591	21.2%	5.2%	\$47,386	13.2%
Jackson	26,237	21.9%	16.0%	\$41,391	18.9%
Ellis	4,104	7.3%	4.4%	\$45,017	15.3%
Roger Mills	3,774	5.7	9.0%	\$54,352	14.1%
Payne	78,399	4.1%	18.2%	\$35,716	23.2%

## **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 Oklahoma are analyzed in the Oklahoma RMP (1994), as amended (Chapter 4). That analysis, which assumes that the impacts from an average well, pipeline and access road would total 5.65 acres of surface disturbance in Oklahoma 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<sub>x</sub>, SO<sub>2</sub>, Pb, PM, CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O. Venting may release VOC/HAP, H<sub>2</sub>S, and CH<sub>4</sub>. 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 NO<sub>2</sub>. VOCs and NO<sub>x</sub> 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 Tulsa area has recorded exceedances of the O<sub>3</sub> NAAQS. The additional NO<sub>x</sub> 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.

While the act of leasing Federal minerals would have no impact on climate as a result of GHG emissions, subsequent exploration/development of the proposed lease could have effects on global climate through GHG emissions. However, those effects on global climate change cannot be determined. (Refer to cumulative effects section, 4.3.15). 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 Oklahoma for 2010 (Table 20).

**Table 20. 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
Oklahoma	67,730,000	3.39	1,827,328	6.81
Federal leases in Oklahoma	187,000	0.01	14,549	0.05

In order to estimate the contribution of Federal oil and gas leases to greenhouse gases in Oklahoma, 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, 2012), and applying production percentages to estimate emissions for Oklahoma. 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 21. 2010 Oil and Gas Field Production Potential Emissions**

Location	Oil (Metric tons of CO <sub>2</sub> <sup>e</sup> )		Gas (Metric tons of CO <sub>2</sub> <sup>e</sup> )		Total O&G Production (Metric tons CO <sub>2</sub> e)	%U.S. Total GHG emissions
	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>		
United States	300,000	30,600,000	10,800,000	126,000,000	167,700,000	2.6
Oklahoma	10,170	1,037,340	735,480	8,580,600	10,363,590	0.15
Federal leases in Oklahoma	30	3,060	5,400	63,000	71,490	0.001

Table 21 shows the estimated greenhouse gas emissions for oil and gas field production for the U.S., Oklahoma, and Federal leases in Oklahoma. 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. Note that units of Metric tons CO<sub>2</sub><sup>e</sup> have been used in the table above to avoid very small numbers. CO<sub>2</sub><sup>e</sup> is the concentration of CO<sub>2</sub> that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas.

Table 21 also 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 CO<sub>2</sub><sup>e</sup> from the life cycle of oil and gas. For example, acquisition (drilling and development) for petroleum is responsible for only 8% of the total CO<sub>2</sub><sup>e</sup> 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 22). To establish the exact number of federal wells in Oklahoma is problematic due to the

ongoing development of new wells, the abandonment of unproductive wells, land sales and exchanges, and incomplete or inaccurate data bases. To determine the most transparent and publicly accessible method of estimating the number of active federal wells in Oklahoma, OFO utilized AFMSS, EIA and ONRR data.

To estimate the potential emissions from the proposed lease sale, an estimate of emission per well is useful (Table 22). To establish the exact number of Federal wells in Oklahoma 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. Total emissions from Federal leases in Oklahoma in 2010 was estimated at 71,490 metric tons CO<sub>2</sub><sup>e</sup>; therefore, the estimate of emission per well is 196.4 metric tons CO<sub>2</sub>e annually.

**Table 22. 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%
Total Oklahoma Federal Emissions from Oil & Gas Field Production	71,490	0.001%
Federal lease Oil & Gas Field Production		
Oil & Gas Field Production at Full Development For Proposed Action (10 Wells)	1,964	0.0000003%

Environmental impacts of GHG emissions from oil and gas consumption are not effects of the proposed action as defined by CEQ, and thus are not required to be analyzed 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 greenhouse gas 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 CO<sub>2</sub> and CH<sub>4</sub> 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.

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 Oklahoma State University (OSU). This would eliminate the potential for impacts to soils as a result of exploration/development on the one proposed lease parcel. However, the impacts described above could occur on private surface

outside of the leased parcel as a result of the operator constructing a well pad and directionally drilling through the leased parcel. Even though the pad is not on the parcel, the act of constructing a pad that contains the well that was directionally drilled through the leased parcel is a connected action that would be considered despite the surface distance from the parcel.

### ***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 Floodplains, Wetlands, Riparian Areas**

##### ***4.3.4.1 Floodplains***

While the act of leasing Federal minerals produces no impacts to floodplains, 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 result in impairment of the floodplain values from removal of vegetation, removal of wildlife habitat, impairment of water quality, decreased flood water retention and decreased groundwater recharge.

Floodplains occur within proposed parcels -184, -185, and -188. Lease stipulation ORA-1 for Floodplain Protection would be attached to parcels the three parcels. ORA-1 states that, "All or portions of the lands under this lease lie in and or adjacent to a major watercourse and are subject to periodic flooding. Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the BLM." In addition to ORA-1, the BLM identified the need to develop a Floodplain Protection Lease Notice that would also be attached to these parcels. This notice would inform the lessee and operator that surface occupancy of these areas and surface disturbance within up to 200 meters of the outer edge of the floodplain may not be allowed in order to protect the integrity and functionality of the floodplain and associated watercourse (Appendix 1). Furthermore, controlled surface use requiring special mitigation measures may be required and will be developed during the application for permit to drill.

##### ***Mitigation***

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

##### ***4.3.4.2 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 four parcels (-184, -185, -186 and -188) .

Potential impacts from the hydraulic fracturing of a well could arise from the chemicals that are used at the well pad location. If the well location was within close proximity to water sources a potential impact to the waters could arise due to the chemicals being used during the hydraulic fracturing process. A more site specific analysis would take place during the APD review and subsequent NEPA analysis. There also is the potential for illegal dumping of waste products into fresh water pits used during the hydraulic fracturing purposes. If this illegal dumping was to occur there is the potential to impact migratory birds and other wildlife species.

The hydraulic fracturing of a well can potentially result in an increase of surface disturbances associated with equipment needed to complete the process. Part of the increase in surface disturbance is associated with a location within the lease used to place a centrally located frack pond or frack tank farm. Frack ponds are used to hold fresh water as part of the hydraulic fracturing process, and frack tank farms are used to hold fresh water in enclosed tanks, as part of the hydraulic fracturing process.

### ***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."

If surface disturbance occurs in or near wetlands or riparian areas, future operations within this lease sale parcel will require, but are not limited to, the following mitigation measures:

- The BLM Wildlife Resource General Conditions of Approval (WRCOAs) #3 **Pipelines and Wetlands:** Bore under any encountered wetlands for the purpose of pipeline installation. Trenching will not be used to install any pipeline through a wetland or to cross any creek.
- Best Management Practices (BMPs) (i.e. silt fencing, haybales, etc.) are required to minimize sediment and run-off from entering into associated water courses or stock ponds during operations.

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.

### **4.3.5 Farmlands, Prime or Unique**

While the act of leasing Federal minerals would produce no impacts to prime or unique farmlands, subsequent exploration/development of the proposed lease would remove the area from production for the life of the well. Direct impacts resulting from the construction of well pads, access roads, and reserve pits can affect the soil properties, increase erosion, and reduce water infiltration potentially affecting the characteristics unique to prime or unique farmlands.

The amount of farmlands lost depends on the amount and type of development proposed during the APD process. Up to 199.4 acres (31%) of six proposed lease parcels could be impacted and/or removed as prime farmland, while all acreage within five proposed parcels (340.3 acres) and portions of six proposed parcels (104.2 acres) totaling 444.5 acres (69%) would not be affected as they are not prime or unique farmland. It is anticipated that there would be no permanent loss of prime or unique farmland once all reclamation activities are complete. Initial construction and development would result in

greater surface disturbance and more area temporarily lost for production. Acres not needed during the production phase would be reclaimed and returned to prime or unique farmlands suitable for production. When the well is no longer productive, the entire site would be reclaimed and returned to prime or unique farmlands.

### ***Mitigation***

During the APD process, efforts would be made to relocate the disturbance onto soils identified as “not prime farmland”; however, if relocation is not an option the following mitigation measure would be placed on the project.

When removing soil, the three major mineral soil horizons (A, B, and C) would be removed and stockpiled independent of one another. All separation would occur prior to implementation of any other construction activities. During the interim and final reclamation phases, the three independently stockpiled soil layers would be replaced in the reverse order that they were removed with the C horizon placed first followed by B, then A.

The soil and water resources mitigation measures would also minimize the impacts to prime or unique farmlands.

## **4.3.6 Heritage Resources**

### ***4.3.6.1 Cultural Resources***

Fifteen previously recorded historic properties have been documented within the potential APEs of the proposed lease parcels. 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 Oklahoma State Historic Preservation Office has been consulted and Section 106 of the National Historic Preservation Act as amended compliance has been completed.

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.

#### ***4.3.6.2 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.

#### ***4.3.6.3 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 Oklahoma 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 Oklahoma 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 Oklahoma State Historic Preservation Office at (405) 521-6249.

#### **4.3.7 Invasive, Non-native Species**

While the act of leasing Federal minerals would not contribute to the spread or control of invasive or non-native species, subsequent exploration/development of the proposed lease may. Any surface disturbance could establish new populations of invasive non-native species, although the probability of this happening cannot be predicted using existing information. Noxious weed seeds can be carried to and from the project areas by construction equipment, the drilling rig and transport vehicles.

##### ***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.

#### **4.3.8 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 reseeded 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.

### **4.3.9 Wildlife**

#### ***4.3.9.1 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.

#### ***4.3.9.2 Special Status Species***

No State listed species or their critical habitat is present in the proposed lease sale parcels.

#### ***4.3.9.3 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.

3. 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.

#### ***4.3.9.4 Wildlife***

While the act of leasing Federal minerals would produce no direct impacts to wildlife, subsequent development of a lease may produce impacts. Impacts could result from 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 for 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.

#### **4.3.10 Wastes – Hazardous or Solid**

While the act of leasing Federal minerals would produce no impacts on the environment from hazardous or solid wastes, subsequent 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 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.

#### **4.3.11 Mineral Resources**

While the act of leasing Federal minerals would produce no impacts to mineral resources, subsequent 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.

NM-10 has been attached to -182 and -183, which indicates that the lease is subject to drainage by well(s) adjacent to the lease and that within six months of leasing the operator must submit plans for protecting the lease from drainage.

#### **4.3.12 Visual Resources**

While the act of leasing Federal minerals would produce no impacts to visual resources, subsequent 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 middleground 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.

#### **4.3.13 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.

#### **4.3.14 Cumulative Effects**

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.

**Table 23. Actual – Acres of Federal Minerals/Acres Available/Acres Leased**

<b>State</b>	<b>Federal O&amp;G Mineral Ownership</b>	<b>Acres Available</b>	<b>Acres Leased</b>	<b>Percent Leased</b>
KS	744,000	614,586	125,091	20%
NM	34,774,457	29,751,242	4,839,255	16%
OK	1,998,932	1,668,132	324,072	19%
TX	3,404,298	3,013,207	425,511	14%
Totals/Average	40,921,687	35,058,167	5,713,929	16%

**Table 24. Parcels Nominated and Offered in the February 2014 Oil and Gas Lease Sale**

<b>Field Office</b>	<b>No. of Nominated Parcels</b>	<b>Acres of Nominated Parcels</b>	<b>No. of Parcels to be Offered</b>	<b>Acres of Parcels to be Offered</b>
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

**Table 25. Foreseeable – Acres of Federal Minerals/Acres Available/Acres Leased**

<b>State</b>	<b>Federal O&amp;G Mineral Ownership</b>	<b>Acres Available</b>	<b>Acres Leased</b>	<b>Percent Leased</b>
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%

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.

Analysis of cumulative impacts for reasonably foreseeable development of oil and gas wells in Oklahoma was analyzed in the Oklahoma RMP (1994), as amended (pg. 4-6 – 4-8). Potential development of all available federal minerals in Oklahoma 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 Oklahoma with an estimated 113 acres of disturbance. Over the last 10 years there have been no changes to the basic assumptions or projections described in the Oklahoma RMP (1994), as amended, analysis.

More than 100 years of oil and gas development in Oklahoma has resulted in an extensive infrastructure of existing roads and pipelines. The Oklahoma Corporation Commission reports a total of 115,000 oil wells and 65,000 natural gas wells that are drilled and not plugged in Oklahoma. A total of 74,319 thousand barrels of oil was produced in 2011 with an average of 62 rotary rigs in operation per month. They also report a total of 1,827,328 million cubic feet of natural gas was produced in 2011 with an average of 120 rotary rigs in operation per month. Impacts from this development would remain on the landscape until final abandonment and reclamation of facilities occurs as wells are plugged when they are no longer economically viable.

#### ***4.3.14.1 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 five counties 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 eastern or western Oklahoma 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 leases is not expected to impact the 8-hour average ozone concentrations, or any other criteria pollutants in eastern or western Oklahoma .

#### ***4.3.14.2 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 was held on July 30, 2013 to review Field Office recommendations for nominated parcels.

### 5.1 Public Involvement

The parcels and applicable stipulations were posted online for a two-week public scoping period beginning on July 22, 2013. Two comments were received from private individuals. One comment did not have substantial comments for the purposes of the EA analysis and will not be addressed in this EA. The second comment letter contained three substantial comments, all of which are addressed within the EA. The comment letter and BLM response can be found in Appendix 6. In addition, this EA was made available for public review and comment for 30 days beginning on September 3, 2013. No comments were received.

## 6.0 REFERENCES

---

- Bamberger, M. and R.E. Oswald. 2013. Impacts of Gas Drilling on Human and Animal Health. *New Solutions: A Journal of Environmental and Occupational Health Policy* 22: 51-77.  
<http://baywood.metapress.com/app/home/contribution.asp?referrer=parent&backto=issue,5,9;journal,6,88;linkingpublicationresults,1:300327,1>.
- CCSP, 2008: *Climate Models: An Assessment of Strengths and Limitations*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Bader D.C., C. Covey, W.J. Gutowski Jr., I.M. Held, K.E. Kunkel, R.L. Miller, R.T. Tokmakian and M.H. Zhang (Authors)]. Department of Energy, Office of Biological and Environmental Research, Washington, D.C., USA, 124 pp.
- EDDMapS. 2013. Early Detection & Distribution Mapping System. The University of Georgia – Center for Invasive Species and Ecosystem Health. Available at: <http://www.eddmaps.org>.
- Energy Information Administration, 2012. National and Statewide Production Reports.  
<http://www.eia.gov/petroleum/data.cfm#crude> and  
<http://www.eia.gov/dnav/ng/hist/n9010us2a.htm>. (Accessed 1/14/13).
- Environmental Protection Agency (EPA). 2012. Air Trends: Design Values.  
<http://www.epa.gov/airtrends/values.html>. (Accessed 1/10/13).
- EPA. 2012a. Air Data: Air Quality Index Report. [http://www.epa.gov/airquality/airdata/ad\\_rep\\_aqi.html](http://www.epa.gov/airquality/airdata/ad_rep_aqi.html). (Accessed 8/2/13).
- EPA. 2012b. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010. EPA 430-R-12-001.  
<http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>. (Accessed 1/10/2013).
- EPA. 2011. Technology Transfer Network: Clearinghouse for Inventories and Emissions Factors.  
<http://www.epa.gov/ttn/chief/eiinformation.html>.
- EPA. 2009. State of the Ground Water Report. Ground Water Center, Source Water Protection Branch, EPA, Region 6. Dallas, Texas. Available at:  
<http://www.epa.gov/region6/water/swp/groundwater/2008-report.pdf>.
- EPA, Natural Gas Star Program (2006 data). Environmental Protection Agency, Washington, D.C.  
<http://www.epa.gov/gasstar/accomplishments/index.html>.
- Fletcher, S. M. 2012. Risk Assessment of Groundwater Contamination from Hydraulic Fracturing Fluid Spills in Pennsylvania. Thesis (S.M. in Technology and Policy)--Massachusetts Institute of Technology, Engineering Systems Division, Technology and Policy Program.  
<http://hdl.handle.net/1721.1/72885>.
- Goddard Institute for Space Studies. 2013. Annual Mean Temperature Change for Three Latitude Bands. Datasets and Images. GISS Surface Temperature Analysis, Analysis Graphs and Plots. New York,



New York. <http://data.giss.nasa.gov/gistemp/graphs/fig.B.lrg.gif>.

Groundwater Protection Council (GWPC). 2009. Modern Shale Gas Development in the United States: A Primer. Prepared for the U.S. Department of Energy, Office of Fossil Energy, and National Energy Technology Laboratory (NETL). DE-FG26-04NT15455. Oklahoma City, OK. Available at:

[http://www.netl.doe.gov/technologies/oil-gas/publications/epreports/shale\\_gas\\_primer\\_2009.pdf](http://www.netl.doe.gov/technologies/oil-gas/publications/epreports/shale_gas_primer_2009.pdf).

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2015: The Physical Basis (Summary for Policymakers). Cambridge University Press. Cambridge, England and New York, New York. <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf>.

Johnson, K. 1998. Geology and Mineral Resources of Oklahoma. Oklahoma Geological Survey Information Series #2. Norman, Oklahoma. Available at:

<http://www.ogs.ou.edu/pubsscanned/InfSeries/infseries2.pdf>.

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

National Academy of Sciences. 2006. Understanding and Responding to Climate Change: Highlights of National Academies Reports. Division on Earth and Life Studies. National Academy of Sciences. Washington, D.C. [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb1048006.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1048006.pdf).

Nicot, J.-P. and B.R. Scanlon. 2012. Water use for shale-gas production in Texas, U.S. Environmental Science and Technology 46:3580—3586.

Osborn, N.I. and R.H. Hardy. 1999. Statewide Groundwater Vulnerability Map of Oklahoma. Oklahoma Water Resources Board Technical Report 99-1. Available at:

<http://www.owrb.ok.gov/studies/reports/gwvulnerability/entire-report.pdf>.

Osburn, L. and R. Funkhouser. 2002. Inventory and Water Quality Sampling of Springs of Ellis County, Oklahoma. Oklahoma Geology Notes. Oklahoma City, Oklahoma 62:27-37.

Oklahoma Corporation Commission (OCC). 2012. 2011 Report on Oil and Natural Gas Activity Within the State of Oklahoma. Technical Services Department Oil and Gas Division. Oklahoma City, Oklahoma. Available at: <http://www.occeweb.com/og/2011%20Annual%20Report.pdf>.

US Census Bureau. (2012). State and County Quick Facts: Data derived from Population Estimates, American Community Survey, Census of Population and Housing, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits, Consolidated Federal Funds Report.

<http://quickfacts.census.gov/qfd/index.html>.

US Bureau of Labor Statistics (BLS). 2013. Economy at a Glance: Oklahoma. Southwest Information Office. Dallas, Texas. Available at: [http://www.bls.gov/eag/eag.ok.htm#eag\\_ok.f.P](http://www.bls.gov/eag/eag.ok.htm#eag_ok.f.P)

- US. Bureau of Economic Analysis (BEA). 2012. Regional Data: Oklahoma 2011. Gross Domestic Production by State. Washington, D.C. Available at:  
<http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=1#reqid=70&step=10&isuri=1&7007=2011&7093=Levels&7090=70&7035=-1&7036=-1&7001=1200&7002=1&7003=200&7004=NAICS&7005=-1&7006=40000>.
- USDA (Department of Agriculture, Natural Resource Conservation Service [NRCS]). Web Soil Survey.  
<http://websoilsurvey.nrcs.gov/>.
- USDI (US Department of the Interior, Bureau of Land Management [BLM]). 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development: The Gold Book (4<sup>th</sup> ed), P-417.
- USDI (BLM). February 1994. Oklahoma Resource Management Plan and Final Environmental Impact State. Tulsa, Oklahoma.
- USDI (BLM). May 1994. Record of Decision and Final Oklahoma Resource Management Plan. Tulsa, Oklahoma.
- USDI (BLM). 2011. Air quality Technical Report. New Mexico State Office.  
[http://www.blm.gov/nm/st/en/prog/more/air\\_resources/air\\_resources\\_technical.html](http://www.blm.gov/nm/st/en/prog/more/air_resources/air_resources_technical.html).
- US Government Accountability Office Report (2007). Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources. GAO-07-863. 1st paragraph, 1st page, GAO Highlights. <http://www.gao.gov/products/GAO-07-863>.
- USDI, US Geological Survey (USGS). 2011. 2008 Minerals Yearbook: Oklahoma [Advance Release]. Available at: <http://minerals.usgs.gov/minerals/pubs/state/2008/myb2-2008-ok.pdf>.
- USDI (USGS). 2008. Mineral Deposits and Resources of Oklahoma (Exclusive of Oil and Gas). Educational Publication 9: 10. Available at: [http://www.ogs.ou.edu/pubsscanned/EP9p10\\_11minoilgas.pdf](http://www.ogs.ou.edu/pubsscanned/EP9p10_11minoilgas.pdf).
- Wenzel, C. 2012. A Case Study—Hydraulic Fracturing Geography: The Case of the Eagle Ford Shale, TX, USA. Thesis (M.S.)--Texas State University-San Marcos, Department of Geography.  
<https://digital.library.txstate.edu/handle/10877/4247>.
- Zoback, M., S. Kitasei, and B. Copithorne. 2010. Addressing the Environmental Risks from Shale Gas Development. Briefing Paper 1. Worldwatch Institute Natural Gas and Sustainable Energy Initiative. Available at: <http://www.worldwatch.org/files/pdf/Hydraulic%20Fracturing%20Paper.pdf>.

## **7.0 AUTHORITIES**

---

Code of Federal Regulations (CFR)

40 CFR All Parts and Sections inclusive Protection of Environment, Revised as of January 1, 2001.

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

US Department of the Interior, Bureau of Land Management and Office of the Solicitor (editors). 2001.

The Federal Land Policy and Management Act, as amended. Public Law 94-579.

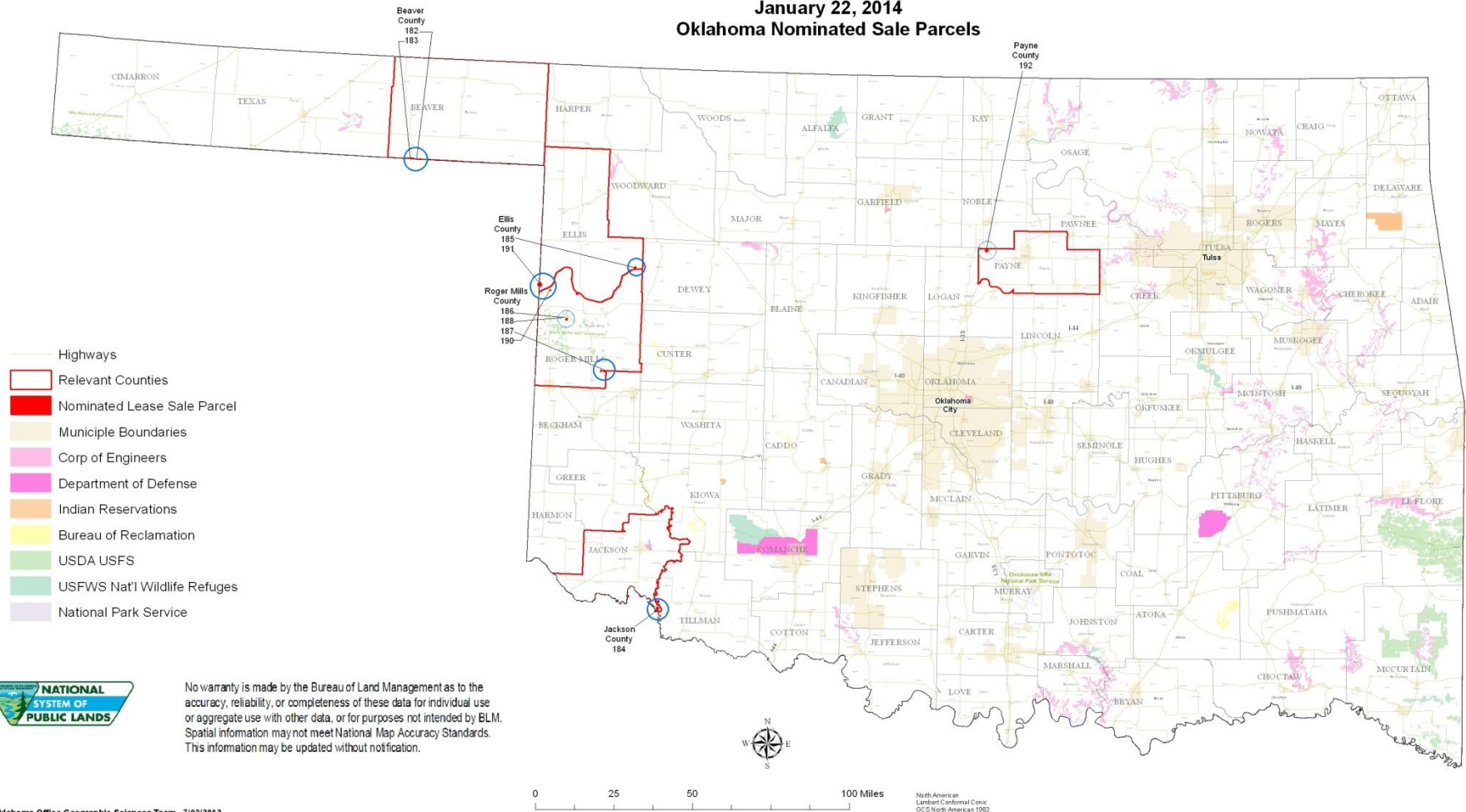
## APPENDIX 1. OKLAHOMA FIELD OFFICE LEASE STIPULATION SUMMARY

Stipulation	Description/Purpose
ORA-1 OK	<b>FLOODPLAIN PROTECTION:</b> A result of EO 11988 Floodplain Management of May 24, 1977. All or portions of the lands under this lease lie in and or adjacent to a major watercourse and are subject to periodic flooding. Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the Bureau of Land Management.
ORA-2 OK	<b>WETLAND/RIPARIAN:</b> 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.
ORA-3 OK	<b>SEASON OF USE:</b> Surface occupancy of this lease will not be allowed from February 15 – May 15 for protection of the lesser/greater prairie-chicken breeding season.
NM-10	<b>DRAINAGE:</b> All or part of the lands contained in this lease are subject to drainage by wells(s) located adjacent to this lease. The lessee shall be required within 6 months of lease issuance to submit to the authorized officer plans for protecting the lease from drainage. Compensatory royalty will be assessed effective the expiration of this six-month period if no plan is submitted. The plan must include either an Application for Permit to Drill (APD) for a protective well, or an application to communitize the lease so that it is allocated production from a protective well off the lease. Either of these options may include obtaining a variance to State-spacing for the area. In lieu of this plan, the lessee shall be required to demonstrate that a protective well would have little or no chance of encountering oil and gas in quantities sufficient to pay in excess the costs of protecting the lease from drainage or an acceptable justification why a protective well would be uneconomical, the lessee shall be obligated to pay compensatory royalty to the Minerals Management Service at a rate to be determined by the authorized officer.
WO-ESA-7 TX,OK	<b>ENDANGERED SPECIES ACT SECTION 7 CONSULTATION STIPULATION:</b> 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.
LN-3	<b>FLOODPLAIN MANAGEMENT:</b> All or portions of the lands under this lease lie in and/or adjacent to a major watercourse and may be subject to periodic flooding. Surface occupancy of these areas and surface disturbance within up to 200 meters of the outer edge of the floodplain may not be allowed in order to protect the integrity and functionality of the floodplain and associated watercourse. Controlled surface use requiring special mitigation measures may be required and will be developed during the application for permit to drill. These would be required as part of the environmental analysis, approval for drilling or any other operation on this lease. These measures could include modifications or relocation of proposed well locations; burial of linear facilities such as pipelines; modifications in surface activities; minimizing surface disturbance by co-locating roads, utilities and pipelines in common rights-of-ways; interim reclamation of all surface disturbance initiated immediately after construction; reduction of long term noise producing activities; suitable off-site mitigation or other reasonable measures to mitigate impacts to floodplains.

<b>Stipulation</b>	<b>Description/Purpose</b>
WO-NHPA TX, OK	<b>CULTURAL RESOURCES AND TRIBAL CONSULTATION STIPULATION:</b> 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.
OSU #1	<b>No Surface Occupancy Lake Carl Blackwell:</b> This no surface occupancy stipulation is to protect Lake Carl Blackwell and associated facilities owned by Oklahoma State University (OSU).
OSU #2	<b>Lake Carl Blackwell:</b> Prior to conducting operations on these lands, a plan of operations must be approved by the Tulsa District Office of the Bureau of Land Management. Any drilling, construction, or operations on the leased lands are subject to site-specific stipulations as may be necessary to assure reasonable protection of Lake Carl Blackwell and associated facilities owned by the OSU. A plan shall not be approved if it will result in unacceptable impacts on any land use or the environment.

## APPENDIX 2. OKLAHOMA NOMINATED LEASE SALE PARCELS

### BLM New Mexico Competitive Oil and Gas Lease Sale January 22, 2014 Oklahoma Nominated Sale Parcels



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.

Produced by the BLM Oklahoma Office Geographic Sciences Team. 7/02/2013

Figure 1. Beaver County, Proposed Parcel -182 and -183.

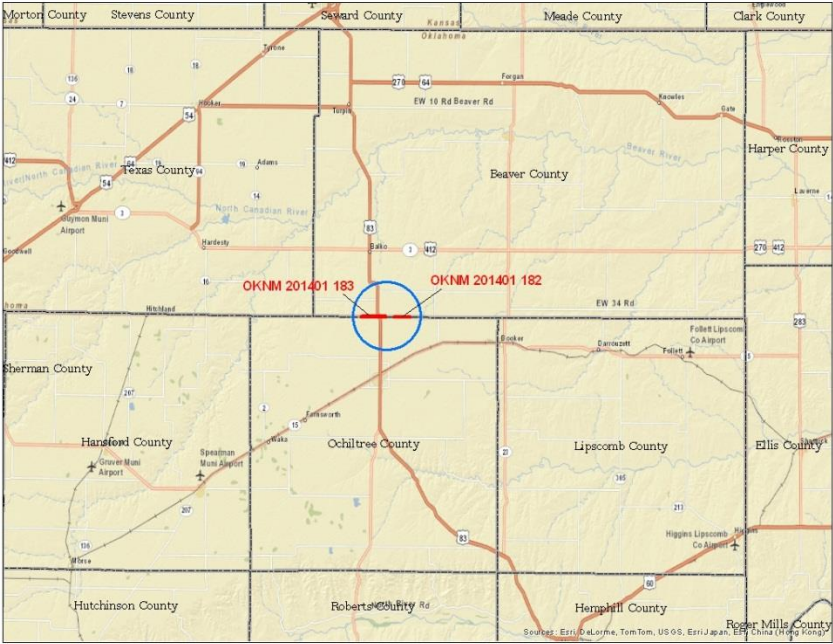
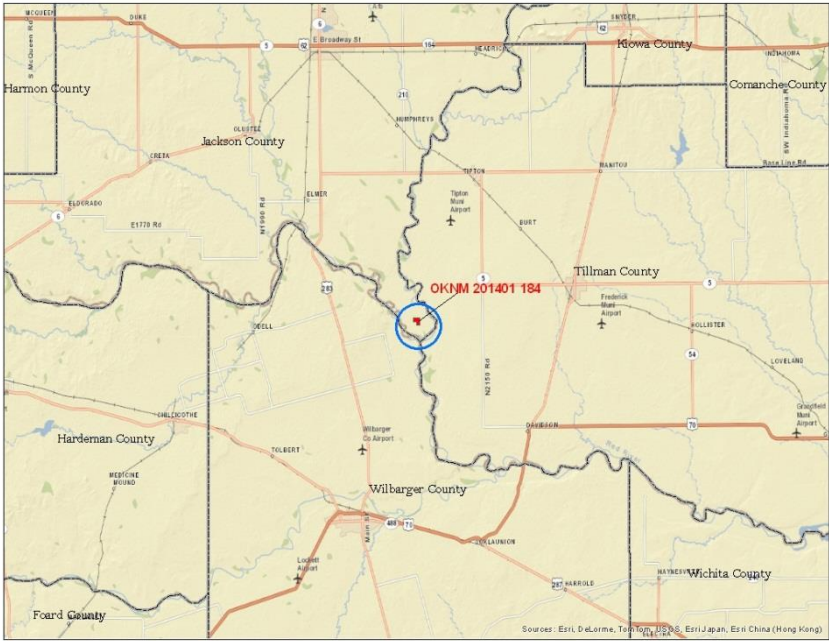
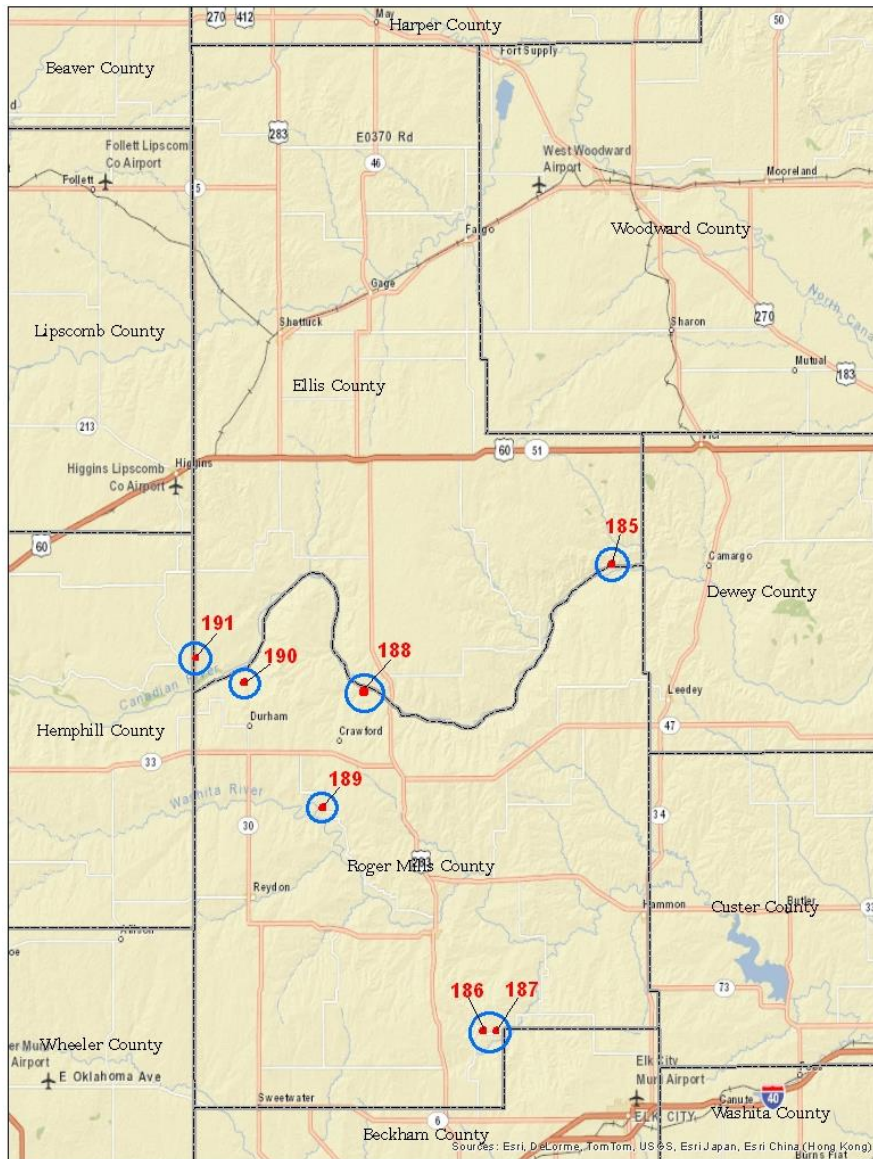


Figure 2. Jackson County, Proposed Parcels -184.





**Figure 3. Roger Mills and Ellis Counties, Proposed Parcels -185 through -188 and -190 through -191.**



**Figure 4. Payne County, Proposed Parcel -192.**





## **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"><li>• Domestic wastes (i.e. food scraps, paper, etc.)</li><li>• Excess construction materials</li><li>• Used lubricating oils</li><li>• Solvents</li><li>• Woody debris</li><li>• Paints</li><li>• Sewage</li></ul>
Drilling	<ul style="list-style-type: none"><li>• Drilling muds, including additives (i.e. chromate and barite) and cuttings</li><li>• 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)</li><li>• Equipment, power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, oil, tires, hoses, hydraulic fluids; paints; solvents)</li><li>• Fuel and chemical storage drums and containers</li><li>• Cementing wastes</li><li>• Production testing wastes</li><li>• Excess construction materials</li><li>• Scrap metal</li><li>• Sewage</li><li>• Rigwash</li><li>• Excess drilling chemicals</li><li>• Processed water</li><li>• Contaminated soil</li><li>• Domestic wastes</li></ul>
HF	See below

Phase	Waste
Production	<ul style="list-style-type: none"> <li>Power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, filters, tires, hoses, coolants, antifreeze; paints; solvents, used parts)</li> <li>Discharged produced water</li> <li>Production chemicals</li> <li>Workover wastes (e.g. brines)</li> </ul>
Abandonment/ Reclamation	<ul style="list-style-type: none"> <li>Tank or pit bottoms</li> <li>Contaminated soil</li> <li>Scrap metal</li> <li>Insulating materials</li> <li>Sludge</li> </ul>

### 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 2. 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 radium<sub>226</sub> and radium<sub>228</sub>, can be brought to the surface in drill cuttings and produced water. Radon<sub>222</sub>, 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. SOIL PROPERTIES OF THE PROPOSED LEASE PARCELS

Parcel	Soil Name	Soil Symbol	Acres in area	% in area	Erosion K Factor	Wind Erodibility Index	Prime and Unique Farmland*
-182	Pullman clay loam	Pm	2.0	5.0	.32	48	Y
	Darrouzett clay loam	RcA	9.6	23.9	.32	38	Y
	Ulysses-Darrouzett complex	Ur	28.4	71.1	.32	48	Y
-183	Pullman clay loam	Pm	38.1	50.8	.32	48	Y
	Darrouzett clay loam	RcA	36.9	49.2	.32	38	Y
-184	Gracemont fine sandy loam	GmuA	46.1	38.3	.20	86	N
	Jester fine sand	JesC	62.1	51.6	.15	220	N
	Jester fine sand	JesF	11.5	9.5	.15	220	N
	Lincoln loamy sand	LnuA	0.7	0.6	.17	134	N
-185	Quinlan-Woodward complex	QwE	6.4	16.0	.37	56	N
	Quinlan-Rock outcrop complex	Rb	33.7	84.0	.37	56	N
-186	Carey silt loam	CaC	0.4	0.9	.37	48	Y
	Quinlan-Woodward complex	QwE	8.9	21.9	.37	56	N
	Quinlan-Rock outcrop complex	Rb	27.6	68.3	.37	56	N
	Woodward loam	WoC	3.3	8.1	.37	56	Y
	Westola fine sandy loam	Ya	0.3	0.8	.20	86	Y
-187	Quinlan-Woodward complex	QwE	39.8	100	.37	56	N
-188	Lincoln fine sandy loam	Ln	0.8	1.3	.20	86	N
	Hardeman-Likes Devol complex	PcE	15.6	24.0	.24	134	N
	Water	W	4.4	6.8	--	--	--
	Westola fine sandy loam	Za	44.0	67.9	.20	86	N
-190	Enterprise very fine sandy loam	EnB	1.1	2.7	.43	86	Y
	Enterprise very fine sandy loam	EnD	3.5	8.8	.43	86	N
	Hardeman-Likes Devol complex	PcE	35.4	88.6	.24	134	N
-191	Eda-Tivoli complex	Pt	18.9	64.6	.15	134	N
	Tivoli fine sand	Tv	10.4	35.4	.15	220	N
-192	Coyle loam	3	0.3	0.2	.37	48	Y
	Pulaski fine sandy loam	6	65.6	41.4	.20	86	N
	Norge loam	34	4.0	2.5	.37	48	Y
	Norge loam	35	5.5	3.5	.37	48	N
	Port silt loam	37	20.9	13.2	.37	56	Y
	Port-Oscar complex	39	13.1	8.3	.37	56	Y
	Pulaski fine sandy loam	43	27.5	17.3	.20	86	Y
	Teller loam	57	4.6	2.9	.37	56	Y
	Mulhall loam	62	2.2	1.4	.37	48	N
	Grainola clay loam	65	0.2	0.1	.37	38	Y
	Masham silty clay loam	66	3.3	2.1	.43	86	N
	Coyle loam	CoyB	0.6	0.4	.37	48	Y
	Easpor loam	EasA	0.5	0.3	.37	56	Y
	Grainola-Ashport-Mulhall complex	GAMD	2.2	1.4	.37	38	N
	Grainola-Lucien complex	GrLC	7.6	4.8	.43	56	Y
	Grainola-Lucien complex	GrLE	0.4	0.3	.37	38	N

\* N: Not prime or unique farmland      Y: All areas prime farmland

## **APPENDIX 4. BIOLOGICAL EVALUATION.**

---



## **APPENDIX 5. CULTURAL RESOURCES REPORT**

---

## APPENDIX 6. RESPONSE TO COMMENT LETTER

---

To whom it may concern,

This letter message is in response to the lease sell for the property listed at:  
NM-201401-188 64.930 Acres T.0160N, R.0240W, IM PM, OK  
Sec. 008 LOTS 2;  
008 ACCR & RIPR ACREAG TO L2; 008 SEE EXH A FOR M&B W/MAP;  
Roger Mills County

The property described has been in our family for many years we are concerned for the preservation and integrity of:

- 1 [• The riparian areas and one of the last stands of old cottonwoods and wild turkey roost, bobwhite quail habitat in this area.
- The lease area contains plants, animals, and their habitats that will be threatened, endangered (Turkey, Quail, Deer, Etc.)
- The lands under this lease lie in a major watercourse (South Canadian River) and a natural spring/creek that flows directly into the South Canadian River.
- The lands under this lease contain riparian areas including grassland, woodland, wetland, and even non-vegetative.
- 2 [• Due to limited vehicle access to the purposed area, building a road through the riparian area and bridges over creeks would be required.

As the land owner we are not opposed to directional drilling from outside the identified area; however, we would like to take every precaution possible to protect the natural habitat that our family has worked so hard to establish over the last 75 years.

As noted in your documentation, the following stipulations are currently in place:

- ORA-1: Floodplain Protection
- ORA-2: Wetland/Riparian Protection
- ORA-3: Season of Use for Lesser Prairie Chicken WO-ESA-7: Endangered Species Act
- Consultation WO-NHPA: National Historic Preservation Act Consultation

- 3 [In addition to the stipulations that have been determined by others, please consider the effects on wildlife, habitat, and natural riparian areas that we have presented above.

Sincerely

Terrell Scroggins  
8165 N 1790 Rd  
Crawford, Oklahoma

***General response to the comment letter:***

Leasing and developing Federal minerals occurs in two major phases: leasing and application for permit to drill (APD).

During the leasing phase, the BLM receives nominations for land in which Federal mineral interest exists. An Environmental Analysis is completed to determine if there will be significant impacts as a result of leasing and potentially developing the parcel. During the analysis, the BLM completes a general review of all resources that may be present within the parcel. At this phase it would be too intensive to complete a detailed analysis, when the BLM really does not know where the actual pad, access road, pipelines, or utility lines will go. In fact, many times, the minerals are accessed from a surface hole and pad that is outside the delineated parcel. If a resource is identified in a portion of the parcel the analysis applies to the entire parcel and not just the area with the resource.

During the APD phase, the operator submits an APD which consists of a detailed description of their intentions to develop Federal minerals including: pad, access road, and pipeline locations; drilling depths and mechanism; reclamation efforts; anticipated amount and source of water to be used; spill prevention and contamination measures, just to name a few. For further information please refer to Onshore Order #1. Once the BLM receives all the necessary information, a site visit is conducted and all resources within the proposed disturbance area and within an appropriate distance are documented and will be analyzed further. During the onsite and review of the project, the BLM will work with operators to minimize the total disturbance and any impacts on resources that are sensitive (i.e. wetlands, cottonwoods, wildlife corridors, etc.). As well, the landowner's concerns and wishes will be taken into account. If potential impacts are unavoidable (i.e. crossing a stream), mitigation measures and/or conditions of approval (COAs) will be implemented (i.e. boring under the stream to place a pipeline) and enforced. All anticipated actions will be analyzed within a second EA that is specific to the project and the disturbance area. It is during this analysis that site-specific, detailed analysis of all resources present is completed. Once the analysis is complete, the EA and APD are signed and all mitigation measures and COAs are given to the operator to follow. If an operator does not adhere to the measures or COAs they can be fined.

***Response to individual comments:***

1. The resources you have listed have been identified within the Environmental Assessment (EA) Section 3.0—Affected Environment. Once an APD is submitted these resources would be analyzed more in depth and identified in Section 3.0 of the APD EA.
2. Unfortunately, at the lease sale phase, there is no way to predict where a road, pipeline, or utility line will be needed to develop the Federal minerals. We can only assume that those actions will occur and that there may be some impact. Those potential impacts are addressed in Section 4.0—Environmental Consequences of the EA. During the APD phase, the BLM will conduct a more detailed analysis to identify specific impacts and what those impacts will cause cumulatively across the landscape.
3. The suggested resources to consider have been analyzed in Section 4.0—Environmental Consequences of the EA.