BLM

U.S. Department of the Interior

Bureau of Land Management

Finding of No Significant Impact
Environmental Assessment
DOI-BLM-NM-040-2013-59-EA
February, 2014

February 2014 Competitive Oil and Gas Lease Sale

Houston, Trinity, Jackson, Jasper, San Jacinto, Montgomery, Tarrant, Walker, Wise, and Hemphill Counties, Texas

U.S. Department of the Interior

Bureau of Land Management

Oklahoma Field Office

7906 E. 33rd Street

Tulsa, Oklahoma 74145

Phone: 918.621.4100

Fax: 918.621.4130

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
OKLAHOMA FIELD OFFICE

Project: July 2013 Competitive Oil and Gas Lease Sale
EA Log Number: DOI-BLM-NM-040-2013-14-EA
Location: Shelby, Sabine, and Live Oak Counties, Texas

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 Texas Resource Management Plan (RMP), 1996, 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

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), the Davy Crockett National Forest (DCNF), Sam Houston National Forest (SHNF), Lyndon B Johnson National Grassland (LBJ), Black Kettle National Grassland (BKNG), and Army Corp of Engineers (COE) are posted online for a two week public scoping period. Comments received are reviewed and incorporated into the environmental assessment (EA).

Once the draft parcel review is completed and returned to the NMSO, a list of nominated lease 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 the forty-four (44) parcels nominated for the February 2014 Competitive Oil and Gas Lease Sale, five (5) parcels of which have multiple Surface Management Agencies (SMAs)s within the same parcel. Twenty-five (25) of the 44 parcels are located on surface estate administered by the DCNF, a portion of five (5) of the 25 are located on split-estate private surface, with the Federal mineral estate under each administered by the Oklahoma Field Office (OFO); fourteen (14) parcels are located on surface estate administered by the SHNF; one (1) of the 44 parcels is located on surface estate administered by the LBJ; one (1) of the 44 parcels is located on surface estate administered by the BKNG; two (2) of the 44 parcels are located on surface estate administered

by the COE; and one (1) of the 44 parcels is located on split-estate private surface (Lavaca Navidad River Authority), with the Federal mineral estate under each administered by the 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, River Authorities (RA) or Bureau of Reclamation (BOR) and the mineral estate is also federally owned, the Forest Service/BOR 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, RA, or BOR 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 SUPO 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). On RA, BOR and split-estate lands, the BLM has the sole responsibility to regulate all surface disturbing activities associated with oil and gas exploration and development.

The parcels and applicable stipulations were posted online for a two-week public scoping period beginning on July 22, 2013. No comments were received. In addition, this EA 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 Federal oil and gas resources 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 Texas Resource Management Plan (RMP) (May 1996), as amended. The Texas RMP, as amended, does not specifically describe individual tracts of split estate; rather it broadly describes the split estate situation in Texas and includes "all Federal minerals underlying other Federal SMAs lands as wells as split-estate (non-federal surface over Federal minerals)" (pg. 1).

The RMP identifies the potential stipulations that could be attached to split-estate tracts that are proposed for leasing and states "All new leases and all expired leases that are reissued would be leased with surface resource protection stipulations. Mandatory stipulations would be incorporated into each lease where those stipulations apply. In addition, options stipulations will be included where resource values exist that warrant special protections" (pg. 8). The potential stipulations could include seasonal timing limitations and other controlled surface use stipulations which were designed to minimize or alleviate potential impacts to special resource values. Since the parcels under consideration falls within this planning area and the applicable stipulations identified in the RMP would be attached to the parcels, if leased, leasing the parcels would be in conformance with the Texas RMP. Leasing the split-estate parcels would also be consistent with the RMPs goals and objectives for natural and cultural resources.

For SMA parcels, the RMP states "the SMA is contacted for consent to lease and also for identification of specific agency surface protection stipulations" (pg. 9). The Forest Service and BOR were contacted regarding parcels in their jurisdiction. Each submitted letters of Consent to Lease, along with specific stipulations to attach to each parcel. Leasing the SMA parcels is consistent with the Texas 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 (1996), 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 Texas 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) or any supplemental standards required by the OFO cultural resources staff. When draft parcels locations are received by the OFO, cultural resource staff reviews the location for any known cultural resources in BLM and State 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, along with the appropriate stipulations from the RMP, the Sabine National Forest and BOR, 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.

- 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 recreation in the designated Wildlife Management Area and Army Corp recreational areas?
- 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 Texas RMP (1996), as amended, and other data sources, to not be present:

- Areas of Environmental Concern
- Livestock Grazing
- Wild Horse and Burros
- Public Health and Safety
- Wild and Scenic Rivers
- Wilderness
- Cave and Karst
- Rights-of-way

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 forty-four (44) 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 Federal minerals on forty-three (43) of forty-four (44) nominated parcels, totaling 34,018.63 acres:

- All of twenty (20) parcels totaling 21,700.26 acres administered by the Davy Crockett National Forest in Houston and Trinity Counties, TX;
- A portion of five (5) parcels totaling 8,781.95 acres administered by the Davy Crockett National Forest in Houston and Trinity Counties, TX;
- A portion of five (5) parcels totaling 1,486.90 acres administered by the BLM Oklahoma Field Office (OFO) and on private surface (split-estate) in Houston and Trinity Counties, TX;
- All of fourteen (14) parcels totaling 1,496.47 acres administered by the Sam Houston National Forest in San Jacinto, Montgomery, and Walker Counties, TX;
- All of one (1) parcel totaling 264.48 acres administered by the Lyndon B. John (LBJ) National Grasslands in Wise County, TX;
- All of one (1) parcel totaling 165.18 acres administered by the Black Kettle National Grassland in Hemphill County, TX; and
- All of two (2) parcels totaling 123.39 acres administered by the U.S. Army Corps of Engineers in Jackson and Tarrant Counties, TX;

Standard terms and conditions as well as stipulations listed in the Texas RMP (1996), as amended, and stipulations identified by the SMAs would apply. A complete description of these parcels, including any stipulations, is provided in Table 1. A description of each stipulation is included in Appendix 1.

National Forest stipulations are attached to entire acreage of 36 parcels. Five parcels also have FS stipulations and OFO identified stipulations as a result of the mixing of split-estate and FS land within the same lease parcel. The five parcels include -193, -197, -201, -227, and -228. COE stipulations are attached to parcels -216 and -226.

The OFO identified stipulations for split-estate portions of the parcels. ORA-2 (Wetland/Riparian Protection) would be attached to parcels -193, -197, -201, -227, and -228, which states "Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the BLM. Impacts or disturbance to wetlands and riparian habitats which occur on this lease must be avoided or mitigated." Two lease notices, WO-ESA-7 and WO-NHPH, would also be attached to these parcels as well as to parcels -216 and -226. These notices would notify the lease holder that the BLM reserves direction to modify, if necessary, any action proposed on the lease to ensure:

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

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

Once sold, the lease purchaser would have the exclusive right to use as much of the leased lands as would be necessary to explore and drill for oil and gas within the lease boundaries, subject to stipulations attached to the lease; restrictions deriving from specific, nondiscretionary statutes; and such reasonable measures as may be required by the authorized officer to minimize adverse impacts to other resource values, land uses or users not addressed in the lease stipulations at the time operations are proposed (43 CFR 3101). Oil and gas leases are issued for a 10-year period and continue for as long thereafter as oil or gas is produced in paying quantities. If a lease holder fails to produce oil and gas, does not make annual rental payments, does not comply with the terms and conditions of the lease, or relinquishes the lease, exclusive right to develop the leasehold reverts back to the federal government and the lease can be reoffered in another lease sale.

Reasonably Foreseeable Development

At the leasing stage, it is uncertain if Applications for Permit to Drill on leased parcels would be received, nor is it known if or to what extent development would occur. Such development may include constructing a well pad and access road, drilling a well using a conventional pit system or closed-loop system, hydraulically fracturing the well, installing pipelines and/or hauling produced fluids, regularly monitoring the well, and completing work-over tasks throughout the life of the well. In Oklahoma and Texas, typically, all of these actions are undertaken during development of an oil or gas well; it is reasonably foreseeable that they may occur on leased parcels. See Appendix 3 for a complete description of the phases of oil and gas development.

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

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

Table 1. Alternative B—Proposed Action Parcels

Parcel	Comments	Acres
NM-201401-193 TX TR K-1A-I, Parcel #3; TR K-40C; TR K-40D; TR K-13 **Houston and Trinity Counties, TX**	**Private Surface (546.65 acres):** Lease with the following BLM Stipulations (applies to 546.65 acres): ORA-2: Wetland/Riparian Protection WO-ESA-7: Threatened & Endangered Species Consultation WO-NHPA: Tribal & Cultural Consultation **Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest (1893.89 acres) Lease with the following FS Stipulations (applies to 1893.89 acres): FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	2440.540
NM-201401-194 TX TR K-1A-I, Parcel #4; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	2459.870
NM-201401-195 TX TR K-1A-II, Parcel #1; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU-1C: Drilling Restriction within 150' of Hiking and ORV Trails FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	2548.850

Parcel	Comments	Acres
NM-201401-196 TX TR K-1A-II, Parcel #2; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU-1E: Toledo Bend Lakeshore Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	2530.150
NM-201401-197 TX TR K-1A-III; TR K-40E **Houston County, TX**	**Private Surface (305.20 acres):** Lease with the following BLM Stipulations (applies to 305.20 acres): ORA-2: Wetland/Riparian Protection WO-ESA-7: Threatened & Endangered Species Consultation WO-NHPA: Tribal & Cultural Consultation **Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest (1060.80 acres) Lease with the following FS Stipulations (applies to 1060.80 acres): FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	1366.00
NM-201401-198 TX TR K-1A-IV, Parcel #1; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	2383.970
NM-201401-199 TX TR K-1A-IV, Parcel #2; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	1634.890
NM-201401-200 TX TR K-1A-IV, Parcel #3; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	1810.950

Parcel	Comments	Acres
NM-201401-201 TX TR K-1A-V, Parcel #1; K-12 **Houston County, TX**	**Private Surface (1.07 acres):** Lease with the following BLM Stipulations (applies to 1.07 acres): ORA-2: Wetland/Riparian Protection WO-ESA-7: Threatened & Endangered Species Consultation WO-NHPA: Tribal & Cultural Consultation **Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest (2295.39 acres) Lease with the following FS Stipulations (applies to 2295.39 acres): FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU-1C: Drilling Restriction within 150' of Hiking and ORV Trails FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection FS8 (TX) NSO-2D: Protect Scenic Values	2296.460
NM-201401-202 TX TR K-1A-V, Parcel #2; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	1678.240
NM-201401-203 TX TR K-1A-V, Parcel #3; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	2257.200
NM-201401-204 TX TR K-1A-VII; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	9.200
NM-201401-205 TX TR K-1A-VIII; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	27.000

Parcel	Comments	Acres
NM-201401-206 TX TR K-1B-VI, Parcel #1; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	1448.730
NM-201401-207 TX TR K-1B-VI, Parcel #2; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	1442.270
NM-201401-208 TX TR K-1E; K-18 **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	738.000
NM-201401-209 TX TR K-1N; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	291.000
NM-201401-210 TX TR K-2Z; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU-1C: Drilling Restriction within 150' of Hiking and ORV Trails FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	138.000
NM-201401-211 TX TR K-6; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	140.000

Parcel	Comments	Acres
NM-201401-212 TX TR K-27; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	58.000
NM-201401-213 TX TR K-119; **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	36.700
NM-201401-214 TX TR K-603, (THE N2); **Houston County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	33.600
NM-201401-216 TX TR A-6; A-7; A-8 **Jasper County, TX**	**Other Surface Management Agency (SMA):** Army Corp of Engineers, Town Bluff Dam Lease with the following Stipulations: NSO/DD: No Surface Occupancy Directional Drilling Permitted NSO/ELEV: No Surface Occupancy within 1000' of high water mark ORA-3: Season of Use Stipulation Hunting (September 1 – March 1) NM-10: Drainage WO-ESA-7: Endangered Species Act Consultation WO-NHPA: National Historic Preservation Act Consultation	51.700
NM-201401-217 TX TR J-35a; **San Jacinto and Montgomery Counties, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	105.000

Parcel	Comments	Acres
NM-201401-218 TX TR J-28; **Montgomery County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection FS8 (TX) NSO-2D: Protect Scenic Values FS8 (TX) NSO-3: Lake Conroe	27.980
NM-201401-219 TX TR J-1s; **Montgomery County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection FS8 (TX) NSO-2D: Protect Scenic Values FS8 (TX) NSO-3: Lake Conroe	29.000
NM-201401-220 TX TR J-16; **Montgomery County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	167.000
NM-201401-221 TX TR J-16a; J-16a-I; J-16a-II; **Montgomery County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	117.900
NM-201401-222 TX TR J-264; **Montgomery County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	25.000

Parcel	Comments	Acres
NM-201401-223 TX TR J-142a; J-142b **Montgomery County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	28.420
NM-201401-224 TX TR 4; J-94c; J-94d; J-94e; J-94f; **San Jacinto County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	28.420
NM-201401-225 TX TR J-45; **San Jacinto County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	28.420
NM-201401-226 TX TR D-305; D-313; **Tarrant County, TX**	**Other Surface Management Agency (SMA):** Army Corp of Engineers , Benbrook Lake Lease with the following Stipulations: NSO/DD: No Surface Occupancy Directional Drilling Permitted NSO/ELEV: No Surface Occupancy within 1000' of high water mark NM-10: Drainage WO-ESA-7: Endangered Species Act Consultation WO-NHPA: National Historic Preservation Act Consultation	71.690
NM-201401-227 TX TR K-1A-I, Parcel #1; K-40A **Trinity County, TX**	**Private Surface (414.39 acres):** Lease with the following BLM Stipulations (applies to 414.39 acres): ORA-2: Wetland/Riparian Protection WO-ESA-7: Threatened & Endangered Species Consultation WO-NHPA: Tribal & Cultural Consultation **Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest (1618.09 acres) Lease with the following FS Stipulations (applies to 1618.09 acres): FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	2032.480

Parcel	Comments	Acres
NM-201401-228 TX TR K-1A-I, Parcel #2; K-40B **Trinity County, TX**	**Private Surface (219.59 acres):** Lease with the following BLM Stipulations (applies to 219.59 acres): ORA-2: Wetland/Riparian Protection WO-ESA-7: Threatened & Endangered Species Consultation WO-NHPA: Tribal & Cultural Consultation **Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest (1913.78 acres) Lease with the following FS Stipulations (applies to 1913.78 acres): FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	2133.370
NM-201401-229 TX TR K-10G; K-702 **Trinity County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Davy Crockett National Forest Lease with the following FS Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	33.640
NM-201401-230 TX TR J-30; **Walker County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following FS Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	30.000
NM-201401-231 TX TR J-1m; **Walker County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following FS Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection FS8 (TX) CSU-1G: Neches River and Cochino Bayou Shore Protection	414.000
NM-201401-232 TX TR J-1L; **Walker County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following FS Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	132.000

Parcel	Comments	Acres
NM-201401-233 TX TR J-85a; **Walker County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following FS Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	74.300
NM-201401-234 TX TR J-77; **Walker County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Sam Houston National Forest Lease with the following FS Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	40.000
NM-201401-235 TX TR 96; **Wise County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Lyndon B. Johnson National Grassland Lease with the following FS Stipulations: FS1 (Lufkin): Secretary of Agriculture Rules and Regulations Compliance FS8 (TX) CSU-1B: Perennial & Intermittent Stream Protection FS8 (TX) CSU-1K: Flood Prevention & Erosion Control	264.480
NM-201401-236 TX TR A, PORTIONS OF SURVEY 160, BLK 41 OF H&TC RR, CO SURVEY; TX TR B, PORTIONS OF SURVEY 147, BLK 41 OF H&TC RR, CO SURVEY; **Hephill County, TX**	**Other Surface Management Agency (SMA):** U.S. Forest Service (USFS), Black Kettle National Grasslands Lease with the following FS Stipulations: FS1-NM-Cibola: Secretary of Agriculture Rules and Regulations Compliance FS3 (TX) CSU-1A: Closed Loop Circulation System Required FS3 (TX) NSO-1: Protection of Lake Marvin and Recreation Areas FS3 (TX) TLS-1B: Bald Eagle Timing Stipulation	165.180

2.3 Alternatives Considered But Eliminated From Detailed Analysis

Leasing all forty-four (44) parcels was a considered alternative but eliminated from further analysis as a result of one parcel (Table 2) requiring additional information prior to accurately attaching appropriate stipulations to lease the parcel. The parcel will be deferred until the additional information is available and further internal review is completed.

The following one (1) nominated parcel will be deferred:

Table 2. Parcel deferred.

Parcel	Comments	Acres
NM-201401-215 TR IC-57,I-C-70,I-C-72-1; TR I-C-72-2,I-C-73,IC-77-1; TR I-C-77-2,I-C-78,I-C-79-1; TR I-C-79-2,I-C-80,I-C-97; TR I-C-107-1,I-C-108,I-C-109 TR I-C-110,I-C-111,I-C-112-1 TR I-C-112-2,I-C-112-3; TR I-C-196-1,I-C-196-2; TR I-C-114-1,I-C-115; TR I-C-157 **Jackson County, OK**	Need additional information prior to attaching appropriate stipulations	1273.760

3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

This section describes the environment that would be affected by implementation of the alternatives described in Section 2. Aspects of the affected environment described in this section focus on the relevant resources and issues. Only those elements of the affected environment that have potential to be significantly impacted are described in detail.

The five private surface parcels and two COE parcels will be analyzed in detail in this EA. The five National Forests and National Grasslands parcels analyzed the environmental effects associated with leasing their portions of the 41 Forest Service surface parcels identified in this document. After a review conducted by the OFO staff in the summer of 2013, the OFO concluded that there have not been any changed circumstances that would render their analyses invalid. Hence, the following resource analysis tiers to and incorporates by reference the information and analysis contained in the U.S. Forest Service EISs.

Houston County (-193, -197, and -201)

Houston County is in the east-central part of Texas. It lies about 140 miles north of the Gulf of Mexico and about 80 miles west of the Louisiana State line. It consists of 1,237 square miles (791,680 acres), of which 1,231 square miles (787,840 acres) is land and 6 square miles (3,840 acres) is water. The Neches River forms the eastern boundary, which separates the county from Angelina and Cherokee Counties. The Trinity River forms the western boundary, which separates the county from Leon and Madison Counties. It is bordered by Anderson County on the north and Trinity and Walker Counties on the South. The three proposed parcels are in the southeastern portion of the county along the Trinity County boundary. Proposed parcel -193 straddles both counties spanning an elevation of 300 to 440 feet above sea level.

Trinity County (-193, -227, and -228)

Trinity County is in the east-central part of Texas extending diagonally from the Trinity River, which forms the southwest border, to the Neches River, which forms the northeast border. It is bounded on the north by Houston and Angelina Counties, on the east by Angelina and Polk Counties, on the south by Walker and Polk Counties, and on the west by Houston and Walker Counties. The county has an area of 714 square miles (456,960 acres), of which 693 square miles (443,520 acres) is land and 21 square miles (13,440 acres) is water. The topography of the county is undulating, breaking into abrupt but low hills in some parts of the Neches River. The elevation ranges from 250 to 300 feet above sea level. The highest elevation is one half mile south of the town of Groveton. The proposed parcels are in the northern portion of the county at an elevation ranging from 200 to 340 feet above sea level.

Jasper County (-216)

Jasper County is located in southeast Texas, bored on the north by San Augustine and Sabine counties, on the east by Newton County, on the south by Orange County, and on the west by Hardin and Tyler counties. The county covers an area of about 969 square miles (620,160 acres), of which 937 square miles (599,680 acres) is land and 32 square miles (20,480 acres) is water. Elevations range from 25 to

400 feet above sea level, with the terrain along the northern border and southern third of the county undulating to rolling, while the rest of the county is generally flat. The proposed parcel is along the eastern county boundary at an elevation of about 90 feet above sea level.

Tarrant County (-226)

Tarrant County is in the north-central part of Texas. It is square in shape and has an area of about 863 square miles (552,320 acres) of land and 34 square miles (21,760 acres) of water. It is bounded to the north by Wise and Denton Counties, to the east by Dallas County, on the south by Ellis and Johnson Counties, and on the west by Parker County. The county slopes mainly to the east and southeast. The topography is nearly level to hilly. The elevation ranges from about 960 feet along the Parker County line to about 420 feet in the channel of the West Fork of the Trinity River as it leaves the county. The proposed lease parcel is in the southwest quarter of the state along the western county boundary at about 730 feet above sea level.

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 (Air Resources Technical Report)(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.

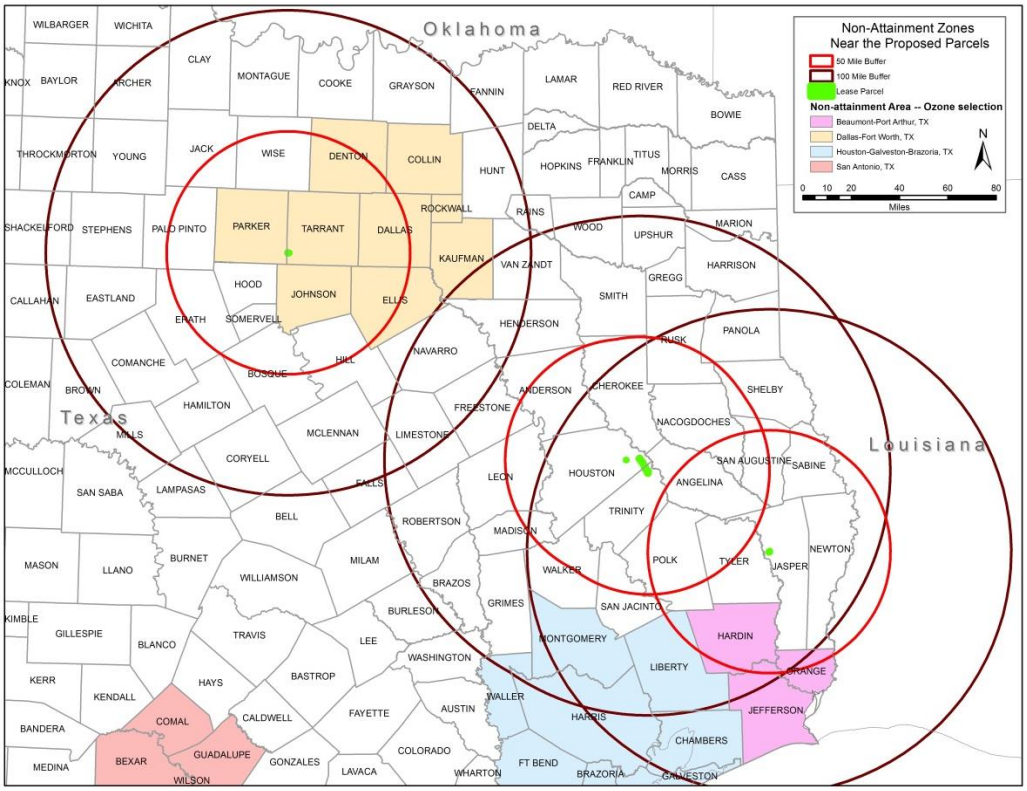
3.1.1 Air Quality

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_2), ozone (O_3), particulate matter (PM10 & PM2.5), sulfur dioxide (SO_2) 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 Texas’ State Implementation Plan (SIP) and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands.

The area of the analysis is considered a Class II air quality area by the EPA. There are three classifications of areas that attain national ambient air quality standards, 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 U.S. are designated as Class II, which allow a moderate amount of air quality degradation. No areas of the U.S. 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, agriculture, and industrial sources.

All parcels are less than 75 miles from at least one EPA designated "non-attainment" area (0_3) while five areas were identified less than 200 miles from any of the proposed parcels. All parcels in Houston, Trinity, and Jasper Counties are less than 75 miles north of the Beaumont-Port Arthur, TX and Houston-Galveston-Brazoria, TX "non-attainment" areas. Parcels in Houston and Trinity Counties are less than 100 miles southeast of the Dallas-Ft. Worth "non-attainment" area; while the Jasper County parcel is less than 175 miles southeast of the "non-attainment" area. The Jasper County parcel is less than 160 miles northwest of the Baton Rouge, LA "non-attainment" area. The parcel in Tarrant County is within the Dallas-Ft. Worth "non-attainment" area (Figure 1).

Figure 1. "Non-attainment" areas near the proposed lease parcels.



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

There is no data available for SO_2, lead and CO. Lead and CO concentrations would not be elevated in rural areas, so there is no monitoring conducted for these pollutants. "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 (EPA 2012a). First line of data in each pollutant and design value represents the Houston and Trinity Parcel, the second line of data represents the Jasper County parcel, and the third line of data represents the Tarrant County parcel.

Pollutant	Design Value (County)*	Averaging period	NAAQS
O_3	0.074 ppm (Montgomery, TX)	8-hour	0.075 ppm[1]
	0.075 ppm (Orange, TX)		
	0.090 ppm (Tarrant, TX)		
$PM_{2.5}$	12.4 µg/m^3 (Harris, TX)	Annual	12.0 µg/m^3[,2]
	12.4 µg/m^3 (Harris, TX)		
	10.6 µg/m^3 (Tarrant, TX)		
$PM_{2.5}$	24.0 µg/m^3 (Harris, TX)	24-hour	35 µg/m^3[,3]
	24.0 µg/m^3 (Harris, TX)		
	23.0 µg/m^3 (Tarrant, TX)		
PM_{10}	0.0 µg/m^3 (Harris, TX)	24-hour	150 µg/m^3[,5]
	0.0 µg/m^3 (Harris, TX)		
	0.0 µg/m^3 (Tarrant, TX)		
Pb	0.01 µg/m^3 (Harris, TX)	Rolling 3-month average	0.15 µg/m^3
	0.01 µg/m^3 (Harris, TX)		
	0.02 µg/m^3 (Harris, TX)		
NO_2	5 ppb (Montgomery, TX)	Annual	53 ppb
	6 ppb (Orange, TX)		
	9 ppb (Tarrant, TX)		
NO_2	58 ppb (Harris, TX)	1-hour	100 ppb[3]
	33 ppb (Orange, TX		
	54 ppb (Tarrant, TX)		
SO_2	1.0 ppb (Harris, TX)	Annual	30 ppb[6]
	1.0 ppb (Harris, TX)		
	1.0 ppb (Dallas, TX)		
SO_2	10.0 ppb (Harris, TX)	1-hour	75 ppb[6]
	10.0 ppb (Harris, TX)		
	4.0 ppb (Dallas, TX)		
CO	2.0 ppm (Harris, TX)	8-hour	9 ppm[4]
	2.0 ppm (Harris, TX)		
	1.0 ppm (Tarrant, TX)		
CO	3.0 ppm (Harris, TX)	1-hour	35 ppm[4]
	3.0 ppm (Harris, TX)		
	1.4 ppm (Harris, TX)		

* Nearest County to proposed parcels with monitoring

+ Incomplete data or no monitoring stations within 100 miles

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

[2] Annual mean, averaged over 3 years

[3] 98th percentile, averaged over 3 years

[4] Not to be exceeded more than once per year
[5] Not to be exceeded more than once per year on average over 3 years
[6] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

Mean AQI values for the area of the proposed lease were generally in the good range (AQI<50) in 2011. The median AQI was 37 in Polk County, 39 in Orange County, 42 in Montgomery County and 49 in Tarrant County; all considered "good." The maximum AQI was 109 in Polk County, 129 in Orange County, 140 in Montgomery County and 169 in Tarrant County. The air quality index in the area annually reaches "unhealthy for sensitive groups" on a number of days each year. Over the past decade, there appears to be a trend toward improved air quality, with fewer "very unhealthy" and "unhealthy" days in the past four years and an downward trend in the total number of "unhealthy for sensitive groups" days in the past decade. Recent years' improvement in the air quality index may be due to reduced air pollution resulting from local, state and national regulations aimed at reducing ozone and particulate matter concentrations. This data is shown in Table 4 (EPA 2012b).

Table 4. Number of Days classified as "unhealthy for sensitive groups" or worse (EPA 2012b). Unhealthy for sensitive groups/unhealthy/very unhealthy

County	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Polk[+]	ND*	ND	ND	ND	ND	ND	ND	Nd	ND	10
Montgomery[+]	5/2	9/1/2	5/1	15/0/1	10/2	7/1	3/0	0/0	4/0	8/0
Orange[++]	11/0	12/1	5/1	10/0	7/0	3/0	1/0	2/0	6/0	5/0
Tarrant	31/8/2	33/10	25/4	41/9/9	32/7	14/1/1	21/1	25/2	14/0	24/4

[+]Proxy for Houston and Trinity Counties [++]Proxy for Jasper County *ND: No Data

Dallas-Ft. Worth "Non-Attainment" Area

Proposed parcel -226 is located within the Dallas-Ft. Worth (DFW) non-attainment area (Figure 1). The DFW non-attainment area includes 10 counties (Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise Counties) being designated non-attainment and classified as moderate under the 2008 eight-hour ozone NAAQS. The attainment deadline for the DFW moderate non-attainment area is December 31, 2018. Operators must comply with Rules in Title 30, Texas Administrative Code, Chapters 115 and 117 that are part of the State Implementation Plan strategy to meet the National Ambient Air Quality Standard for ozone. These rules reduce ozone by limiting VOC and NOx emissions from stationary and mobile sources.

In accordance with the Federal Clean Air Act, all federal actions in a non-attainment area must be analyzed to ensure that the action does not cause or contribute to violations of the National Ambient Air Quality Standards or delay timely attainment of the standards. This is referred to as the general conformity rule. EPA has approved a general-conformity SIP for the state of Texas. General conformity rules establish a threshold of emissions levels in tons per year based on the severity of an area's air quality problem. If a federal action has direct and indirect emissions below the threshold, emissions are considered to be "de minimus" and there is no need for a general conformity determination which demonstrates emissions will not exacerbate non-attainment or the timing of attainment. For the Dallas-

Fort Worth area, the de minimus threshold is 50 tons per year of VOC and 50 tons per year of NOx emissions (http://www.tceq.texas.gov/airquality/mobilesource/gc.html).

The Texas Commission on Environmental Quality (TCEQ) maintains an emission inventory of current information for sources of NO_x and VOC—those that most contribute to ozone levels. The total inventory of NO_x and VOC emissions for an area is derived from estimates developed for five general categories of emissions sources: point, area, non-road mobile, on-road mobile, and biogenic. Unlike other non-attainment areas in Texas, where industrial point sources account for a greater proportion of the total NO_x emissions in the area, point sources account for only about one-tenth of the total NO_x emissions in the DFW area. The majority of NO_x emissions in the DFW area come from on-road mobile sources (cars and trucks) and non-road mobile sources (i.e. construction equipment, aircraft, and locomotives). TCEQ has implemented several ozone emission reduction strategies to meet the 2018 attainment date set by EPA. Despite a continuous increase in the population of the DFW area, the area is exhibiting decreasing trends for ozone and its precursors, NOx and VOC. The eight-hour ozone design value in 2010 is 18% lower than the eight-hour ozone design value in 1991. The number of eight-hour ozone exceedance days over the past 20 years has also decreased significantly from 26 days in 1991 to 8 days in 2010. Over the same time period the number of ozone monitors in the DFW area more than doubled (TCEQ 2011).

Modeling and data analyses have consistently shown that NO_x reductions are far more effective at reducing ozone in DFW than VOC reductions. In 2008, biogenic emissions are 66% of the total VOCs in the DFW area. Oil and gas VOC emissions for the same area are 14% of the total VOCs. Thus, even if VOC emissions from oil and gas activities were controlled, there would be enough biogenic VOCs to carry ozone reactions forward.

Emissions of ozone and fine particle smog forming compounds from all Barnett Shale activities were approximately 191 tons per day (tpd) on an annual average basis in 2009. During the summer, VOC emissions increased raising the NO_x and VOC total to 307 tpd, greater than the combined emissions from the major airports and on-road motor vehicles in the DFW area. Emissions in 2009 for air toxic compounds were approximately 6 tpd on an annual average, with peak summer emissions of 17 tpd (Armendariz 2009).

3.1.2 Climate

Texas lies within both “cool” and “warm” parts of the Temperate Zone of the northern hemisphere. There are three major climatic types which are classified as Continental, Mountain, and Modified Marine. There are no distinct boundaries which divide these climate types. Most of the State, climatologically, has a Modified Marine climate which is classified and named “subtropical” with four subheadings. A marine climate is caused by the predominant onshore flow of tropical maritime air from the Gulf of Mexico. The onshore flow is modified by a decrease in moisture content from east to west and by intermittent seasonal intrusions of continental air. The four subheadings of Subtropical—humid, subhumid, semi-arid and arid—account for the changes in moisture content of the northward flow of Gulf air across the State (Larkin and Bomar 1983).

Table 5. Summary of climate components that could affect air quality in the region.

Climate Component	Houston County	Trinity County	Jasper County	Tarrant County
Mean maximum summer temperatures	92.7°F	92.2°F	91.2°F	93.2°F
Mean minimum winter temperatures	38.4°F	36.4°F	39.4°F	37.1°F
Mean annual temperature	66.3°F	65.2°F	66.4°F	65.7°F
Total annual precipitation	45.18 inches	49.31 inches	56.18 inches	37.80 inches
Total annual snowfall	0.4 inches	0.2 inches	0.3 inches	2.1 inches
Mean annual wind speed	13 mph	14.77 mph	13.65 mph	16.02 mph
Prevailing Wind Direction	South	South	South	South

In addition to the air quality information in the Texas 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_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). CO_2 and CH_4 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_2; CH_4, N_2O; 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_2 concentrations to increase dramatically, and are likely to contribute to overall climatic changes. Increasing CO_2 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_2 and CH_4) 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

The varied climate and topography of Texas 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 produce soils low in phosphorous and potassium, while at the same time being moderately to strongly acidic.

The Natural Resource Conservation Service (NRCS) has surveyed the soils in the proposed parcels. Twenty soil types were identified in seven parcels (Appendix 3).

The NRCS has 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. Five index values were identified from the seven parcels ranging from 38 to 134 tons per year (Appendix 3).

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 0.15 to 0.49. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Two values (0.20 and 0.37) were identified for the proposed lease parcels (Table 5) indicating moderate susceptibility to soil loss by sheet and rill erosion.

3.3 Water Resources

3.3.1 Surface water

Texas' abundant surface water resources include rivers, streams and both natural and man-made reservoirs. There are 23 surface water basins in Texas, including 15 major river basins and eight coastal basins, each with varying hydrological regimes and abilities to provide water supplies. The state's water availability models estimate that available surface water during drought is 13.3 million acre-feet in 2010. Of this amount, only 9.0 million acre-feet can be used as existing supply due to physical and legal constraints. Existing surface water supply is project to decrease to 8.4 million acre-feet by 2060, primarily from sedimentation of existing reservoirs.

Houston County

Houston County Lake, in the west-central part of the county, provides water for the cities Crockett and Grapeland, as well as fishing and recreational activities. The Trinity, Neches River, and numerous smaller streams, creeks, farm ponds, and lakes provide abundant water supplies for the county. Approximately the western two-thirds of Houston County is drained by the Trinity River and its tributaries and the eastern one-third is drained by the Neches River. In the northern part of the county, most of the streams are perennial and have developed a trellis-type drainage pattern, whereas in the southern part of the county, most of the streams are intermittent and have developed a dendritic drainage pattern.

Bristow Creek parallels proposed parcel -193 to the west for about 2.7 miles before heading northeast and passing through 0.5 miles of the parcel. Approximately 0.6 miles of an unnamed tributary of Bristow Creek pass through the southern portion of the parcel. There are four named tributaries (Bristow Creek, Cochino Bayou, McCombe Branch, and Tar Kiln Branch) and at least 11 unnamed tributaries are <1.0 mile from the proposed parcel.

Approximately 0.1 miles of Bristow Creek begin in the extreme southern portion of proposed parcel -197, while 0.9 miles of an unnamed tributary of McCombe Branch parallels the southeastern boundary inside the parcel. There are three named streams (Bristow Creek, McCombe Branch, and Conner Creek) and seven unnamed tributaries <1.0 miles from the proposed parcel.

There are no named or unnamed drainages within proposed parcel -201. There are three named streams and six unnamed streams <1.0 mile from the proposed parcel.

Several small (<1.0 acre) ponds for livestock use or hydraulic fracturing are within 1.0 mile of all three parcels. The nearest larger water body is to parcels -193 and -197 are >3.0 miles away. Ratcliff Lake is about 0.6 miles west of proposed parcel -201.

Trinity County

Lake Livingston in the southwestern part of the county and provides flood control, fishing, and other recreational activities. The smaller creeks and lakes provide abundant water supplies for the county.

Approximately 1.1 miles of unnamed tributaries begin within the proposed parcel and flow towards the Cochino Bayou and North Fork Cedar Creek. There are at least nine unnamed tributaries <1.0 miles from the parcel. Cochino Bayou, Bristow Creek and Tar Kiln Branch are all <1.0 mile to north and west of the proposed parcel, while the North Fork Cedar Creek is about 1.2 miles south.

Approximately 0.9 miles of Cochino Bayou traverse through the center of proposed parcel -228, along with 0.65 miles of Bristow Creek a northern tributary of the Cochino Bayou, and 0.45 miles of Tar Kiln Branch a southern tributary of Cochino Bayou. Approximately 0.15 miles of an unnamed tributary of Bristow Creek flows through the extreme northern tip of the parcel and 0.5 miles of an unnamed tributary of Cochino Bayou forms a portion of the southeastern boundary of the parcel. An additional four unnamed tributaries of Bristow Creek, Tar Kiln and Cochino Bayou are <1.0 miles to the proposed parcel.

For both of these parcels, several small (<1.0 acre) ponds for livestock use or hydraulic fracturing are within 1.0 mile. The nearest larger water body is >3.0 miles away.

Jasper County

Jasper County is drained by the Sabine and Neches Rivers. The rivers empty south of the county into Sabine Lake. The principal water sources in the county include Sam Rayburn Reservoir, Lake B.A. Steinhagen, the Neches River, and the Angelina River.

Approximately 0.75 miles of Sandy Creek forms the northern boundary of the proposed parcel. County Road 155 separates the proposed parcel from B. A. Steinhagen Lake. The entire parcel is within 1000 feet of the high water mark. There is a small (~2.5 acre) pond adjacent to the parcel on private land to the east. Two unnamed tributaries of Sandy Creek are <0.6 miles northwest of the parcel and one unnamed tributary of the Neches River is <0.6 miles south of the parcel.

Tarrant County

The county is drained by the West Fork, Clear Fork, and Elm Fork of the Trinity River. Six lakes within the county make up about 19,500 surface acres and provide flood control, recreation, and part of the county's water supply.

Approximately 0.9 miles of Clear Fork Trinity River pass through proposed parcel -226. The Clear Fork Trinity River and eleven unnamed tributaries are <1.0 mile from the proposed parcel. The main body of Benbrook Lake is <2.0 miles east of the proposed parcel and the closest inlet to the lake is <0.25 miles south of the proposed parcel.

River Basins and Planning Areas of the Proposed Parcels

The proposed parcels in Houston, Trinity, and Jasper Counties are within the Neches River Basin and in the Texas Water Development Board (TWDB) Region I Planning Area. The Neches River Basin is the third largest river basin whose watershed is entirely within Texas and the fourth largest by average flow volume. The Neches River flows from headwaters in Van Zandt County to its confluence with Sabine

Lake, which drains to the Gulf of Mexico. The basin is an important source of surface water supply for growing cities outside the basin.

The Tarrant County proposed parcel is within the Trinity River Basin and in the TWDB Region C Planning Area. The predominant flow of streams is from northwest to southeast, as is true for most of Texas. The major streams in Region C include: Brazos River, Red River, Trinity River, Clear Fork Trinity River, West Fork Trinity River, Elm Fork Trinity River, East Fork Trinity River, and numerous other tributaries of the Trinity River. According to the Texas Parks and Wildlife Department there are 324 streams of various sizes in Region C (Freese and Nichols, Inc. et al. 2010).

Water use in Region C has increased in recent years, primarily in response to increasing population and municipal use. The historical record shows years of high use associated with dry weather particularly for increased municipal demand for outdoor water use (i.e. lawn watering). There is limited steam electric, mining, irrigation, and livestock use in Region C. Although groundwater provided only 7.5 percent of the overall water use in Region C, it provided 13 percent of the irrigation use, 23 percent of the livestock use, and 93 percent of the mining use, including oil and gas development (Freese and Nichols, Inc. et al. 2010).

Watersheds of the Proposed Parcels

The seven proposed parcels lie within three HUC 8 watersheds (Table 6) 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 6. Watersheds of the proposed lease parcels.

Watershed	Parcel	Acres	Watershed Impairments	Nearest Impaired Water
Middle Neches (HUC 8 12020002)	-193, -197, -201, -227, -228	1486.90	Lake Ratcliff: Mercury in Fish Tissue Neches River: Lead	-201 <0.7 miles east of Lake Ratcliff -193, -197, -227, and -228 >2.0 miles west of Neches River
Lower Neches (HUC 8 12020003)	-216	51.70	Sandy Creek: Bacteria B.A. Steinhagen Lake: Mercury in Fish Tissue	Sandy Creek forms the northern boundary of the parcel -216 <500 feet east of B.A. Steinhagen Lake

Watershed	Parcel	Acres	Watershed Impairments	Nearest Impaired Water
Lower West Fork Trinity (HUC 8 12030102)	-226	71.69	Bacteria, Dissolved Oxygen	Approximately 1.0 mile of Clear Fork Trinity River Below Lake Weatherford is within -226 or <500 feet from -226

3.3.2 Groundwater

Groundwater deposits underlie about 76 percent of Texas and it is considered to be one of the state's most valuable resources. Sixty percent of the freshwater used in Texas is supplied from 23 major aquifers. Groundwater supplies are produced from numerous saturated geologic formations comprised of various mineralogic types such as sand and gravel alluviums and cavernous limestones and dolomites.

Houston and Trinity Counties

The source of all groundwater in Houston and Trinity Counties is precipitation. Most of the recharge occurs as rainfall on the outcrops of the water-bearing formations, although lesser amounts of recharge probably result from seepage from streams that cross the outcrop areas. The water that enters the formations moves generally down the dip of the water-bearing beds into the artesian sections of the aquifers. Several factors affect recharge including: the intensity and amount of rainfall, the slope of the land surface, the type of soil, the permeability of the aquifer, the rate of evapotranspiration, and the quantity of water in the aquifer.

Proposed parcels -193, -197, -201, -227, and -228 are along the southern edge of the Carrizo Major Aquifer. The Carrizo aquifer can produce 500 to 3,000 gallons per minute (gpm). The aquifer extends across much of eastern Texas and cross 66 counties. The aquifer contains water under artesian pressure. Under artesian conditions, the water is confined under hydrostatic pressure in the sands between relatively impermeable beds, and where the elevation of the land surface at a well is considerably below the general level of the area of outcrop. Pumpage for irrigation accounts for just over half the water pumped, and pumping for municipal supply accounts for another 40 percent. The groundwater, although hard, is generally fresh in the outcrop, whereas softer groundwater with higher total dissolved solids occurs in the subsurface. High iron and manganese content is characteristic of much of the aquifer, and localized saline contamination has affected portions of the aquifer (TWDB 2011).

Jasper County

Proposed parcel -216 is in the northeastern corner of the Gulf Coast Major Aquifer. The aquifer parallels the Gulf of Mexico coastline from the Louisiana border to the border of Mexico and covers 54 counties. The maximum total sand thickness of the aquifer ranges from 700 feet in the south to 1,300 feet in the north. Freshwater saturated thickness averages about 1,000 feet. Water quality varies with depth and locality; it is generally good in the central and northeastern parts of the aquifer, including the proposed parcels, where the water contains less than 500 milligrams per liter of total dissolved solids, but declines to the south, where it typically contains 1,000 to more than 10,000 milligrams per liter of total dissolved solids and where the Gulf Coast Aquifer productivity decreases. High levels of radionuclides, thought

mainly to be naturally occurring are found in some wells in the outcrop and in South Texas. The aquifer is used for municipal, industrial, and irrigation purposes. In Harris, Galveston, Fort bend, Jasper, and Wharton Counties, water level declines of as much as 350 feet have led to land subsidence (TWDB 2011).

Tarrant County

The Trinity aquifer provides water supplies to North-Central Texas, including the proposed parcel, for over a century. By the 1920s water levels declined in the aquifers and wells stopped flowing in many areas initiating the installation of pumps into wells. Groundwater wells continued to increase until the near present. Water level declines have been relatively minor in recharge zones, but water level declines increase to more than 800 feet towards the east in the Dallas-Fort Worth Metroplex area and near Waco, Texas, particularly in counties along the Interstate 35 corridor including Tarrant County (TWDB 2007). These declines are primarily attributed to municipal pumping, but they have slowed over the past decade as result of increasing reliance on surface water (TWDB 2011). TWDB estimates the amount of groundwater use associated with gas well development in the Barnett Shale accounts for about 3 percent of the total groundwater use in a 19-county area.

Water quality in the Trinity aquifer is acceptable for most municipal and industrial purposes. In some areas, natural concentrations of arsenic, fluoride, nitrate, chloride, iron, manganese, sulfate, and total dissolved solids in excess of either primary or secondary drinking water standards can be found (Freese and Nichols, Inc. et al. 2010). The primary source of recharge to the Trinity aquifers is infiltration from precipitation. The amount of recharge is estimated to be less than one inch per year, amounting to about 3 percent of average annual precipitation in the area (TWDB 1999).

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.

Proposed parcel -216 and -226 are within mapped floodplains. Proposed parcels -193, -197, and -201 are not in mapped floodplains. Floodplains in Trinity County cannot be identified as the unincorporated areas in the county have not been mapped by Federal Emergency Management Agency (FEMA).

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.

All of the proposed parcels are in or near wetland and/or riparian habitat.

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 FFPA 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 20 different soil types within the seven proposed lease parcels. Twelve soil types were identified as "Not Prime Farmland," totaling 854.7 acres or 53.8 percent of the total acreage of all proposed lease parcels. Eight soil types were identified as "All areas are prime farmland," totaling 734.0 acres or 46.2 percent of the total acreage of all proposed lease parcels. 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 25,000 archeological sites are recorded in Texas and over 3,000 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 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.

A Class I cultural resource review was done on each parcel which identified several eligible historic properties within the many of the lease boundaries. Many other parcels are known to have archeological sites within their surface boundaries. Parcel -197 has a historic cemetery located within

the boundaries of the lease. Parcel -201 has the Eligible Central Coal & Coke Co. sawmill complex within the lease boundary. Parcels -206 and -207 are within ½ mile of the El Camino Real de los Tejas National Historic Trail. Parcel -226, has the remnants of a probably Bruce Goff designed home. Parcel -236 Lake Marvin Works Progress Administration recreational facilities which are also eligible for the National Register of Historic Places.

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 includes with the cultural resource report and include statements on any new paleontological material discovered during inventory. These reports are reviewed and new fossil material is reported to paleontologists.

3.6.3 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 scared 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 Alabama-Coushatta Tribe of Texas, the Comanche Nation, and the Tonkawa Tribe. 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 Texas listed 27 plant species as having a serious potential to cause economic or ecological harm to the state (4 TAC §19.300, as amended). The Early Detection & Distribution Mapping System (2013) at the University of Georgia has identified 61 species in Houston County, 40 species in Trinity County, 68 species in Jasper County and 174 species in Tarrant County as being exotic to the US and listed as a problem somewhere in the US. Five of the 55 species in Houston County, five of the 40 species in Trinity County, ten of the 68 species in Jasper County and nine of the 174 species in Tarrant County were also listed by the State of Texas (Table 7).

Table 7. Invasive and Non-native Species documented in Sabine and Live Oak Counties.

County	Species	Habitat	Potential Habitat
Jasper Tarrant	Alligatorweed *Alternanthera philoxeroides*	Invades aquatic areas and adjoining uplands; can also grow terrestrially	Yes: -216 and -226 streams in the parcel
Houston Jasper Tarrant	Giant reed *Arundo donax*	Grows in various ecosystems, habitat types, and cover types; areas following disturbances where vegetation is killed and/or removed and/or soil is disturbed; more common in riparian, floodplain, and wetland habitats	Yes: -193, -197, -201, and -216, and -226 likely disturbance after development as well each have some degree of wetland/riparian areas; -226 in floodplain;
Trinity Tarrant	Baloonvine Cardiospermum halicacabum	Climbing plant widely distributed in tropical and subtropical environments; often found as a weed along roads and rivers	Yes: -193, -226, -227, and -228 likely disturbance after development as well each have streams in the parcel
Trinity Jasper Tarrant	Waterhyacinth *Eichhornia crassipes*	Floating plant in all types of freshwater; occurs throughout the southeast	Yes: -193, -216, -226, -227, and -228 streams in the parcel
Houston Jasper Tarrant	Hydrilla *Hydrilla verticillata*	Grows in only a few inches to >20 feet deep freshwater (springs, lakes, marshes, ditches, rivers, tidal zones); somewhat winter-hardy, optimum water temperature is 68-81°F; can grow in any nutrient conditions with or without full sun and even in 7% salinity of seawater	Yes: -197, -201, -216, and -226 streams in the parcel No: -193
Houston Trinity Jasper	Japanese climbing fern *Lygodium japonicum*	Can grow in sun or shade, damp, disturbed or undisturbed areas; usually moist, swampy habitat; disturbed areas are preferred; needs other vegetation around it to spread	Yes: -193, -197, -201, -216, -227 and -228 likely disturbance after development, all in subtropical climate with sufficient surrounding vegetation
Tarrant	Broomrape *Orobanche ramosa*	Typically a pest in agricultural fields, infesting crops including tobacco, potato, and tomato.	No: not in cropland
Trinity Tarrant	Torpedograss *Panicum repens*	Grows in or near shallow waters forming monocultures where it can quickly displace native vegetation; can also be found in more upland situations especial in sod production	Yes: -193, -226, -227, and -228 streams in the parcel
Jasper Tarrant	Kudzu *Pueraria Montana var. lobata*	Spreads rapidly in open, disturbed areas (abandoned fields, roadsides, forest edges), in densely vegetated areas spread slowly; areas with mild winters (40-60°F), summer temperatures >80°F and annual precipitation >40"; deep, well-drained, loamy soils	Yes: -216 and -226 in sparsely vegetated areas in disturbed areas (roads, streams) as well as additional disturbance likely from development

County	Species	Habitat	Potential Habitat
Jasper	Waterfern Salvavinia *Salvavinia minima*	Float fern that grows on the surface of still waterways.	Yes: found in B.A. Steinhagen Lake
Houston Jasper	Giant salvinia *Salvinia molesta*	Slightly acidic, high nutrient, warm, slow-moving freshwater (streams, lakes, ponds, ditches, rice fields); resistant to periods of low temperature, dewatering, and elevated pH levels; low tolerance to salinity	Yes: -216 found in B.A. Steinhagen Lake; -193 and -197 streams in the parcel No: -201 no water in parcel
Jasper	Tropical soda apple *Solanum viarum*	Most invasive in pastures but also occurs in croplands and native plant communities; in Texas, occurs in native grasslands and forested areas.	No: Habitat has been significantly altered from the native plant community
Houston Trinity Jasper Tarrant	Chinese tallowtree *Triadica sebifera*	Invades several plant communities including Gulf coastal prairies and many types of forests in the southeastern U.S.; common on disturbed sites such as spoilbanks, roadsides, agricultural lands, urban areas, and storm-damaged forests.	Yes: -193, -197, -201, -216, -226, -227, and -228 likely disturbance after development; most have roads forming their boundary or are within the parcel

3.8 Vegetation

Differences in amount and frequency of rainfall, variation in soils and temperatures gives Texas a great diversity of vegetation. From the grassy plains of North Texas to the coastal and inland wetlands to the semi-arid brush lands of South Texas, plant species change accordingly.

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 Texas, there are 12 level III ecoregions and 56 level IV ecoregions and most continue into ecologically similar parts of adjacent states.

The proposed parcels in Houston, Trinity, and Jasper Counties are in the Southern Tertiary Uplands ecoregion (EPA 35e). The Tertiary Uplands ecoregion is part of the larger South Central Plains (Level III) ecoregion. The South Central Plains is locally termed the “piney woods” and is made up of mostly irregular plains on the western edge of the southern coniferous forest belt. The Southern Tertiary Uplands (Level IV ecoregion) covers the remainder of longleaf pine range north of the Flatwoods ecoregion in Texas and Louisiana (7,667 square miles). Historical vegetation was dominated by longleaf pine-bluestem woodlands (*Pinus palustris-Schizachyrium spp. and Andropogon spp.*), but a variety of forest types were present, including short-leaf pine hardwood forests (*Pinus echinata-Quercus spp.*), mixed hardwood-loblolly pine (*Pinus taeda*) forests, and hardwood-dominated forests along streams. On more mesic sites, some American beech (*Fagus grandifolia*) or magnolia-beech-loblolly pine forests occurred. Some sandstone outcrops of the Catahoula formation have distinctive barrens or glades in Texas and Louisiana that contain several rare species. Forested seeps in sand hills support acid bog species including southern sweet bay (*Magnolia virginiana*), hollies or gallberry (*Ilex spp.*), wax-myrtles (*Morella spp.*), insectivorous plants, orchids, and wild azalea (*Rhododendron spp.*). Large parts of the region are federally owned and managed by the National Forest, while other parts are cultivated for timber production or used as pasture for livestock production (Griffith et al. 2007).

The proposed parcel in Tarrant County is in the Western Cross Timbers ecoregion (EPA 29c), which covers the wooded areas west of the Grand Prairie ecoregion on sandstone and shale beds, covering 8,274 square miles. This ecoregion, along with the Eastern Cross Timbers ecoregion, make up the southern portion of the larger Cross Timbers level III ecoregion (EPA 29) that extends into Oklahoma and Kansas. The entire region is a mosaic of oak woodland and prairie that forms the transition between the eastern deciduous forest and the Great Plains. The oak woodland is concentrated on sandstone substrates while prairie grasses dominate on surrounding limestone formations or interior limestone inclusions. Trees in the Western Cross Timbers are drought-stressed; they experience erratic precipitation and seasonal extremes in temperature. Trees growing under such conditions may be several hundred years old and no taller than 20 to 30 feet. The dominant trees are post oak and blackjack oak with an understory of shrubs and grasses. The prairie openings historically contained taller grasses such as big bluestem (*Andropogon gerardii*), yellow Indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*) growing on deeper soil, and shorter grasses such as sideoats grama (*Bouteloua curtipendula*), buffalograss (*Buchlow dactyloides*), and silver bluestem (*Bothriochloa laguroides ssp. torreyana*) growing on shallow soil. The grassy understory is better developed on the red, gravelly soils. The riparian vegetation resembles that of the Grand Prairie and Eastern Cross Timbers.

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 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." A biological evaluation was prepared by an Oklahoma Field Office biologist to document the potential for and effects on federally protected species. A total of seven federally protected species were identified as occurring or having the potential to occur in the county (Table 8).

Table 8. Federally listed species identified within the county parcels.

Scientific Name	Federal Status	County	Habitat/Distribution
Louisiana pine snake *(Pituophis ruthveni)*	C	Jasper	*Habitat:* Occur in longleaf pine-oak sandhills interspersed with moist bottomlands; sometimes in adjacent blackjack oak woodlands and in sandy areas of short-leaf pine/post oak forest; prefers openly wooded areas over dense forest; frequently found in fields, farmland, and tracts of second-growth timber. *Distribution*: Historically in portions of west-central Louisiana and extreme east-central Texas. This area roughly coincides with a disjunct portion of the longleaf pine ecosystem situated west of the Mississippi River. Currently extant in a small portion of the historical range.

Scientific Name	Federal Status	County	Habitat/Distribution
Red-cockaded woodpecker *(Picoides borealis)*	E	Jasper, Houston, Trinity	*Habitat:* Open pine forests with large, widely-spaced older trees provide essential habitat for the red-cockaded woodpecker. *Distribution:* The red-cockaded woodpecker can be found in the Pineywoods of east Texas.
least tern *(Sterna antillarum)*	E	Tarrant	*Habitat:* Terns live along large rivers and may sometimes be found hunting fish in shallow wetlands and the margins of ponds and lakes. Least Terns require bare sand and gravel for nesting and typically nest in small colonies consisting of two to 20 pairs along large rivers on sand bars and scoured bends. *Distribution:* In Texas, Interior Least Terns are found at three reservoirs along the Rio Grande River, on the Canadian River in the northern Panhandle, on the Prairie Dog Town Fork of the Red River in the eastern Panhandle, and along the Red River (Texas/Oklahoma boundary) into Arkansas.
Whooping Crane *(Grus Americana)*	E	Tarrant	*Habitat:* 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; salt marshes of Aransas National Wildlife Refuge (NWR); coastal prairies with swales and ponds. *Distribution:* Breed in Canada during the summer months; migrate to Texas' coastal plains near Rockport in and around Aransas NWR November – March
Navasota ladies'-tresses *(Spiranthes parksii)*	E	Jasper	*Habitat:* Margins of post oak (*Quercus stellata*) woodlands in sandy loams along intermittent tributaries of rivers. Often in areas where edaphic or hydrologic factors (such as high levels of aluminum in the soil or a perched water table) limit competing vegetation in the herbaceous layer. Besides post oak, associated species include water oak (*Q. nigra*), blackjack oak (*Q. marilandica*), and yaupon (*Ilex vomitoria*). *Distribution:* Endemic to eastern Texas, Navasota River, in Brazos County. Also in Burleson, Grimes and Navasota Counties.
Neches River rose-mallow *(Hibiscus dasycalyx)*	C	Houston, Trinity	*Habitat:* Openings in post oak woodlands in sandy loams along upland drainages or intermittent streams, often in areas with suitable hydrologic factors, such as a perched water table associated with the underlying claypan. *Distribution:* Bastrop, Brazos, Burleson, Fayette, Freestone, Grimes, Jasper, Leon, Limestone, Madison, Milam, Robertson, Washington Counties.
Texas prairie dawn-flower *(Hymenoxys texana)*	E	Trinity	*Habitat:* In poorly drained, sparsely vegetated areas (slick spots) at the base of mima mounds in open grassland or almost barren areas on slightly saline soils that are sticky when wet and powdery when dry. *Distribution:* Fort Bend, Harris and Trinity Counties.

3.9.2 Special Status Species

Texas legislature authorized the Texas parks and Wildlife Department (TPWD) to establish a list of endangered plants and animals in the state (31 T.A.C §65.171 -65.176). Endangered species, under the

Texas legislation, means "species which the Executive Director of TPWD has named as being 'threatened with statewide extinction (animals)' [or] 'in danger of extinction throughout all of a significant portion of its range' (plants)." Threatened species, under Texas legislation, means "species which the TPWD Commission has determined are likely to become endangered in the future." TPWD regulations prohibit the taking, possession, transportation, or sale of any of the animal species designated by state law as endangered or threatened without the issuance of a permit. In addition, some species listed as threatened or endangered under state law are also listed under federal regulations. These animals are provided additional protection by the Service and ESA. Thirty-three state listed species were identified within the four counties (Table 9).

Table 9. State listed species occurring within the county parcels.

Scientific Name	State Status	County	Habitat/Distribution
American Peregrine Falcon *(Falco peregrinus anatum)*	T	Tarrant, Jasper, Trinity, Houston	*Habitat:* They can be found nesting at elevations up to about 12,000 feet, as well as along rivers and coastlines or in cities, where the local Rock Pigeon populations offer a reliable food supply. In migration and winter you can find Peregrine Falcons in nearly any open habitat, but with a greater likelihood along barrier islands, mudflats, coastlines, lake edges, and mountain chains. *Distribution*: The American Peregrine is a resident of the Trans-Pecos region, including the Chisos, Davis, and Guadalupe mountain ranges.
Bald Eagle *(Haliaeetus leucocephalus)*	T	Tarrant, Jasper, Trinity, Houston	*Habitat:* Bald Eagles typically nest in forested areas adjacent to large bodies of water, staying away from heavily developed areas when possible. Bald Eagles are tolerant of human activity when feeding, and may congregate around fish processing plants, dumps, and below dams where fish concentrate. For perching, Bald Eagles prefer tall, mature coniferous or deciduous trees that afford a wide view of the surroundings. In winter, Bald Eagles can also be seen in dry, open uplands if there is access to open water for fishing. *Distribution*: Bald Eagles are present year-round throughout Texas as spring and fall migrants, breeders, or winter residents. The Bald Eagle population in Texas is divided into two populations; breeding birds and nonbreeding or wintering birds. Breeding populations occur primarily in the eastern half of the state and along coastal counties from Rockport to Houston. Nonbreeding or wintering populations are located primarily in the Panhandle, Central, and East Texas, and in other areas of suitable habitat throughout the state
Interior Least Tern *(Sterna antillarum athalassos)*	E	Tarrant, Houston	*Habitat:* Terns live along large rivers and may sometimes be found hunting fish in shallow wetlands and the margins of ponds and lakes. Least Terns require bare sand and gravel for nesting and typically nest in small colonies consisting of two to 20 pairs along large rivers on sand bars and scoured bends. *Distribution*: In Texas, Interior Least Terns are found at three reservoirs along the Rio Grande River, on the Canadian River in the northern Panhandle, on the Prairie Dog Town Fork of the Red River in the eastern Panhandle, and along the Red River (Texas/Oklahoma boundary) into Arkansas.

Scientific Name	State Status	County	Habitat/Distribution
Peregrine Falcon *(Falco peregrinus)*	T	Tarrant, Jasper, Trinity, Houston	*Habitat:* Occupies wide range of habitats. *Distribution*: Both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; also known to be a resident breeder in west Texas.
Whooping Crane *(Grus americana)*	E	Tarrant,	*Habitat:* 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; salt marshes of Aransas National Wildlife Refuge (NWR); coastal prairies with swales and ponds. *Distribution*: Breed in Canada during the summer months; migrate to Texas' coastal plains near Rockport in and around Aransas NWR November – March.
White-faced Ibis *(Plegadis chihi)*	T	Jasper, Trinity	*Habitat:* Prefers freshwater marshes, sloughs, and irrigated rice fields. *Distribution*: The White-faced Ibis is an uncommon to common resident along the Texas coast; and, is a rare and localized breeder inland as far north as the Panhandle.
Wood Stork *(Mycteria Americana)*	T	Jasper, Trinity, Houston	*Habitat:* Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water. *Distribution*: Breeds in Mexico and then moves into the Gulf States in search of mud flats and other wetlands, and forested areas. No breeding record in Texas since 1960.
Bachman's Sparrow *(Aimophila aestivalis)*	T	Jasper, Trinity, Houston	*Habitat:* The Bachman's Sparrow prefers areas with a high density of herbaceous cover and a low density of mid and overstory. *Distribution*: In Texas, the Bachman's Sparrow occurs only in the far eastern portion of the state.
Piping Plover *(Charadrius melodus)*	T	Jasper, Trinity, Houston	*Habitat:* Beaches, bayside and mud and salt flats. *Distribution*: Wintering migrant along the Texas Gulf Coast.
Red-cockaded Woodpecker *(Picoides borealis)*	E	Jasper, Trinity, Houston	*Habitat:* Open pine forests with large, widely-spaced older trees provide essential habitat for the red-cockaded woodpecker. *Distribution:* The red-cockaded woodpecker can be found in the Pineywoods of east Texas.
Swallow-tailed Kite *(Elanoides forficatus)*	T	Jasper	*Habitat:* Nesting and foraging habitats include various pine forests and savannas, cypress swamps and savannas, cypress-hardwood swamps, hardwood hammocks, mangrove swamps, narrow riparian forests, prairies, and freshwater and brackish marshes. *Distribution*: Breeding range extends from South Carolina south to Florida, and west to Louisiana and east Texas.
Gray Wolf *(Canis lupus)*	E	Tarrant	*Habitat:* Forests, brushlands or grasslands. *Distribution*: Extirpated
Red Wolf *(Canis rufus)*	E	Tarrant, Trinity	*Habitat:* Brushy and forested areas, as well as coastal plains. *Distribution*: Extirpated
Black Bear *(Ursus americanus)*	T	Jasper, Trinity	*Habitat:* Bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear. *Distribution*: Transient

Scientific Name	State Status	County	Habitat/Distribution
Louisiana Black Bear *(Ursus americanus luteolus)*	T	Jasper, Trinity	*Habitat:* Bottomland hardwoods and large tracts of inaccessible forested areas. *Distribution*: Transient
Rafinesque's Big-Eared Bat *(Corynorhinus rafinesquii)*	T	Jasper, Trinity	*Habitat:* Occurs in forested regions largely devoid of natural caves. Its natural roosting places are in hollow trees, crevices behind bark, and under dry leaves. It has been observed most frequently in buildings, both occupied and abandoned. Texas specimens have been captured in barns and abandoned wells. *Distribution*: A bat of the southeastern United States, Rafinesque's big-eared bat reaches the westernmost portion of its range in the pine forests of East Texas.
Louisiana Pigtoe *(Pleurobema riddellii)*	T	Tarrant, Jasper, Trinity, Houston	*Habitat:* Streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments. *Distribution*: Sabine, Neches, and Trinity (historic) River basins.
Texas Heelsplitter *(Potamilus amphichaenus)*	T	Tarrant, Jasper, Trinity, Houston	*Habitat:* Quiet waters in mud or sand and also in reservoirs. *Distribution*: Sabine, Neches, and Trinity River basins.
Sandbank Pocketbook *(Lampsilis satura)*	T	Jasper, Trinity, Houston	*Habitat:* Small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms. *Distribution*: East Texas, Sulfur south through San Jacinto River basins; Neches River.
Texas Pigtoe *(Fusconaia askew)*	T	Jasper, Trinity, Houston	*Habitat:* Rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures. *Distribution*: East Texas River basins, Sabine through Trinity Rivers as well as San Jacito River.
Southern hickorynut *(Obovaria jacksoniana)*	T	Houston	*Habitat:* Medium sized gravel substrates with low to moderate current. *Distribution:* Neches, Sabine and Cypress river basins.
Alligator Snapping Turtle *(Macrochelys temminckii)*	T	Jasper, Trinity, Houston	*Habitat:* Perennial water bodies, deep water of rivers, canals, lakes, and oxbows, bayous, swamps, ponds, brackish coastal waters. *Distribution*: Extensive
Northern Scarlet Snake *(Cemophora coccinea copei)*	T	Jasper	*Habitat:* Mixed hardwood scrub on sandy soils. Semi-fossorial, active April-September *Distribution*: East Texas
Timber/Cranebrake Rattlesnake *(Crotalus horridus)*	T	Tarrant, Jasper, Trinity, Houston	*Habitat:* Swamps, floodplains, upland pine and deciduous forests, riparian zones, abandoned farmland, limestone bluffs, sandy soil or black clay. *Distribution*: Extensive

Scientific Name	State Status	County	Habitat/Distribution
Louisiana pine snake *Pituophis ruthveni*	C	Jasper, Trinity, Houston	*Habitat:* Occur in longleaf pine-oak sandhills interspersed with moist bottomlands; sometimes in adjacent blackjack oak woodlands and in sandy areas of short-leaf pine/post oak forest; prefers openly wooded areas over dense forest; frequently found in fields, farmland, and tracts of second-growth timber. *Distribution*: Historically in portions of west-central Louisiana and extreme east-central Texas. This area roughly coincides with a disjunct portion of the longleaf pine ecosystem situated west of the Mississippi River. Currently extant in a small portion of the historical range.
Red-cockaded woodpecker *(Picoides borealis)*	E	Jasper	*Habitat:* Open pine forests with large, widely-spaced older trees provide essential habitat for the red-cockaded woodpecker. *Distribution:* The red-cockaded woodpecker can be found in the Pineywoods of east Texas.
Texas Horned Lizard *(Phrynosoma cornutum)*	T	Tarrant, Houston	*Habitat:* Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees. *Distribution:* Texas horned lizards range from the south-central United States to northern Mexico, throughout much of Texas, Oklahoma, Kansas and New Mexico.
Navasota ladies'-tresses *(Spiranthes parksii)*	E	Jasper	*Habitat:* Margins of post oak (*Quercus stellata*) woodlands in sandy loams along intermittent tributaries of rivers. Often in areas where edaphic or hydrologic factors (such as high levels of aluminum in the soil or a perched water table) limit competing vegetation in the herbaceous layer. Besides post oak, associated species include water oak (*Q. nigra*), blackjack oak (*Q. marilandica*), and yaupon (*Ilex vomitoria*). *Distribution:* Endemic to eastern Texas, Navasota River, in Brazos County. Also in Burleson, Grimes and Navasota Counties.
Texas prairie dawn-flower *(Hymenoxys texana)*	E	Trinity	*Habitat:* In poorly drained, sparsely vegtated areas (slick spots) at the base of mima mounds in open grassland or almost barren areas on slightly saline soils that are sticky when wet and powdery when dry. *Distribution:* Fort Bend, Harris and Trinity Counties.
Shovelnose Sturgeon *(Scaphirhynchus platorynchus)*	T	Tarrant	*Habitat:* Open, flowing channels with bottoms of sand or gravel. *Distribution:* Red River below reservoir and rare occurrence in Rio Grande.
Blue Sucker *Cycleptus elongates)*	T	Jasper	*Habitat:* Channels and flowing pools with a moderate current. *Distribution:* Large portions of major rivers in Texas
Creek Chubsucker *(Erimyzon oblongus)*	T	Jasper, Trinity	*Habitat:* Prefers headwaters, small rivers and creeks. *Distribution:* Various tributaries of the Red, Sabine, Neches, Trinity and San Jacinto Rivers.
Paddlefish *(Polyodon spathula)*	T	Jasper, Trinity	*Habitat:* Prefers large, free flowing rivers *Distribution:* Red, Sabine, Neches, Trinity and San Jacinto Rivers.

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 U.S. Fish and Wildlife Service (USFWS) 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.

For the purpose of this BE, the term "migratory birds" applies generally to native bird species protected by the Migratory Bird Treaty Act (MBTA). This includes native passerines (flycatchers and songbirds) as well as birds of prey, migratory waterbirds (waterfowl, wading birds, and shorebirds), and other species such as doves, hummingbirds, swifts, and woodpeckers. The term "migratory" is a misnomer and should be interpreted broadly to include native species that remain in the same area throughout the year as well as species that exhibit patterns of latitudinal or elevational migration to avoid winter conditions of cold or a shortage of food. For most migrant and native resident species, nesting habitat is of special importance because it is critical for supporting reproduction in terms of both nesting sites and food. Also, because birds are generally territorial during the nesting season, their ability to access and utilize sufficient food is limited by the quality of the territory occupied. During non-breeding seasons, birds are generally non-territorial and able to feed across a larger area and wider range of habitats.

Among the wide variety of species protected by the MBTA, special concern is usually given to the following groups:

- Species that migrate across long distances, particularly Neotropical migrant passerines that winter in tropical or Southern Hemisphere temperate zones.
- Birds of prey, which require large areas of suitable habitat for finding sufficient prey.
- Species that have narrow habitat tolerances and hence are vulnerable to extirpation from an area as a result of a relatively minor habitat loss.
- Species that nest colonially and hence are vulnerable to extirpation from an area and hence are vulnerable to extirpation from an area as a result of minor habitat loss.

Because of the many species that fall within one or more of these groups, BLM focuses on species identified by the USFWS as Birds of Conservation Concern (BCC).

Table 10. Birds of Conservation Concern (BCC) known to breed and/or nest in or near the proposed parcels.

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*
-193, -197, -201, -227, -228	West Gulf Coastal Plain/Ouachitas (25)	28	Weches	Little blue heron, Chuck-willow's-widow, red-headed woodpecker, loggerhead shrike, brown-headed nuthatch, wood thrush, prairie warbler, prothonotary warbler, worm-eating warbler, Swainson's warbler, Louisiana waterthrush, Kentucky Warbler, Bachman's sparrow, painted bunting, orchard oriole
-216	West Gulf Coastal Plain/Ouachitas (25)	28	Town Bluff	Little blue heron, Chuck-willow's-widow, red-headed woodpecker, loggerhead shrike, brown-headed nuthatch, wood thrush, prairie warbler, prothonotary warbler, worm-eating warbler, Louisiana waterthrush, Kentucky Warbler, Bachman's sparrow, painted bunting, orchard oriole
-226	Oaks and Prairies (21)	19	Weatherford	Little blue heron, red-headed woodpecker, scissor-tld flycatcher, loggerhead shrike, Bell's vireo, orchard oriole

* *Species in Underline and Italicized*: Wetland Associated Species
All other species: Woodland or Scrub Associated Species

3.9.4 Wildlife

Counties in Texas where the proposed lease tracts occur contain diverse wildlife populations as well as habitats. Generally speaking the eastern one-third of Texas receives ample rainfall and supports much of the oak, pine and hickory forests. The bulk of the central portion of Texas is within the cross timbers area where the transition begins from eastern deciduous forests to the more arid portions of western Texas. The faunal diversity follows this same transition from cypress swamps and alligators in the southeast tip of the state to piñon-juniper and mule deer in the furthest western portion of the Texas panhandle. Regional information on wildlife and their habitats in Texas is contained on pages 1-12 of the TXRMP 1996, as amended.

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 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

Texas has produced more oil and natural gas than any other state and to date remains the largest daily producer. Oil and natural gas are found in most parts of the state. No state or any other region worldwide has been as heavily explored or drilled for oil and natural gas as Texas. The Railroad Commission of Texas (RRC) lists 399,488 wells (active and inactive well but not including plugged and abandoned) statewide (RRC 2012). In Texas, an average of 356,621,060 barrels (BBL) of crude oil and 7,362,263,313 thousand cubic feet (MCF) were produced from 2006-2011. Oil and natural gas production in Texas can be divided into seven major producing basins. The Permian Basin dominates oil production in the state, and the Gulf Coast Basin dominates natural gas production. Major oil fields in Texas include Wasson, Yates, and Spraberry in West Texas, as well as the largest Texas oil field, East Texas field in the East Texas Basin. Major natural gas fields in Texas include Newark East field in the Fort Worth basin; Carthage field in East Texas; Panhandle, West, field in the Anadarko Basin; and Giddings field in the Gulf Coast basin (Kim and Ruppel 2005).

There is not one target field in Houston, Trinity, and Jasper Counties. All three counties are just outside the current known boundaries of two major plays: the Haynesville/Bosier and Eagle Ford Shale. Producing formations in the Houston and Trinity Counties have been from the Tertiary-age, Sparta, Queen-City, Carrizo, and Wilcox. Cretaceous-age producing formations include extreme outcrops of the Eagle Ford Shale (Sub-Clarksville), Woodbine, Buda, Gerogetown, Edwards Lime, Glen Rose (Mooringsport and Rodessa), James Lime, Pettet, Crane, Travis Peak, and Hosston. Producing formations in Jasper County include the Frio, Wilcox, Cockfield, and Yegua formations from the Cenozoic-age and the Austin Chalk, Eagleford Shale, Woodbine, and Georgetown formation from the Cretaceous-age.

The main oil and gas field in Tarrant County is the Barnett Shale field, particularly the Newark East Field. The Barnett Shale is a geologic formation that produces natural gas and extends west and south from the city of Dallas, covering 5,000 square miles, spanning 21 counties. The hydrocarbon productive region of the Barnett Shale has been designated as the Newark East Field, and large scale development of the natural gas resources in the field began in the late 1990s. The RRC has records of 16,346 total gas wells in the Newark East Field, with an additional 2,532 permitted locations on file where the operator has not yet filed completion paperwork or the completed well has not been set up with the Commission (as of September 2012). The vast majority of the wells and permits are for natural gas production, but a small number of oil wells (49 regular producing oil wells, as of September 2012) are also in operation or permitted in the area, and some oil wells co-produce casinghead gas. The issuance of new Barnett Shale area drilling permits has been following an upward trend of increasing natural gas production.

Table 11. Total oil and gas production in each of the proposed parcel counties for 2012 (RRC 2013).

	Oil (bbl)	Casinghead (MCF)	Natural Gas (MCF)	Condensate (BBL)
Houston	739,052	30,312	439,912	29,368

	Oil (bbl)	Casinghead (MCF)	Natural Gas (MCF)	Condensate (BBL)
Trinity	56,271	31,738	363,990	2,240
Jasper	208,427	461,099	16,581,069	581,748
Tarrant	0	0	821,408,218	31,767

Lignite coal underlies the proposed parcels in Houston and Trinity County. Tarrant County is known for its past production of limestone for building stone material. All of the counties are likely to have clay, sand, and rock quarry potential, although none exist in or near the proposed parcels.

Drainage of fluid minerals has been identified as occurring in proposed parcels -216 and -226.

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 and timber production activities include croplands, pastures, timber plots, clear cuts, outbuildings (i.e. barns, storage sheds, and chicken coups), irrigation pipes/ditches/pivots, and improved and unimproved roads to access outbuildings, crops, pastures, plots, etc. Oil/gas development, agriculture/farming, and timber production facilities are readily visible from residences, highways, and country roads in all of the counties, including each proposed parcel. As well significant urban development, including subdivisions, industrial warehouses, commercial facilities, and transportation infrastructure, is readily visible from proposed parcel -226.

Proposed parcels -216 and -226 are in developed recreation areas where 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.

Proposed parcel -201 is approximately 0.6 miles south of the 20-mile-long Four C National Recreation Trail which begins at Ratcliff Lake and winds through a diverse forest of pines, bottomlands, boggy sloughs, and upland forests. Numerous overlooks throughout the trail offer panoramic views of the forest and Neches River bottomlands.

The Big Slough Wilderness Area is between 5.5 and 7.0 miles north of all the proposed parcels in Houston and Trinity County. The wilderness area is free of modern development and gives the visitor a place for solitude and primitive experiences.

Table 12 describes the distance from the proposed parcels to major roadways that should be considered during a VRM review. No roads in or near the proposed parcels have been identified as scenic byways or highways.

Table 12. Distance from proposed parcels to nearest major roadway.

Parcel	Interstate/Distance	U.S. Highway/Distance	State Routes	Other Roadways
-193	45 / >50.0 miles	69 / ~9.5 miles	7 / Cross through N end of parcel	FS 511 forms E boundary of parcel
-197	45 / >50.0 miles	69 / ~8.0 miles	7 / <0.1 miles	FS 511 forms E boundary of parcel
-201	45 / >50.0 miles	69 / ~13.0 miles	7 / <0.1 miles	FM 227 passes through the parcel
-216	45 / >50.0 miles	190 / ~1.4 miles	63 / ~7.5 miles	0.55 miles of unnamed mapped roads pass through parcel
-226	20 / ~5.0 miles	377 / <0.25 miles	171 / ~8.0 miles	FM 1187 & CR 1101 form the N & S boundary of parcel respectively
-227	45 / >50.0 miles	69 / ~13.0 miles	7 / ~4.0 miles	FS 511 forms E boundary of parcel
-228	45 / >50.0 miles	69 / ~11.0 miles	7 / ~3.0 miles	FS 511 forms E boundary of parcel

3.13 Recreation

Houston and Trinity Counties

The Davy Crockett National Forest (DCNF) adjoins all of the proposed lease parcels in Houston and Trinity County. The DCNF offers visitors numerous recreation activities including: bicycling, camping, hiking, equestrian riding, OHV riding, wildlife watching, picnicking, water activities, hunting, and fishing. The Forest offers a number of recreational sites for fishing, camping, and hunting. Additionally, there are large tracts of land available for “exploration” and primitive camping and hunting.

Proposed parcel -201 is approximately 0.5 miles from Ratcliff Lake Recreation Area. The recreation area was built in 1936 by the Civilian Conservation Corps and surrounds the 45-acre Ratcliff Lake. The area offers recreation visitors camping, picnicking, a swimming beach and bathhouse, concession stand, an amphitheater, an interpretive forest trail, boating, and fishing.

Jasper County

Proposed parcel -216 is on the banks of B.A. Steinhagen Lake, a popular shallow, recreational lake operated by the US Army Corp of Engineers (COE). The purpose of the Lake is to assist Sam Rayburn Reservoir in providing flood control to the Angelina and Neches River basins, supply water to the Lower Neches Valley Authority and the Beaumont area, produce a clean source of electric generation, and to offer some of the best fishing, camping, and birding in Texas. The COE operates three developed parks around the Lake. Recreational activities include camping, swimming, watersports, hiking, horseback riding, hunting and fishing. Due to the shallow nature of the reservoir, the most popular game fish is catfish (e.g. channel, blue, and flathead); however, largemouth, spotted, and white bass, crappie, bluegill and redear sunfish are all present in good numbers.

Town Bluff Dam and B.A. Steinhagen Lake, originally identified as "Dam B," was authorized by the River and Harbor Act of 1945. Construction began in March 1947 with completion of the dam in June 1953. The Robert D. Willis Hydropower Project construction started in March 1987 and the hydropower facilities became available for commercial operation in November 1989. The hydropower project is a first-of-its-kind partnership between private enterprise and the U.S. Government in that the Sam Rayburn Municipal Power Agency paid for the entire project in advance rather than reimbursing the Federal Government over the life of the project. The Southwestern Power Administration markets the power and energy generated by the hydropower plan to the Sam Rayburn Municipal Power Agency for distribution to its customers in Jasper, Liberty, and Livingston, Texas, and Vinton, Louisiana.

Hunting is common around B.A. Steinhagen Lake. The Angelina Neches/Dam B Wildlife Management Area (WMA) is at the north end of the Lake. The WMA covers 12,636 acres of which about 7,000 acres are a portion of the reservoir. Typical hunted species include white-tailed deer, feral hog, waterfowl, squirrels, rabbits, dove, migratory birds, predators, furberears, and frogs. A unique, but limited, hunting opportunity is offered each September by the Texas Parks and Wildlife Department that allows hunting of American alligators. Due to ideal habitat, there is a very healthy population of American alligator found in the lake.

Tarrant County

The main body of Benbrook Lake is <2.0 miles east of the proposed parcel and the closest inlet to the lake is <0.25 miles south of the proposed parcel. Benbrook Lake is owned and operated by COE. After significant flooding along the Trinity River in 1908, 1922, and 1936, the COE determined flood control projects in North Texas were needed. Construction on the lake began in May 1947 and was practically completed when floodgates were closed and deliberate impoundment began in September 1952. At the normal levels, the lake covers 3,770 surface acres and could increase to as much as 7,630 surface acres if the lake were to reach maximum flood elevation.

Recreation at Benbrook Lake includes camping, picnicking, swimming, water sports, hiking, horseback riding, bird watching, bicycling, fishing and hunting. Largemouth bass, hybrid striped bass, channel and blue catfish, white bass and crappie all provide good angling opportunities. Hunting is limited to seasons and is based on a permitting system. Common hunted species include white-tailed deer, turkey, and squirrel.

3.14 Socioeconomics and Environmental Justice

3.14.1 Socioeconomics

Texas saw an increase in employment in 2011, gaining 205,100 seasonally adjusted nonfarm jobs, representing an annual growth of 2 percent. Over the same period, U.S. nonfarm employment only rose 1.3 percent. All Texas industries except the information and construction industries and the government sector saw job increases. The state's mining and logging industry ranked first in job creation with an annual employment growth rate of 18.8 percent in 2011. The professional and business services

industry ranked second in job creation, seeing a 4.1 percent increase. The Texas unemployment rate remained below the national unemployment rate in 2011 and even decreased in the last half of 2011.

Houston, Trinity, and Jasper Counties

The overall economy of the region consists primarily of agriculture, agribusiness, mineral production, wholesale and retail trade and timber production. Most of the area is largely forested and has various timber industries including paper mills. Oil and gas production is scattered throughout, while beef cattle are prominent, being found in and around all proposed parcels. Poultry production and processing are common but not as prevalent as in neighboring counties. Tourism is important in areas near large reservoirs.

Tarrant County

Tarrant County is part of the larger "North Texas" region as defined by the U.S. Census Bureau which includes the Dallas/Fort Worth/Arlington metropolitan statistical area. North Texas ranks fourth in population in the nation amongst metropolitan areas, behind only New York City, Los Angeles, and Chicago. The region's population growth is largely based on natural increase (50.7%)—birth outnumbering deaths—and international migration (35.3%), while migration from other parts of the United States represented only 14 percent.

The North Texas economy is the fourth largest in the nation in terms of jobs—3.0 million in 2007. North Texas added 263,144 jobs between 2000 and 2007, placing it seventh among the top ten regions in the number of jobs created and fifth in the rate of job growth across the nation. Despite the slowing national economy North Texas continues to see employment growth according to the Texas Workforce Commission (Walz 2008). In Tarrant County alone the unemployment rate in April 2013 was 5.9 percent and all of north Texas was 6.7 percent, 1.8 to 2.6 percent lower than the national average of 8.5 percent (North Texas Commission 2013). The North Texas economy is fairly diverse with employment distributed among the most major sectors. The largest share of job was in the trade, transportation, and utilities sector at 21 percent, followed by professional business services at 16 percent, education and health services at 13 percent, along with government at 13 percent, and hospitality at 10 percent. Manufacturing, construction and mining, and other services all contribute less than 10 percent (North Texas Commssion 2013). The diversity of the economic base is reflected in the major businesses located in the region, which placed 24 companies on the Fortune 500 list of the nation's largest companies by revenue (Walz 2008).

3.14.2 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 13 describes the demographics of each proposed parcel county.

Table 13. 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
Texas	26,059,203	38.1%	19.0%	$50,920	17.0%
Houston	23,161	10.6%	28.5%	$32,437	20.7%
Trinity	14,309	9.1%	12.0%	$38,138	16.6%
Jasper	35,923	6.1%	19.6%	$40,099	17.5%
Tarrant	1,880,153	27.4%	23.9%	$56,178	14.2%

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 Texas are analyzed in the Texas RMP (1996), 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 Texas is incorporated by reference into this document.

Proposed lease parcels -216 and -226 have no surface occupancy stipulations attached to the parcel. As a result, accessing the minerals in these leases would occur through directional drilling where surface disturbance would occur outside the boundaries of the lease parcel. Exploration/development of the lease would produce no effect on any resources, except for minerals, within the boundaries of the lease parcel as a result of the no surface occupancy stipulation. However, when the minerals are accessed from a surface location outside the lease parcel, effects to the resources at the access site are likely. The effects described in section 4.3 apply to the proposed lease parcels, assuming that the two parcels are accessed through directional drilling with surface disturbance outside the proposed lease parcel boundaries.

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 over air quality emissions into the atmosphere.

During drilling and completion, the following source of emissions are anticipated during any oil and gas exploration or development: combustion engines (i.e. fossil fuel fired internal combustion engines used to supply electrical or hydraulic power for hydraulic fracturing to drive the pumps and rigs used drill the well, drill out the hydraulic stage plugs and run the production tubing in the well; generators to power drill rigs, pumps, and other equipment; compressors used to increase the pressure of the oil or gas for transport and use; tailpipe emissions from vehicles transporting equipment to the site), venting (i.e. fuel storage tanks vents and pressure control equipment), mobile emissions (i.e. vehicle bringing equipment, personnel, or supplies to the location) and fugitive sources (i.e. pneumatic valves, tank leaks, dust). A number of pollutants associated with combustion of fossil fuels are anticipated to be released during drilling including: CO, NO_x, SO_2, Pb, PM, CO_2, CH_4, and N_2O. Venting may release VOC/HAP, H_2S, and CH_4. 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_2. VOCs and NO_x contribute to the formation of ozone, which is a pollutant of concern in Oklahoma and Texas. 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.

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.

All of the proposed parcels are outside of but less than 75 miles from an ozone nonattainment area, except proposed parcel -228 which is within the DFW nonattainment area. The additional NO_x and VOCs emitted from any new oil and gas development on all of the leases are likely too small to have a

significant effect on the overall ozone levels of the area. All development must comply with all state and federal air quality regulations. Development on proposed parcel -228 would also have to comply with more stringent rules set forth by the State Implementation Plan and Texas Air Quality Rules and, if emissions exceed 50 tons per year of VOC or NOx, a general conformity determination must be made by the BLM.

Mitigation

The BLM encourages industry to incorporate and implement best management practices (BMPs), which are designed to reduce impacts to air quality by reducing emissions, surface disturbances, and dust from field production and operations. Typical measures include: adherence to BLM's Notice to Lessees' (NTL) 4(a) concerning the venting and flaring of gas on Federal leases for natural gas emissions that cannot be economically recovered, flared hydrocarbon gases at high temperatures in order to reduce emissions of incomplete combustion; water dirt roads during periods of high use in order to reduce fugitive dust emissions; collocate wells and production facilities to reduce new surface disturbance; implementation of directional drilling and horizontal completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores; require that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored; and perform interim reclamation to reclaim areas of the pad not required for production facilities and to reduce the amount of dust from the pads. In addition, the BLM encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions.

In October 2012, EPA promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds during gas well completions. Mitigation includes a process known as "Green Completion" in which natural gas brought up during flowback must be recaptured and reroute into the gathering line.

4.3.1.2 Climate

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

Leasing the subject tract would have no direct impact on climate as a result of GHG emissions. There is an assumption, however, that leasing the parcels would have indirect effects on global climate through GHG emissions. However, those effects on global climate change cannot be determined (See cumulative effects section, Chapter 4 for additional information). It is unknown whether the petroleum resources specific to these leases in the Proposed Action are gas or oil or a combination thereof.

Production statistics developed from EIA (EIA, 2012) are shown for the US and Texas in Table 14.

Table 14. 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
Texas	427,386,000	21.4	7,593,697	28.3
Federal leases in Texas	291,000	0.01	20,831	0.08

In order to estimate the contribution of Federal oil and gas leases to greenhouse gases in Texas it is assumed that the percentage of total U.S. production is comparable to the percentage of total emissions. Therefore, emissions are estimated based on production starting with total emissions for the United States from EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010* (EPA, 2012b), and applying production percentages to estimate emissions for Texas. 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 Bureau of Land Management (BLM) and allow for comparison with other sources in a broad sense.

Table 15. 2010 Oil and Gas Field Production Potential Emissions

Location	Oil (Metric tons of CO_2^e)		Gas (Metric tons of CO_2^e)		Total O&G Production (Metric tons CO_2e)	%U.S. Total GHG emissions
	CO_2	CH_4	CO_2	CH_4		
United States	300,000	30,600,000	10,800,000	126,000,000	167,700,000	2.6
Texas	64,200	6,548,400	3,056,400	35,658,000	45,327,000	0.71
Federal leases in Texas	30	3,060	8,640	100,800	112,530	0.002

Table 15 shows the estimated greenhouse gas emissions for oil and gas field production for the U.S., Texas, and Federal leases in Texas. 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_2^e have been used in the table above to avoid very small numbers. CO_2^e is the concentration of CO_2 that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas.

Table 15 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_2^e from the life cycle of oil and gas. For example, acquisition (drilling and development) for petroleum is responsible for only 8% of the total CO_2e 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 16). To establish the exact number of Federal wells in Texas is problematic due to the ongoing development of new wells, the abandonment of unproductive wells, land sales and exchanges, and incomplete or inaccurate data bases.

Table 16. 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%
Texas Emissions From Oil & Gas Field Production	45,327,000	0.71%
Federal lease Oil & Gas Field Production (4,513 wells)	112,530	0.002%
Oil & Gas Field Production at Full Development For Proposed Action (7 Wells)	174.51	0.0000003%

The table above estimated that the total emissions from Federal leases in Texas in 2010 were 112,530 metric tons CO_2^e. Therefore, the estimate of emission per well is 24.93 metric tons CO_2e annually.

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

Mitigation

The EPA's GHG emissions data describes "Natural Gas Systems" and "Petroleum Systems" as two major categories of US sources of GHG emissions. The inventory identifies the contributions of natural gas and petroleum systems to total CO_2 and CH_4 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 CO_2 emissions from oil and gas exploration and development (Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2010 (EPA, 2012b). One of the factors in this improvement is the adoption by industry of the BMPs proposed by the EPA's Natural Gas Energy Star program. The OFO will work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy. While EPA data shows that methane emissions increased from oil and gas exploration and development from 1990-2010, reductions in methane emissions from oil and gas exploration and development should occur in future years as a result of EPA's recently finalized oil and gas air emissions regulations.

4.3.2 Soils

While the act of leasing Federal minerals would produce no impacts to soils, subsequent exploration/development of the proposed lease may produce impacts by physically disturbing the topsoil and exposing the substratum soil on subsequent project areas. Direct impacts resulting from the oil and gas construction of well pads, access roads, and reserve pits include removal of vegetation, exposure of the soil, mixing of horizons, compaction, loss of topsoil productivity and susceptibility to wind and water erosion. Wind erosion would be expected to be a minor contributor to soil erosion with the possible exception of dust from vehicle traffic during all phases of development. Vehicle traffic related wind erosion would be limited to approved travel routes in which the surface has not been paved or dressed in a material to prevent soil movement. The extent of wind erosion related to vehicle traffic will be dependent on a number of factors including: length of well bore; whether hydraulic fracturing is used during completion; whether telemetry is used during production; whether the well is gas, oil, condensate, or a combination thereof. These impacts could result in increased indirect impacts such as runoff, erosion and off-site sedimentation. Activities that could cause these types of indirect impacts include construction and operation on well sites, access roads, gas pipelines and facilities.

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

Contamination of soil from drilling, hydraulic fracturing, and production wastes mixed into soil or spilled on the soil surfaces could cause a long-term reduction in site productivity. Contaminants spilled on soil would have the potential to pollute and/or change the soil chemistry. See section 4.3.11 – Wastes,

Hazardous or Solid for a more in-depth analysis of spill contamination. These direct impacts can be reduced or avoided through proper design, construction, maintenance and implementation of BMPs.

Mitigation

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

During the life of the development, all disturbed areas not needed for active support of production operations should undergo "interim" reclamation in order to minimize the environmental impacts of development on other resources and uses. Upon abandonment of wells and/or when access roads are no longer in service final reclamation would be implemented. Earthwork for interim and final reclamation must be completed within 6 months of well completion or well plugging (weather permitting).

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

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

4.3.3 Water Resources

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

Quality

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

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

Contamination of groundwater could occur without adequate cementing and casing of the proposed well bore. For fracturing fluid to escape the wellbore and affect the usable quality water or contaminate or cross contaminate aquifers, the fluid would have to breech 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.

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 would produce no direct impacts to floodplains, subsequent exploration/development of the proposed lease 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.

Mitigation

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

4.3.4.2 Wetlands, Riparian Areas

While the act of leasing Federal minerals would produce no direct impacts to wetlands or riparian areas; no adverse impacts are expected for wetlands or riparian areas if exploration/development occurred on this lease parcel in the future.

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 habitat. 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 <u>to cross any creek</u>.
- 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 <u>stock ponds</u> during operations.

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 734 acres (46.2%) of the seven proposed lease parcels could be impacted and/or removed as prime farmland, while 854.7 acres (53.8%) 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

Several recorded historic properties have been documented within the APE. A determination of No Historic Properties Affected has been made and none of the proposed parcels have been recommended for withdrawal from the sale. The Texas State Historic Preservation Office declines to comment on lease sales since TXSHPO believes this action does not have the potential to adversely affect historic properties (In a letter dated February 26, 2013 responding to the July 17, 2013 Lease Sale Cultural Resource Report Number NM-040-2013-43); therefore, Section 106 of the NHPA, 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 4 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. The Comanche Nation and the Tonkawa Tribe both reported no concerns with the lease sale. 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 4 for more information.

Mitigation Common to all Heritage 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 Texas State Historic Preservation Office confirmed that studies will need to be done at the APD stage.

Currently, the historic cemetery located within the boundaries of the lease parcel -197 must be avoided completely by any proposed development of the lease. The NRHP Eligible Central Coal & Coke Co. sawmill complex within the lease boundary of parcel -201 must be avoided. Parcels -206 and -207 are within ½ mile of the El Camino Real de los Tejas National Historic Trail and any proposed development of these leases must avoid adverse impacts to the Trial. The remnants of a probably Bruce Goff designed home in parcel -226, must be avoided. The Lake Marvin Works Progress Administration recreational facilities on parcel -236, must be avoided during development of the lease.

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 Texas 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.
- This authorization does not permit any surface disturbance on any other Federal or State Surface management agency or private land owners. The operator or their agent is responsible for obtaining permits, permissions, or Rights-of-ways from other surface management agencies prior to any ground disturbance and ensuring that cultural resources surveys are approved by those agencies.
- If human remains are discovered the procedures of the Texas Health and Safety Code (Title 13, Part 2, Chapter 22 of TAC) or the NAGPRA shall apply, as appropriate.

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. At the APD stage, BLM requirements for use of weed control strategies would minimize the potential for the spread of these species.

Mitigation

Mitigation is deferred to site-specific development at the APD stage. BMPs require that all Federal actions involving 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 parcel. 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 would be reclaimed through reseeding or vegetative cover reestablishment. BMPs identified in BLM guidance documents such as the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development: The Gold Book (USDI, 2007) recommend areas to be restored with native vegetation in regards to both species and structure. This recommendation is contingent upon the wishes of the surface owner.

4.3.9 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 result in removal of wildlife habitat.

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 and 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

General mitigation includes attaching protective stipulation WO-ESA-7, which states that consultation with USFWS may be needed, would be attached to all proposed parcels since Federally protected species or their habitat may be in or near the proposed parcel either now or in the future.

4.3.9.2 Special Status Species

While the act of leasing Federal minerals would produce no direct impacts to special status species, subsequent development of a lease may produce impacts. Impacts could result from increased habitat fragmentation, noise, or other disturbance during development.

4.3.9.3 Migratory Birds

While the act of leasing Federal minerals produces no impacts to migratory birds, 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 an impact to migratory birds and their habitat.

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 Memorandum of Understanding between BLM and the USFWS, 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 any 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 a 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. Strive to complete all disruptive activities outside the peak of migratory bird nesting season to the greatest extent possible.

3) 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.

Additionally, the Wildlife Resource General Conditions of Approval (WRGCOAs) #4 (Burying Transmission Lines) and Notice to Lessees (NTL) 96-01-TDO (Modification of Oil and Gas Facilities to Minimize Bird and Bat Mortality) address measures designed to protect migratory birds from accidental deaths associated with power line collisions/electrocutions, open-vent exhaust stacks and open pits and tanks.

4.3.9.4 Wildlife

The types and extent of impacts expected from oil and gas development to wildlife species and habitats from development are similar to those described in the 4.3.10.2 Special Status Species Section. Although reclamation and restoration efforts for surface disturbance could provide for the integrity of other resources, these efforts may not always provide the same habitat values (e.g. structure, composition, cover, etc.) in the short or in some instance, the long-term in complex vegetative community types (e.g., shrub oak communities).

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 and compressors). The most significant impacts would be limited to the construction, drilling, and completion/stimulation phases, which can span from several weeks to several months and is entirely dependent on the size and extent of new surface disturbance, length of the well bore, formations encountered during drilling, or whether hydraulic fracturing is used just to name a few. During production, impacts from noise and human disturbance would greatly diminish. In general, most wildlife species would become habituated to the disturbances. For other wildlife species with a low tolerance to activities, the operations on the well pad would continue to displace wildlife from the area due to ongoing disturbances such as vehicle traffic from inspectors and semi-trucks hauling produced fluids, noise from compressors and/or a pump-jack if needed, and equipment maintenance. These impacts would last for the life of the well.

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

Mitigation Common to ALL Species

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

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

4.3.10 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 shale gas operations do not incur reportable spills (5 gallons or more), indicating the fluid management process can be, and usually is managed safely and effectively (Fletcher 2012).

Mitigation

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

4.3.11 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.

The proposed lease parcel does not appear to conflict with other mineral resources such as coal, sand, gravel, or clay resulting in no impacts to these resources.

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 -216 and -226, 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

For the historic cemetery located within the boundaries of proposed parcel -197, VRM mitigation will be required if there is any disturbance within ½ mile of the cemetery or remnants of a Bruce Goff designed home in parcel -226.

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

4.3.13 Recreation

While the act of leasing Federal minerals would produce no impacts to recreation resources, subsequent exploration/development of the proposed lease could impact recreation quality and opportunities through: increased vehicle traffic and human presence, loss of areas to recreate, blocked access, and increased noise and visual disturbance.

Mitigation

Mitigation is deferred to site-specific development at the APD stage. ORA-3 would be attached to proposed parcel -216 to prevent recreational hunting and mineral development conflicts from September 1 to March 1 every year.

4.3.14 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. 3.15 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 17. Actual – Acres of Federal Minerals/Acres Available/Acres Leased

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

Table 1817. Parcels Nominated and Offered in the February 2014 Oil and Gas Lease Sale

Field Office	No. of Nominated Parcels	Acres of Nominated Parcels	No. of Parcels to be Offered	Acres of Parcels to be Offered
Carlsbad	34	12,302	20	4,981
Farmington	38	19,103	4	1,200
Kansas	1	120	1	120
Las Cruces	27	31,743	23	27,779
Oklahoma	11	657	10	617
Rio Puerco	76	74,650	0	0
Roswell	5	4,926	5	4,926
Texas	44	35,292	43	34,019
Totals	236	178,793	106	73,642

Table 19. Foreseeable – Acres of Federal Minearls/Acres Available/Acres Leases

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

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 Texas was analyzed in the Texas RMP (1996), as amended (pg. 4-6 – 4-8). Potential development of all available federal minerals in Texas 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 Texas 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 Texas RMP (1996), as amended, analysis.

More than 100 years of oil and gas development in Texas has resulted in an extensive infrastructure of existing roads and pipelines. The Railroad Commission of Texas lists 399,488 current wells (288,073 active and 111,415 inactive) statewide, of which 1,209 active and inactive wells are on Federal leases. 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.

4.3.15.1 Effects on Air Quality

All Counties

The primary activities that contribute to levels of air pollutants in the three counties are predominately combustible engines of road and non-road, diesel and gasoline vehicles and equipment. The Air Quality 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 2011). 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.

Houston, Trinity, and Jasper Counties

The very small increase in emissions that could result from approval of the proposed action or preferred alternative would not result in the area violating 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 lease development are not expected to impact the 8-hour average ozone concentrations, or any other criteria pollutants in the area of the proposed lease.

Tarrant County

Research indicates that emissions of ozone from oil and gas production, particularly in the shale areas, impacts air quality and can contribute to violations of the ozone NAAQS if the area is already in or close to exceeding NAAQS levels (Kemball-Cook et al. 2010). Development of the lease could cumulatively contribute to violations of the NAAQS eight-hour ozone standard. Development on proposed parcel -228 would have to comply with more stringent rules set forth by the State Implementation Plan and Texas Air Quality Rules. If emissions from development on parcel-228 exceed federal de minimus levels, the BLM must make a general conformity determination to ensure project emissions are included in the latest EPA-approved SIP or otherwise offset to ensure attainment is not delayed. These nonattainment area development requirements are designed to ensure that the standard can be met by the 2018 deadline and anticipate continued growth with air pollution control in the nonattainment area. The anticipated emissions are not expected to impact any other criteria pollutant standards.

4.3.15.2 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; 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

On 30 August 2013 a briefing for the BLM NM State Director was held at the Oklahoma Field Office to review Field Office recommendations for nominated parcels.

5.1 Public Involvement

The nominated parcels, along with the appropriate stipulations from the Texas RMP (1996), as amended were posted online for a two week review period beginning July 22, 2013. No comments were received. This EA was made available for public review and comment for 30 days beginning September 3, 2013. No comments were received.

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7.0 AUTHORITIES

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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.

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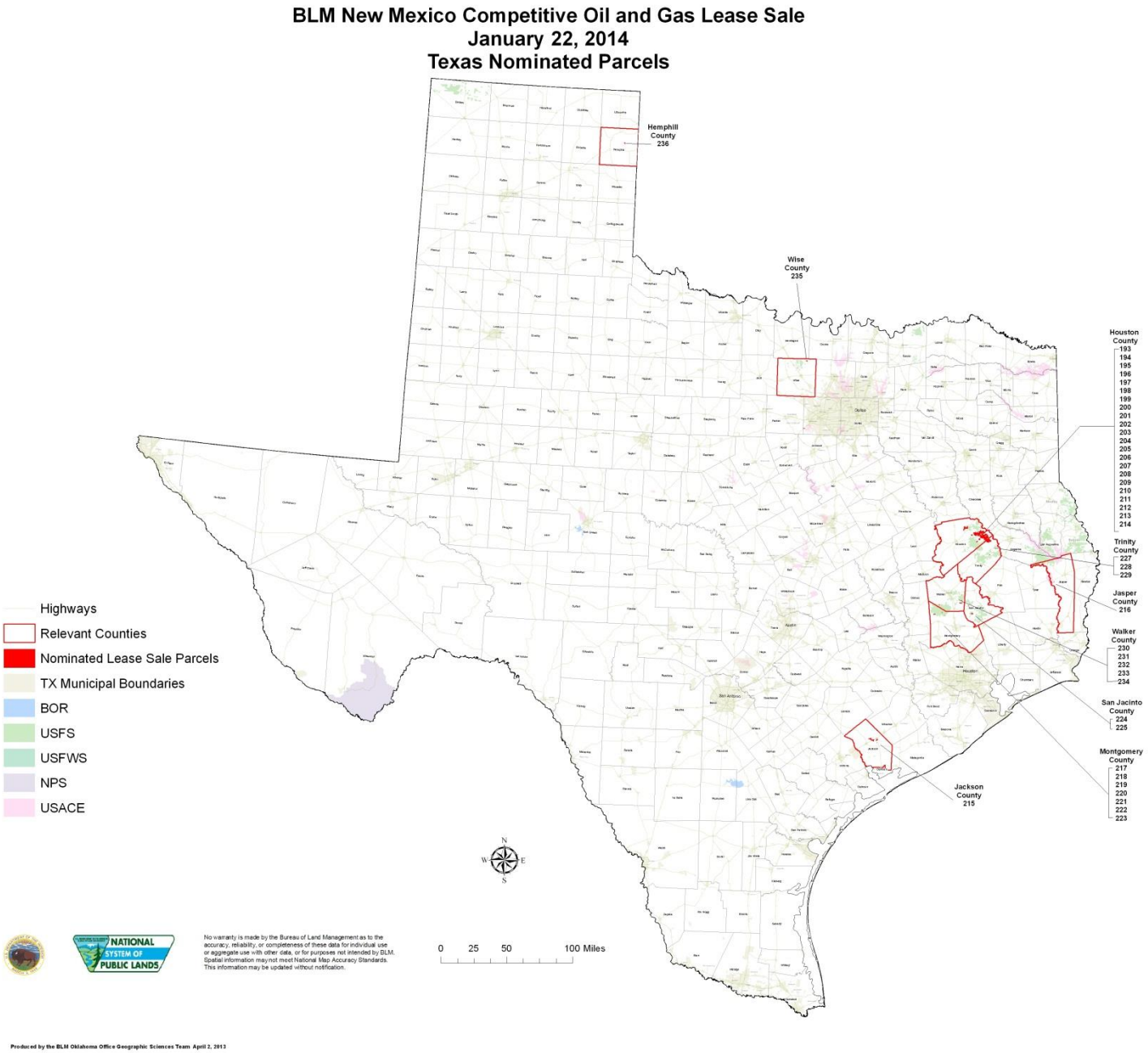
APPENDIX 1. OKLAHOMA FIELD OFFICE LEASE STIPULATION SUMMARY—TEXAS

Stipulation	Description/Purpose
FS 1 TX, OK, KS	**STIPULATION FOR LANDS OF THE NATIONAL FOREST SYSTEM UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE:** The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of the Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of an exploration plan by the Secretary of the Interior, (2) uses of all existing improvements, such as Forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by an exploration plan approved by the Secretary of the Interior.
FS 8 TX CSU-1A	**CONTROLLED SURFACE USE - STREAMSIDE MANAGEMENT:** Portions of this lease contain streamside management zones (floodplains, wetlands). Site- specific proposals for surface-disturbing activities within these areas will be analyzed and will normally result in establishment of protective requirements or limitations for the affected site. Surface occupancy for oil and gas wells will not be allowed within the streamside management zone.
FS 8 TX CSU-1B	**CONTROLLED SURFACE USE – PERENNIAL AND INTERMITTENT STREAM PROTECTION:** Portions of this lease contain segments of either perennial or intermittent streams as defined by the Forest Service. Areas within 100’ of perennial streams or 66’ of intermittent streams will be subject to special requirements or limitations of surface use or occupancy. Specific requirements or limitations will be determined as Surface Use Plan of Operations are submitted and will normally result in establishment of protective requirements or limitations for the affected site.
FS 8 TX CSU-1C	**CONTROLLED SURFACE USE – DRILLING RESTRICTION WITHIN 150’ OF HIKING AND ORV TRAILS:** Proposals for drilling sites located 150 feet or less from the trail may be subject to special requirements or limitations, such to be determined on a case by case basis. Trails may be crossed by vehicles but may not be used as a travelway. Vehicles may not parallel the trail closer than 25 feet. When crossing the trail with vehicles any brushed pushed into the trail must be totally removed from the trail. Shot holes will be placed no closer than 25 feet from the trail’s edge to meet public safety requirements. If necessary, the shot holes may be required to be located farther than 25 feet from the trail. This stipulation is intended to protect the trail and meet visual quality objectives as per National Forests and Grasslands in Texas Final Land and Resource Management Plan, dated March 28, 1996.
FS 8 TX CSU-1E	**CONTROLLED SURFACE USE STIPULATION - TOLEDO BEND RESERVOIR LAKESHORE PROTECTION:** Proposals for a structure, facility, or motorized uses on Toledo Bend Reservoir lands between the 172' and 175' MSL contours, or on a strip of land extending inland 200 meters from the 175' contour, may be subject to special requirements or limitations, such to be determined on a case-by-case basis.
FS 8 TX CSU-1G	**CONTROLLED SURFACE USE STIPULATION – RIVER AND ASSOCIATED BOTTOM LANDS PROTECTION:** Surface occupancy or use on the lands are subject to special operating constraints to meet the visual quality objectives and protect rivers and associated bottom land areas in accordance with the National Forests and Grasslands in Texas Final Land and Resource Management Plan, dated March 28, 1996.
FS 8 TX CSU1-I2	**CONTROLLED SURFACE USE - RED-COCKADED WOODPECKER:** Portions of the land in this lease are, or may be, occupied by clusters of the endangered red-cockaded woodpeckers (RCWs). Exploration and development proposals may be modified and/or limited, in accordance with the Recovery Plan for the Red-cockaded Woodpecker, second revision approved January 27, 2003.

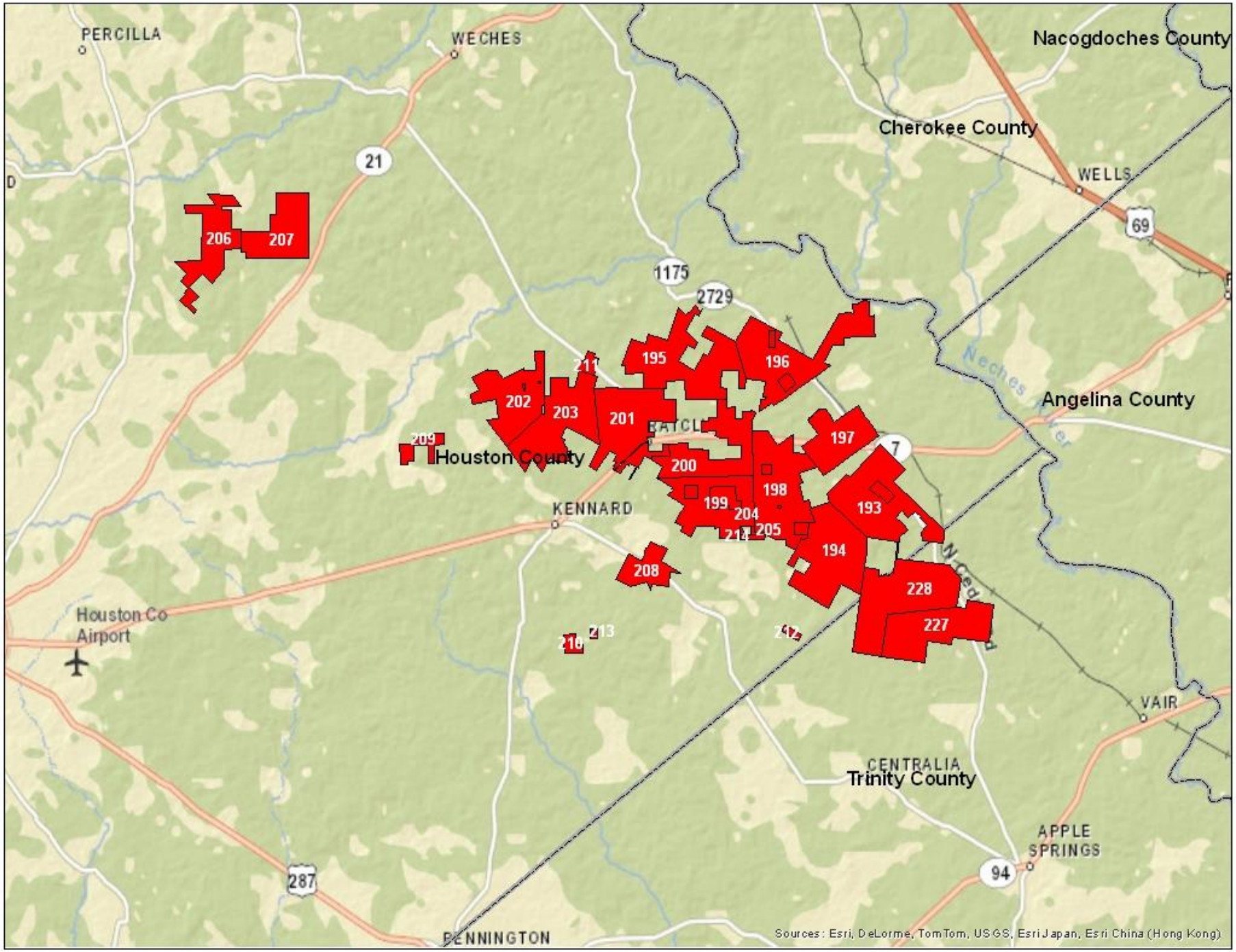
Stipulation	Description/Purpose
FS 8 TX CSU-1K	**CONTROLLED SURFACE USE – FLOOD PREVENTION AND/OR EROSION CONTROL:** Extensive areas within this lease are considered critical areas for flood prevention and/or erosion control. Control structures and erosion damage rehabilitation work either exist now or may be added during the period of the lease. Surface occupancy may be restricted including no surface occupancy, or limited in order to assure minimum conflict with erosion control or flood prevention goals. Restrictions or limitations will be identified by a site-specific analysis of a proposal of lease activities.
FS 8 TX NSO-2	**NO SURFACE OCCUPANCY STIPULATION - PROTECT SCENIC AREA VALUES:** No surface occupancy or use is allowed on the lands to meet visual quality objectives and to protect lake, scenic area and resource area values in accordance with MA-8c-62; MA-9a-72; MA-9b-72; of the National Forests and Grasslands in Texas Final Land and Resource Management Plan dated March 28, 1996.
FS 8 TX NSO-3	**NO SURFACE OCCUPANCY STIPULATION - PROTECT LAKE CONROE:** No surface occupancy or use is allowed on the lands to meet visual quality objectives and to protect lakeshore areas in accordance with the National Forests and Grasslands in Texas Final Land and Resource Management Plan dated March 28, 1996.
FS 3 TX TLS-1B	**TIMING LIMITATION STIPULATION – PROBABLE BALD EAGLE NESTING LOCATIONS (October 1 – May 15):** Part or this entire lease is within one (1) mile of a bald eagle nesting site. During nesting periods, seismic exploration, new clearing of vegetation, and exploratory drilling or any other site-specific proposals for activities within these areas will be analyzed. Such analysis could result in establishment of protective requirements or limitations for the affected site and activities may be restricted if, in the opinion of the responsible agency biologist, restrictions are necessary to assure nesting success.
FS 3 TX CSU-1A	**CONTROLLED SURFACE USE STIPULATION – USE OF A CLOSED LOOP CIRCULATION SYSTEM:** A closed loop circulation system will be used for all oil and gas drilling. No open pits will be allowed this is to avoid potential impacts and contamination to ground and surface water, and the surface disturbance associated with open pits.
FS 3 TX NSO-1	**NO SURFACE OCCUPANCY:** No surface occupancy or use is allowed on the lands as described in the lease in order to protect heritage resources, riparian areas or wetlands, developed recreation facilities and interpretive sites, Lake Marvin, the historical military camp and its associated trail, and slopes with a high erosion potential.
NSO/DD (COE)	**NO SURFACE OCCUPANCY, OPEN FOR DIRECTIONAL DRILLING:** This stipulation is used to protect surface resource values and uses from drilling activities. This stipulation is applied to public use areas, recreation areas, state wildlife and waterfowl refuges, historical sites, trails, roads and military training areas. Directional drilling is permitted from outside the identified areas where occupancy is allowed.
NSO/ELEV (COE)	**NO SURFACE OCCUPANCY BASED ON ELEVATION:** "No drilling on government owned surface where alternative surface ownership is available within the same drilling unit" to protect the integrity of their reservoirs at a specific level based upon lake elevation. This stipulation is subject to negotiation between the surface managing agency and the lessee at the time of operational plan development.
ORA-2 TX, OK	**WETLAND/RIPARIAN:** Mandated by EO 11990 Protection of Wetlands of May 24, 1077. 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	**SEASON OF USE:** Surface occupancy of this lease will not be allowed from September 1 – March 1 to prevent conflicts between recreation use (hunting) and development activities.

Stipulation	Description/Purpose
NM-10	**DRAINAGE:** 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	**ENDANGERED SPECIES ACT SECTION 7 CONSULTATION STIPULATION:** The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 et seq., including completion of any required procedure for conference or consultation.
WO-NHPA TX, OK	**CULTURAL RESOURCES AND TRIBAL CONSULTATION STIPULATION:** This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer (SHPO) and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.

APPENDIX 2. TEXAS NOMINATED LEASE SALE PARCEL.

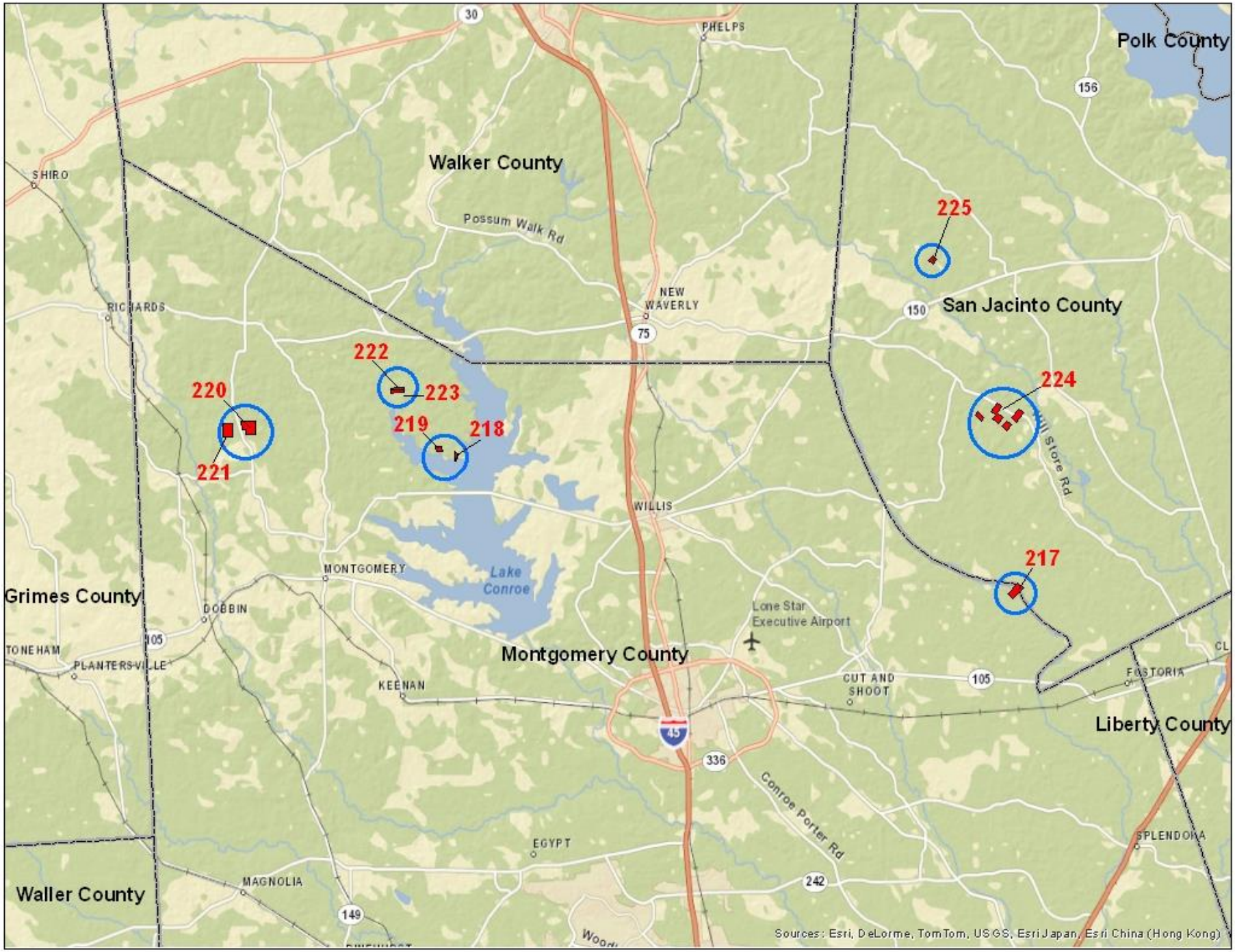


Houston and Trinity Counties nominated parcels.

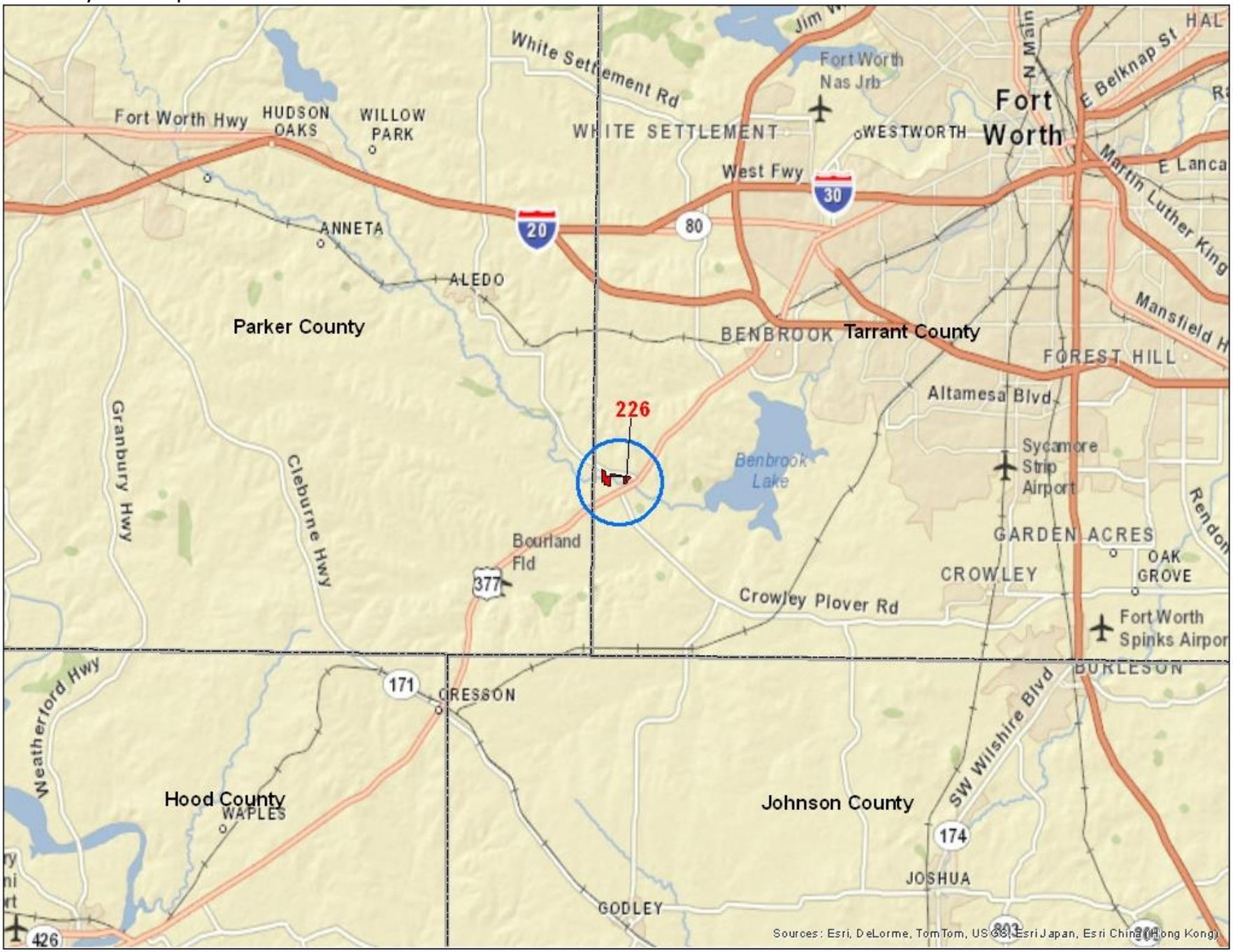


Jasper County nominated parcels.

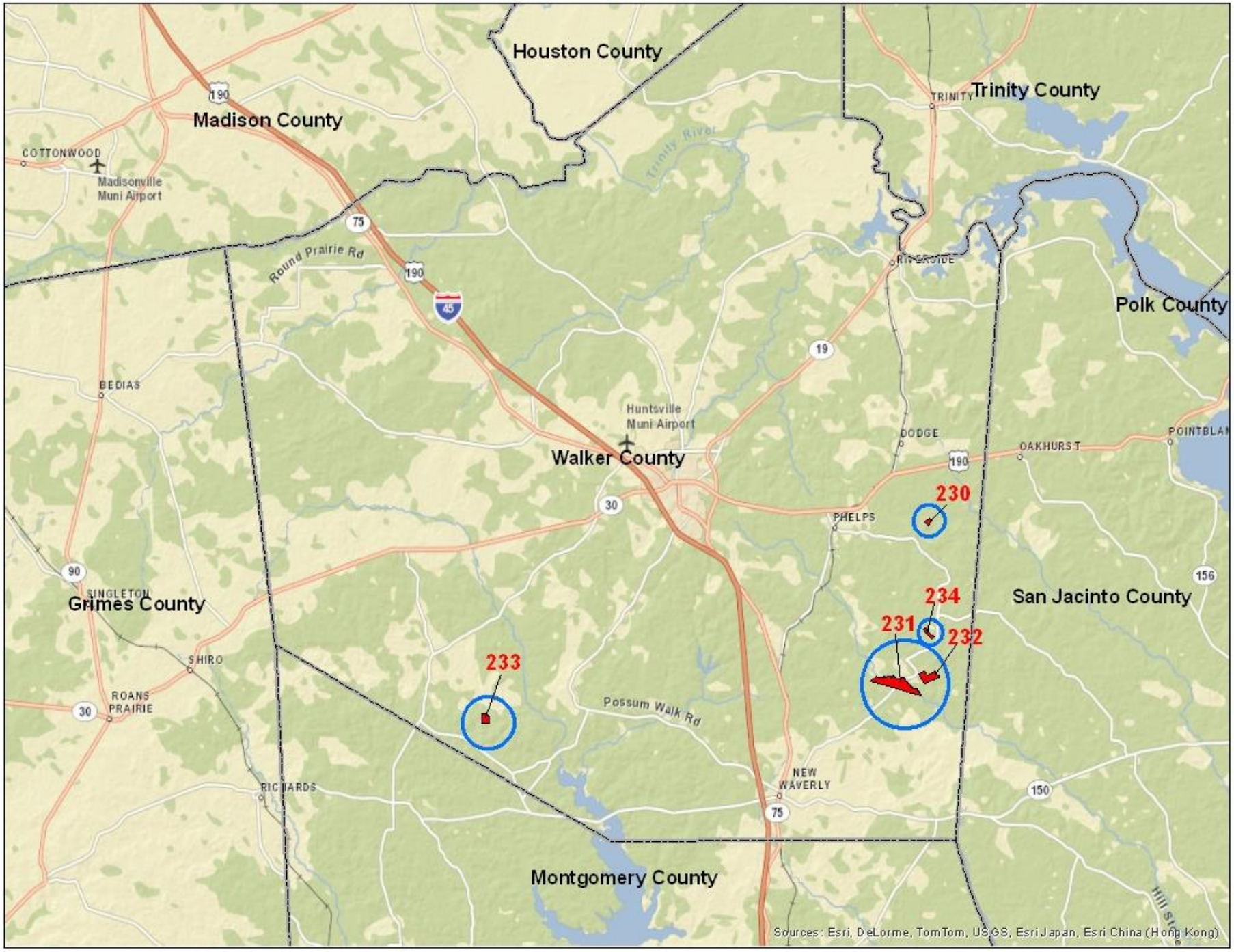
Montgomery and San Jacinto Counties nominated parcels.



Tarrant County nominated parcel.

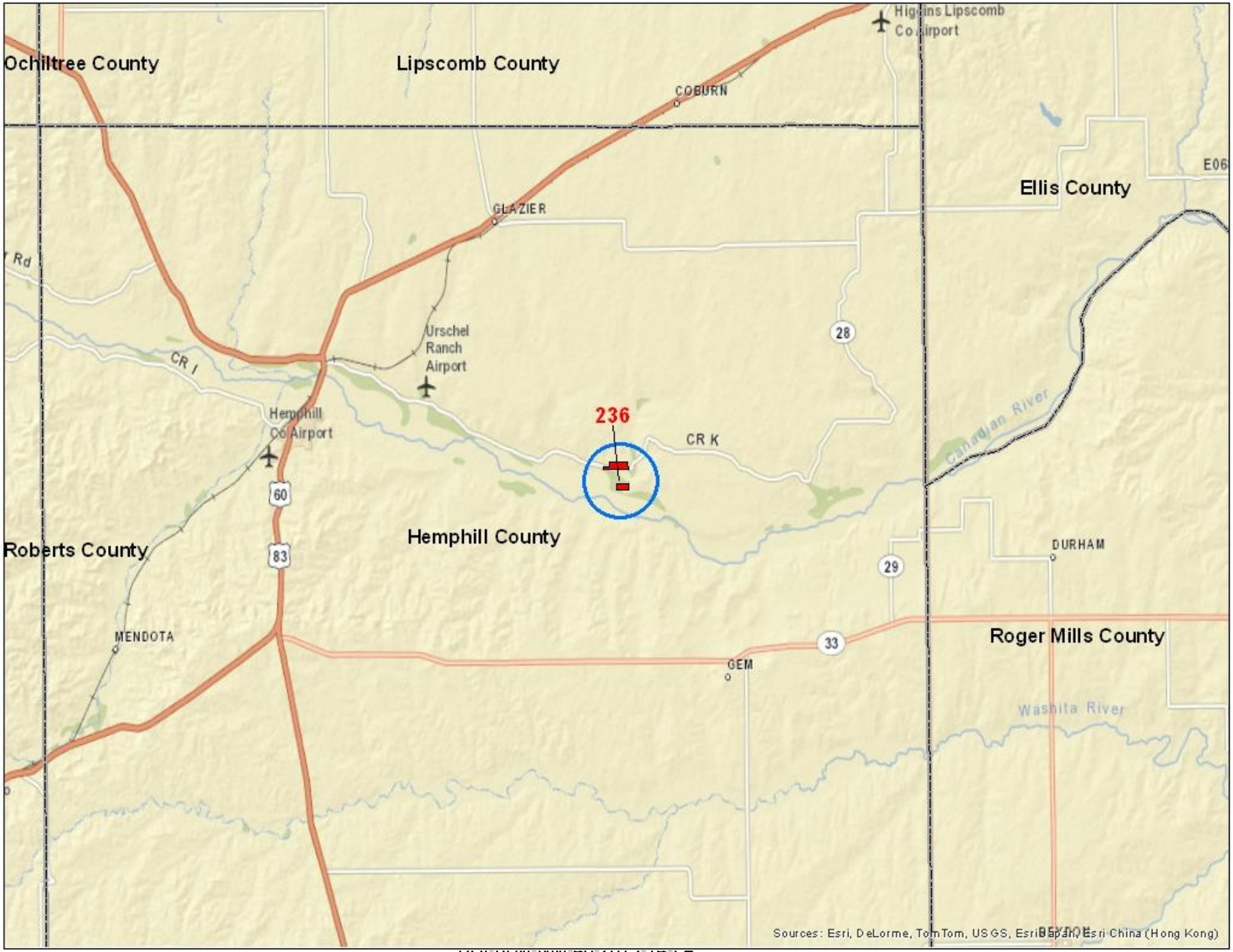


Walker County nominated parcels.



Wise County nominated parcel.

Hemphill County nominated parcel.



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

Phase	Waste
Production	• Power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, filters, tires, hoses, coolants, antifreeze; paints; solvents, used parts) • Discharged produced water • Production chemicals • Workover wastes (e.g. brines) • Tank or pit bottoms • Contaminated soil • Scrap metal
Abandonment/ Reclamation	• Construction materials • Decommissioned equipment • Contaminated soil • Insulating materials • Sludge

Hydraulic Fracturing

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

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

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

concentration of a specific compound (GWPC 2009).

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

NORM

Some soils and geologic formations contain low levels of radioactive material. This naturally occurring radioactive material (NORM) emits low levels of radiation, to which everyone is exposed on a daily basis. When NORM is associated with oil and natural gas production, it begins as small amounts of uranium and thorium within the rock. These elements, along with some of their decay elements, notably $radium_{226}$ and $radium_{228}$, can be brought to the surface in drill cuttings and produced water. $Radon_{222}$, a gaseous decay element of radium, can come to the surface along with the shale gas. When NORM is brought to the surface, it remains in the rock pieces of the drill cuttings, remains in solution with produced water, or, under certain conditions, precipitates out in scales or sludges. The radiation is weak and cannot penetrate dense materials such as the steel used in pipes and tanks.

APPENDIX 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*
-193	Fuller fine sandy loam, 1 to 3 percent slopes	FuB	56.9	10.1	.49	86	N
	Keltys fine sandy loam, 1 to 3 percent slopes	KeB	65.0	11.5	.32	86	Y
	Koury silt loam, frequently flooded	Kp	41.1	7.3	.49	48	N
	Kurth fine sandy loam, 1 to 3 percent slopes	KuB	205.8	36.4	.28	86	Y
	Kurth fine sandy loam, 5 to 8 percent slopes	KuD	93.1	16.5	.28	86	N
	Moswell loam, 1 to 3 percent slopes	MsB	79.7	14.1	.49	56	N
	Penning very fine sandy loam, 0 to 4 percent slopes	PeB	23.4	4.1	.37	56	Y
-197	Cuthbert fine sandy loam, 5 to 15 percent slopes	CtE	70.6	23.9	.28	86	N
	Fuller fine sandy loam, 1 to 3 percent slopes	FuB	7.8	2.7	.49	86	N
	Kirvin fine sandy loam, 2 to 5 percent slopes	KfC	18.0	6.1	.37	86	N
	Kurth fine sandy loam, 1 to 3 percent slopes	KuB	134.6	45.6	.28	86	Y
	Kurth fine sandy loam, 5 to 8 percent slopes	KuD	49.6	16.8	.28	86	N
	Penning very fine sandy loam, 0 to 4 percent slopes	PeB	14.4	4.9	.37	56	Y
-201	Kurth fine sandy loam, 1 to 3 percent slopes	KuB	1.0	100	.28	86	Y
-216	Besner-Mollville complex	BeB	3.8	8.0	.24	86	Y
	Bienville-Alaga association	BIB	44.2	92.0	.20	134	N
-226	Bastsil fine sandy loam, 0 to 3 percent slopes	9	17.6	24.9	.24	86	Y
	Frio silty clay, frequently flooded	27	32.6	46.2	.32	86	N
	Maloterre, Aledo, and Brackett soils, 3 to 20 percent slopes	46	0.5	0.6	.15	56	N
	Sunev clay loam, 1 to 3 percent slopes	77	13.3	18.8	.28	86	Y
	Sunev clay loam, 3 to 8 percent slopes	78	6.6	9.4	.28	86	N
-227	Fuller fine sandy loam, 1 to 3 percent slopes	FuB	27.3	6.7	.49	86	N
	Keltys fine sandy loam, 1 to 3 percent slopes	KeB	137.9	33.7	.32	86	Y
	Keltys fine sandy loam, 5 to 8 percent	KeD	25.2	6.2	.32	86	N
	Kurth fine sandy loam, 1 to 3 percent slopes	KuB	79.5	19.5	.28	86	Y
	Kurth fine sandy loam, 5 to 8 percent slopes	KuD	75.8	18.5	.28	86	N

Parcel	Soil Name	Soil Symbol	Acres in area	% in area	Erosion K Factor	Wind Erodibility Index	Prime and Unique Farmland*
	Penning very fine sandy loam, 0 to 2 percent slopes	PeB	63.2	15.5	.37	56	N
-228	Alazan very fine sandy loam, 0 to 2 percent slopes	AaB	0.1	0.0	.37	86	Y
	Koury silt loam, 0 to 1 percent slopes, frequently flooded	Kp	13.3	6.7	.49	48	N
	Moten-Multey complex, 0 to 2 percent slopes	MxA	37.6	18.8	.37	86	Y
	Pophers silty clay loam, 0 to 1 percent slopes, frequently flooded	Po	149.2	74.5	.32	38	N

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

APPENDIX 5: BIOLOGICAL EVALUATION

APPENDIX 6. CULTURAL RESOURCES REPORT.