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Lybrook D32-2306 01H
Lybrook I30-2306 01H

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ACRONYMS

°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
AADT	Average Annual Daily Traffic
APD	Application for Permit to Drill
AUM	animal unit month
bbl	barrels
BLM	Bureau of Land Management
BOP	blowout preventer
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	Methane
CO	carbon monoxide
CO_2	Carbon dioxide
CO_2e	carbon dioxide equivalent
COA	Conditions of Approval
dB	decibel
dBA	hourly A-weighted sound level in decibels
EA	Environmental Assessment
EIS	Environmental Impact Statement
Encana	Encana Oil & Gas (USA) Inc.
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FFO	Farmington Field Office
GHG	greenhouse gases
HAP	hazardous air pollutant
LAC	La Plata Archaeological Consultants
MLA	Mineral Leasing Act
NAAQS	National Ambient Air Quality Standard
NATA	National Scale Air Toxics Assessments
NATA	National Scale Air Toxics Assessments
NEPA	National Environmental Policy Act
NMAAQS	New Mexico Ambient Air Quality Standards
NMDOT	New Mexico Department of Transportation
NMPIF	New Mexico Partners in Flight
NMPM	New Mexico Principal Meridian
NO_2	nitrogen dioxide
NO_x	nitrous oxides
OSHA	Occupational Safety and Health Administration
PL	Public Law

PM	particulate matter
PM_{10}	particulate matter with a diameter between 2.5 and 10 micrometers
$PM_{2.5}$	particulate matter with a diameter 2.5 micrometers or less
ppb	parts per billion
PRMP	Proposed Resource Management Plan
RFDS	Reasonable Foreseeable Development Scenario
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
SO_2	sulfur dioxide
TUA	temporary use area
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compounds
VRI	Visual Resource Inventory
VRM	Visual Resource Management

1. PURPOSE AND NEED FOR ACTION

1.1 Background

Encana Oil & Gas (USA) Inc. (Encana) is proposing to develop the Lybrook D32-2306 01H and I30-2306 01H well pads (Cluster 1) in Sandoval County, New Mexico. Encana has filed Applications for Permit to Drill (APDs) with the Bureau of Land Management (BLM) Farmington Field Office (FFO) to drill one well from each well pad. Surface disturbance activities associated with drilling the wells would include construction of two well pads, access roads, and subsurface well-tie pipelines. Encana has also applied for right-of-way (ROW) grants with the BLM/FFO to construct the proposed access roads and the proposed well-tie pipelines, and to construct the proposed Lybrook D23-2306 well pad. The proposed project would be located on BLM and State of New Mexico land and would access federally owned minerals. The project area is approximately 3 miles southwest of Counselor, New Mexico. It is on an elevated finger of Sisnathyel Mesa and lies within the headwaters of Escrito Canyon, a tributary to Largo Canyon.

1.2 Purpose and Need for Action

The purpose of the proposed action is to provide Encana with reasonable access to BLM-managed federal mineral leases V-1399 & NMNM 117564 (D32-2306) and NMNM-117546 (I30-2306) to construct the proposed access roads and pipelines and to drill the proposed wells. The need for the action is BLM's responsibility under the Mineral Leasing Act (MLA) of 1920, as amended (30 United States Code [USC] 181 et seq.), to respond to the APDs and ROW applications. The MLA authorizes the BLM to issue oil and gas leases for the exploration of mineral resources and permit the development of those leases. The need for the action is also established by the BLM's authority under the Title V of the Federal Land Policy and Management Act, as amended (43 USC 1761-1771), and Section 28 of the MLA (43 USC 185).

1.3 Decision to be Made

Based on the information in this Environmental Assessment (EA), the BLM/FFO will decide whether to approve the APDs and ROW grants, and if so, under what terms and conditions. In compliance with the MLA, the decision to be made is how resource development should occur. Under the National Environmental Policy Act (NEPA), as amended (Pub. L. 91-90, 42 USC 4321 et seq.), the FFO must determine if there are any significant environmental impacts associated with the proposed action, warranting further analysis in an Environmental Impact Statement (EIS). The BLM/FFO Field Manager is the responsible officer who will decide one of the following:

- To approve the proposed APDs and ROW grants with design features as submitted
- To approve the proposed APDs and ROW grants with additional mitigations
- To analyze the effects of the proposal in an EIS
- To deny the APDs and ROW grants

1.4 Conformance with Applicable Land Use Plan(s)

Pursuant to 40 Code of Federal Regulations (CFR) 1508.28 and 1502.21, this EA incorporates the information and analysis contained in the 2003 Farmington Proposed Resource Management Plan (PRMP)/Final Environmental Impact Statement (FEIS) (USDI/BLM 2003a). The proposed action would be in conformance with the oil and gas leasing and development management actions in the Resource Management Plan (RMP)/Record of Decision (ROD) signed December 2003 and updated in December 2003 (USDI/BLM 2003b). The proposed action would be in conformance with the 2003 RMP/ROD that states, to the extent possible, new ROWs will be located within or parallel to existing ROWs or corridors to minimize resource impacts (USDI/BLM 2003b, page 2-11).

The PRMP/FEIS and ROD are available for review at the FFO in Farmington, New Mexico or electronically at http://www.nm.blm.gov/ffo/ffo_home.html. This project EA addresses site-specific resources and/or impacts that are not covered within the PRMP/FEIS, as required by the NEPA.

Oil and gas development is recognized as an appropriate use of public lands in the FFO planning area (USDI/BLM 2003b). The RMP adheres to the federal mandates contained in the Energy Policy and Conservation Action (42 USC 6217) and Executive Order 13212, that direct federal land managing agencies to expedite the production of the federal mineral estate for the development of reliable domestic sources of energy (USDI/BLM 2003b, pages 1 and 11). The proposed project would not be in conflict with any local, county, or state plans.

A reasonably foreseeable development scenario (RFDS) was developed for the 2003 RMP that estimated foreseeable oil and gas development in the New Mexico portion of the San Juan Basin, beginning in January 2002 and lasting for 20 years. The RFDS also contemplated technological advances that could alter development of the basin during the 20-year period. The Mancos Shale reservoir was analyzed in the RFDS as an emerging gas play over a large part of the basin where it had not been previously developed (Engler et al. 2001). The PRMP/FEIS for the lands managed by the BLM/FFO indicates development of 9,942 new oil and gas wells from 2003 to 2023 in the San Juan Basin, allowing for about 16,100 acres of long-term disturbance. The ROD that approved the final plan acknowledged these and future projected impacts when balanced against the nation's need for domestic energy sources (USDI/BLM 2003a, 2003b, page 12). The proposed action is within the scale and pace of the RFDS therefore, cumulative impacts from the proposed action were included and analyzed in the Farmington PRMP/FEIS (USDI/BLM 2003a).

1.5 Relationship to Statutes, Regulations, or Other Plans

Encana would comply with all applicable federal, state, and local laws and regulations, as well as obtain the necessary permits for the proposed action. These laws and regulations include, but are not limited to:

- Antiquities Act of 1906, as amended (Public Law [PL] 52-209; 16 USC 431-433)
- American Indian Religious Freedom Act of 1978 (PL 95-431; 92 Stat. 469; 42 USC 1996)
- Archaeological Resources Protection Act of 1979 (PL 96-95; 93 Stat. 721; 16 USC § 470aa et seq.), as amended (PL 100-555; PL 100-588)

- Bald and Golden Eagle Protection Act of 1940, as amended (PL 86-70, PL 87-884, PL 92-535, PL 95-616; USC 668-668d)
- Clean Air Act, as amended (PL 88-206; 42 USC § 7401 et seq.)
- Clean Water Act, as amended (PL 107-303; 33 USC § 1251, et seq.)
- Colorado River Salinity Control Act, as amended (PL 93-320; 7 CFR Part 702)
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (PL 96-510; 42 USC § 9601; 40 CFR Part 307)
- Endangered Species Act of 1973 (PL 93-205; 16 USC § 1531 et seq.)
- Executive Order 11988 Floodplain management
- Executive Order 11990 Protection of Wetlands
- Executive Order 12898 Environmental Justice
- Executive Order 13007 Indian Sacred Sites
- Executive Order 13112 Invasive Species
- Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds
- Migratory Bird Treaty Act of 1918, as amended (16 USC §§ 703-712; 50 CFR Part 21)
- Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 104 Stat. 3048; 25 USC 3001; 43 CFR Part 10).
- Paleontological Resources Preservation Act as part of the Omnibus Public Land Management Act (PL 111-011, Title VI, Subtitle D)
- Safe Drinking Water Act, as amended (PL 93-523; 42 USC 300F-300-9), 40 CFR Parts 144 and 147).
- Section 106 of the National Historic Preservation Act of 1966 (PL 89-665; 80 Stat. 915; 16 USC 470 et seq.), as amended (implemented under regulations of the Advisory Council on Historic Preservation, 36 CFR Part 800)

1.6 Scoping, Public Involvement, and Issues

The Council on Environmental Quality (CEQ) defines scoping as “an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action alternative” (40 CFR 1501.7). Scoping is the process by which the BLM solicits internal and external input on the issues, impacts, and potential alternatives that will be addressed in an EIS or EA. As outlined in the BLM NEPA Handbook, it is optional for the BLM to conduct external scoping on actions analyzed by an EA (USDI/BLM 2008, Section 6.3.2).

The BLM/FFO Interdisciplinary Team was integrally involved in the internal scoping to identify potential issues, understand the proposal, develop the purpose and need, and develop a range of alternatives.

For the purpose of BLM NEPA analysis, an “issue” is a point of disagreement, debate, or dispute with a proposed action based on some anticipated environmental effect. Preliminary issues are frequently identified during the development of the proposed action through scoping.

The following issues were identified as potential issues of concern by the Interdisciplinary Team during internal scoping:

- How would the alternatives affect air quality in the area?
- How would the alternatives affect water resources?
- How would the alternatives affect upland vegetation and noxious weeds?
- How would the alternatives affect wildlife, BLM special management species, State of New Mexico-listed species, and migratory birds?
- How would the alternatives affect cultural resources?
- How would the alternatives affect visual resources?
- How would the alternatives affect transportation and traffic?
- How would the alternatives affect livestock grazing?
- How would the alternatives affect social and economic considerations?
- How would the alternatives affect public health and safety?

As outlined in the BLM NEPA Handbook, it is optional for the BLM to conduct external scoping on actions analyzed by an EA (USDI/BLM 2008, Section 6.3.2). External scoping was conducted through posting this project on the FFO's online NEPA log. The log is located on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html). The log contains a list of proposed and approved actions in the FFO. The public is encouraged to provide comments or request information on projects listed in the logs.

1.6.1 Issues Considered but Not Analyzed

CEQ regulations (40 CFR § 1501.7) state that the lead agency shall identify and eliminate from detailed study the issues that are not important or that have been covered by prior environmental review, narrowing the discussion of these issues in the document to a brief presentation of why they would not have a significant effect on the human or natural environment, or providing a reference to their coverage elsewhere.

During internal scoping, the Interdisciplinary Team identified the following resources as potential issues of concern that would not be significantly impacted or have been evaluated in previous analyses.

For the proposed action, identification of Native American Religious Concerns was limited to reviewing existing, published, and unpublished literature (Van Valkenburgh 1941, 1974; Brugge 1993; Kelly et al. 2006), the site-specific Class III survey report prepared for the proposed action, and a review by the BLM's cultural resources program regarding the presence of traditional cultural properties identified through ongoing BLM tribal consultation efforts. Both well locations are in proximity to Sis Naateel, (Sisnathyel Mesa, Wide Belt Mesa) reported to be the home of several holy individuals important in Blessingway and to be the location of where the Navajo acquired sheep and horses. There is some ambiguity on the identification of this mesa. It is clearly described by Van Valkenburgh (1941:171) as a "large quasi-rectangular mesa standing isolated in the southwestern township of the Jicarilla Apache Indian reservation… 10 miles east of Counselors trading post." See also Van Valkenburgh (1974:32-37).

Brugge (1993:18) encountered the problems of Navajo toponymy and correlating names recorded on recent USGS maps. Brugge (1993:18) went on to state that "the work of Van Valkenburgh has been of value. His descriptions are usually “more detailed than those of other students of Navajo culture…” The mesa shown on the current USGS map as Sisnathyel Mesa does not seem to conform to Van Valkenburgh’s description. Otherwise, there are currently no known remains that fall within the purview of the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) or the Archaeological Resources Protection Act (16 USC 470) within the proposed action area. The proposed action would not impact any known traditional cultural properties, prevent access to sacred sites, prevent the possession of sacred objects, or interfere with or hinder the performance of traditional ceremonies and rituals pursuant to the American Indian Religious Freedom Act of 1978 (42 USC 1996) or Executive Order 13007.

No federally listed species with the potential to occur in Sandoval County or potential habitats for federally listed species were observed within the proposed project area. Furthermore, no designated critical habitat for any federally listed species occurs within the proposed project area. The FFO reviewed and determined that the proposed action is in compliance with listed species management guidelines outlined in the September 2002 Biological Assessment (Cons. No. 2-22-01-I-389) (USDI/BLM 2002). No further consultation with the U.S. Fish and Wildlife Service (USFWS) is required.

2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

Encana is proposing development of the Lybrook D32-2306 01H and Lybrook I30-2306 01H well pads, well-tie pipelines, and access roads (Cluster 1) to access the mineral estate administered by the BLM/FFO. The proposed project area is located in the central portion of the San Juan Basin in the Lybrook area in Sandoval County. The project area is approximately 3 miles southwest of Counselor, New Mexico. A project vicinity map is provided as Figure 1 (see Appendix A). Figure 2 shows the proposed action on the Counselor and Lybrook, New Mexico United States Geological Survey 7.5-minute topographic maps. Figure 3 displays the proposed action on the Counselor and Lybrook, New Mexico 2010 New Mexico digital photo orthoquads (see Appendix A). Photographs of the proposed action components are provided in Appendix A. The legal description of the proposed action components are listed in Table 2-1.

Table 2-1. Proposed action component legal descriptions

Component	Legal Description
Lybrook D32-2306 well pad	1 feet FNL and 337 feet FWL of Section 32, Township 23 North, Range 6 West, NMPM
Lybrook D32-2306 access road and pipeline	The proposed well-tie pipeline and access road would be located in the NW¼ of Section 32 and in the SW¼ of Section 29, in Township 23 North, Range 6 West, NMPM
Lybrook I30-2306 well pad	1867 FSL and 635 feet FEL of Section 30, Township 23 North, Range 6 West, NMPM
Lybrook I30-2306 access road and pipeline	The proposed well-tie pipeline and access road would be located in the E½ of Section 30 and in the NW¼ of Section 29, in Township 23 North, Range 6 West, NMPM

Notes: E = east; FEL = from the east line; FNL = from the north line; FSL = from the south line; NMPM = New Mexico Principal Meridian; NW = northwest; SW = southwest

Activities associated with the proposed project would include construction of the access roads and well pads, drilling, stimulation, and completion of the proposed wells, installation of surface facilities necessary to produce the wells, and installation of pipelines to transport natural gas to markets. These activities are detailed below.

Construction

Drilling of the proposed Lybrook D32-2306 01H oil well would require constructing a pad measuring 400 feet by 400 feet, with a 50-foot-wide construction zone around the perimeter of the pad. The proposed well pad would be located off-lease and would be permitted through a ROW grant. Approximately 2.85 acres would be constructed on BLM-managed lands and 2.89 acres would be constructed on state lands, resulting in a total disturbance of 5.74 acres. The maximum cut will be approximately 11 feet on the south corner (Corner 3) and the maximum fill will be approximately 11 feet on the east side midline (Corner 1).To access the site, Encana would construct an approximately 1,309-foot resource road within a 30-foot wide ROW. The majority of the proposed road would be located on an existing two-track road. Encana

would also construct and operate a proposed well-tie pipeline, which would be approximately 1,481 feet in length. Approximately 1,478 feet of the pipeline would be constructed within a 40-foot-wide ROW on BLM managed lands. Approximately 2.3 feet of the pipeline would be constructed within a 30-foot wide ROW on state lands. Approximately 201.7 feet of the proposed pipeline would overlap the well pad disturbance and. The proposed access road would parallel the proposed pipeline. Total construction width of the pipeline/access road would be 50 feet and would be designated as 20 feet of disturbance adjacent to the road and 30 feet of disturbance on the road. The total disturbance from the access road and pipeline would be 1.41 acres. Total surface disturbance of the proposed project would be 7.15 acres.

Drilling the proposed Lybrook I30-2306 01H oil well would require constructing a 400-foot by 400-foot pad with a 50-foot-wide construction zone around the perimeter, resulting in approximately 5.74 acres of disturbance. The maximum cut will be approximately 15 feet on the south edge of the pad (midline Corner 4) and the maximum fill will be approximately 13 feet on the northwest corner (Corner 6). Encana would also construct and operate a proposed well-tie pipeline, which would be approximately 2,906 feet in length constructed within a 40-foot-wide ROW. Approximately 202 feet of the proposed pipeline would be located within the proposed well pad. To access the site, Encana would construct an approximately 2,490-foot resource road within a 30-foot wide ROW. The proposed road would parallel the proposed pipeline. Total construction width of the pipeline/access road would be 50 feet and would be designated as 20 feet of disturbance adjacent to the road and 30 feet of disturbance on the road. The total disturbance from the access road and pipeline would be 3.10 acres. One temporary use area (TUA) would be needed along the proposed access road/pipeline ROW. The TUA would be 40 feet by 200 feet TUA between Stations 23+05.1 and 25+05.1 resulting in 0.184 acre of disturbance. Total surface disturbance of the proposed project would be 9.02 acres.

Table 2-2 provides a summary of proposed disturbance that would occur under the proposed action. The total surface disturbance associated with the proposed action would be approximately 16.17 acres.

Table 2-2. Summary of proposed disturbance

	Lybrook D32-2306 01H	Lybrook I30-2306 01H
Well pad		
Pad Dimensions	400 x 400 feet	400 x 400 feet
Construction Zone	50 feet wide around perimeter	50 feet wide around perimeter
Area	5.74 acres	5.74 acres
Pipeline/Road		
Length[1]	1,480 feet	2,906 feet
Construction Width	50 feet	50 feet
Area[2]	1.41 acres	3.10 acres
Temporary Use Area		
Dimensions	-	40 x 200 feet
Area	-	0.184 acre
Total Disturbance	**7.15 acres**	**9.02 acres**

[1] Total length of pipeline ROW

[2] Based on the length of the pipeline outside the proposed well pad dimensions

Table 2-3 lists the land status and short- and long-term disturbance that would occur under the proposed action.

Table 2-3. Short and long-term disturbance per land status for the proposed action

Land Status	Short-term Disturbance (acres)	Long-term Disturbance (acres)[1]
BLM	13.28	5.81
State of New Mexico	2.89	0.80
Total	16.17	6.61

[1] Based on 30-foot wide access roads and 1.6 acres per well for operation

Drilling and Completions

After well pad construction is complete, Encana would mobilize a drilling rig to drill the wells from each pad. During drilling operations, equipment on the site would include:

- The drilling rig
- Stockpiles of drill pipe and casing
- A closed-loop system and aboveground tanks for collecting cuttings and fluid
- Mud shakers to separate the cuttings from the fluid
- Generators to provide power to the drill rig
- Office trailers equipped with sleeping quarters for essential personnel

Drilling activities would occur continuously for approximately 2 weeks per well and would require on-site supervision 24 hours per day.

Drilling operations would be conducted in compliance with all Federal Onshore Oil and Gas Orders, all applicable federal and State of New Mexico rules and regulations, and BLM Notice to Lessees. The proposed wells would be horizontal oil wells targeting the Gallup Pool of the Mancos Formation. The proposed Lybrook D32-2306 well would be drilled to a total vertical depth of approximately 5,600 feet and then horizontally drilled for approximately 4,628 feet. The proposed Lybrook I30-2306 wells would be drilled to a total vertical depth of approximately 5,488 feet and then horizontally drilled for approximately 3,749 feet.

Using a fresh water-based drilling mud system, surface casing would be set to an approximate measured depth of 500 feet. After the surface casing is installed, the casing would be cemented in place by pumping cement down the casing, circulating the cement back up the outside of the casing to create a cement sheath around the entire casing, and then tested to ensure the quality and integrity of the cement. Prior to drilling below the surface casing, a blowout preventer (BOP) would be installed on the surface casing, and both the BOP and surface casing would be pressure tested for integrity. After installation and testing of the BOP, a string of intermediate casing would be installed to an approximate measured depth of 6,315 feet for the Lybrook I30-2306 well and 5,657 feet for the Lybrook D32-2306 well. The intermediate casing would be cemented and then tested to ensure the quality and integrity of the cement.

After cementing the intermediate string, a synthetic oil-based drilling mud system would be used to drill the horizontal portion of the wellbore. Additives may be mixed with the mud system to achieve borehole stability, minimize possible damage to geologic formations, provide adequate viscosity to carry the drill cuttings out of the wellbore, and reduce downhole fluid losses.

After drilling the wellbore to its final depth, a production liner would be run and secured into place utilizing an external swell packer system. The production liner provides additional isolation of the wellbore and creates a pathway for natural gas or liquids to travel from the formation to the surface.

After the production liner has been secured into place, the drilling rig would be removed, and a completion rig moved to the site. The completion rig would run a completions string of the same size, weight, and grade as the production liner into the wellbore to tie-in to the liner/liner hanger, providing a secondary barrier during completions that protects intermediate casing from pressures needed to pump into the formation. During completions activities, the well pads would have completions rigs, completions command centers, steel storage tanks, pump trucks and transports, blending and mixing facilities, and related ancillary completions equipment.

Completing the well would require hydraulic fracturing— the process of injecting water, sand, and a small amount of fluid additives into the wellbore under very high pressure to fracture the formation and release the oil. A series of charges would be set through the producing interval in the horizontal portion of the wellbore to perforate the production liner and casing and create small fractures in the target formation. A fluid and sand mixture would be injected at high pressure into the formation to create cracks or fractures, the sand would act as a proppant to keep the fractures open and allow oil to move more efficiently into the wellbore. The fracturing process would be done in stages, with each stage continuing in the same manner along the horizontal portion of the wellbore, using a series of plugs to isolate portions of the well that were previously fractured. After all of the stages are completed, the plugs would be drilled out to allow oil to flow to the wellhead.

Completions would be designed with nitrogen foam to minimize water usage and improve fluid recoveries post-completions. Water would be sourced from a private water well located in the SW/NE ¼ of Section 32, of Township 25 North, Range 9 West, NMPM. This well has been permitted by the State of New Mexico. The well has been assigned the Point of Diversion Number SJ 01979-S4 by the New Mexico Office of the State Engineer. Water would be stored on-site in steel storage tanks (up to 15).

Drilling operations would take approximately 2 weeks per well. Completions activities are expected to take 1 to 3 weeks per well.

Production

Production facilities at the well pads would consist of wellheads, metering units, separators, aboveground condensate and produced water tanks (two tanks per well), and compressors. If artificial lift is required, conventional pumping units (pump jacks) and/or gas lift systems would be installed.

Tank batteries would be placed within corrugated steel secondary containment berms and would be sized to contain a minimum of 110 percent of the storage capacity of the largest tank within the berm.

Containment berms would include an impermeable liner attached to the rings and laid under the tanks. All loading lines would be placed inside the containment berm or would have secondary containment vessels.

Installation of production equipment would take 2 to 3 weeks per well pad. Production facilities would be in place for the life of the wells, which are anticipated to be 30 to 50 years.

Pipeline Installation

The proposed well-tie pipelines would be up to a 6-inch outside diameter buried steel pipelines with a maximum allowable operating pressure of 500 pounds per square inch gauge. Related aboveground appurtenances that would be installed within the pipeline workspace would include cathodic protection equipment, futures, and block valves with blowdowns.

The trench line, or ditch, would be excavated and sloped in accordance with Occupational Safety and Health Administration (OSHA) specifications. The cover from top of pipe to ground level would be a minimum of 36 inches through typical soil and rock and a minimum depth of 48 inches at road crossings. Excavated material would be stockpiled at the edge of the workspace.

The trenching operation would be followed by pipe installation that would include stringing, bending for horizontal or vertical angles in the alignment, welding pipe segments together, inspection, coating joint areas to prevent corrosion, and lowering-into the trench. Backfilling would begin after a section of the pipe has been successfully placed in the ditch and final inspection has been completed.

Cleanup activities would be initiated as soon as practicable after backfilling activities have been completed. The pipelines would be seeded with the seed mix and rates provided in the Reclamation Plan attached to the APDs for the well pads.

Construction and pipeline installation activities would take 4 to 6 weeks per pipeline and reclamation activities would take 1 to 2 weeks per pipeline. The pipelines and related aboveground appurtenances would be in place for the life of the wells, which are anticipated to be 30 to 50 years.

Interim Reclamation

After production facilities are installed at the pads, the size of the well pads would be reduced to the minimum surface area needed for production facilities and future operations. Interim reclamation would consist of grading and recontouring the portion of the well pad not needed for production facilities/future operations to blend with adjacent natural surroundings as much as practicable, covering with salvaged topsoil material, and seeding to reestablish vegetation. Seed mixtures and rates would be in accordance with the Reclamation Plan for the proposed action. Sediment and erosion control measures would be installed as necessary. Interim reclamation would reduce the disturbed area to approximately 1.6 acres per pad. The proposed pipeline ROWs where they do not overlap the access roads would be reclaimed. Approximately 6.6 acres associated with well operation and access would not be reclaimed.

Interim reclamation activities would be initiated within 120 days of final operations and would take 2 to 4 weeks per well pad.

Abandonment and Final Reclamation

Upon abandonment of the wells, the wellbores would be plugged with cement and the production facilities would be removed. Federal and State of New Mexico standards would be followed and Encana would provide the BLM with technical and environmental aspects of the final plugging and abandonment and reclamation procedures. The well pads and access roads would be graded and re-contoured to blend with adjacent natural surroundings as much as practicable, covered with salvaged topsoil material, and seeded to reestablish vegetation. Sediment and erosion control measures would be installed as necessary.

2.1.1 Design Features

All areas of proposed surface disturbance were inspected in the field to ensure that potential impacts to natural resources would be minimized through the implementation of design features. For a detailed description of the design and construction practices associated with the proposed action, refer to the APDs in Appendix B. For the proposed action, standard and project-specific design features include but are not limited to:

- Roads will be maintained in the same or better condition as what existed prior to the commencement of operations and road maintenance will continue until final abandonment and reclamation of the well location.
- Dust emissions will be controlled on the roads and locations, as necessary, with the application of dust suppressants (e.g., magnesium chloride) and/or water.
- The access roads will be designed and constructed as a Resource Road in accordance with the BLM Gold Book Standards (USDI/USDA 2007) and BLM 9113-1 (Roads Design Handbook) and BLM 9113-2 (Roads National Inventory and Condition Assessment Guidance and Instructions Handbook). Construction will include ditching, draining, installing culverts, crowning and capping or sloping and dipping the roadbed, as necessary, to provide a well-constructed and safe road.
- All FFO cultural resources stipulations will be followed as indicated in the Cultural Resource Records of Review, attached to the Conditions of Approval (COA) in the APD/ROW as the case may be. These stipulations may include, but are not limited to temporary or permanent fencing or other physical barriers, monitoring of earth-disturbing construction, project area reduction and/or specific construction avoidance zones, and employee education. All employees, contractors, and sub-contractors of the project will be informed by the project proponent that cultural sites are to be avoided by all personnel, personal vehicles, and company equipment. All employees, contractors, and sub-contractors of the project will also be informed that it is illegal to collect, damage, or disturb cultural resources and that such activities are punishable by criminal and/or administrative penalties under the provisions of the Archaeological Resources Protection Act. In the event of a discovery during construction, the project proponent will immediately stop all construction activities in the immediate vicinity of the discovery and then immediately notify the archaeological monitor, if present, or the BLM. The BLM will then evaluate or cause the site to be evaluated. Should a discovery be evaluated as significant (e.g., National Register, Native American Graves Protection and Repatriation Act, Archaeological Resources Protection Act, it

will be protected in place until mitigating measures can be developed and implemented according to guidelines set by the BLM.

- Prior to construction, the pipeline ROW will be staked at 100- to 200-foot intervals and, when applicable, BLM boundaries will be marked with station numbers at the entrance to and exit from BLM lands.
- Grazing permittees will be notified when construction is scheduled to begin. All hazards to livestock would be fenced or contained.
- All project activities would be confined to permitted areas only.
- Where pipeline construction parallels or crosses public roads, warning signs will be placed to alert motorists of construction. Safety measures will also be implemented along the construction workspace by either using the topsoil or subsoil piles or strung pipe as a barrier. Trenches left open at road crossings will be fenced with orange safety fence and barricades will be installed, if needed.
- Clearing, removal of topsoil, and grading will be limited to the minimum area required for safe and efficient construction.
- Trees larger than 3 inches in diameter will be cut at ground level and delimbed. The wood would be donated to the local Chapter houses for the elderly and needy. Stumps will be cut as close to the ground as possible. Stumps and root balls will be hauled to an approved disposal site or stockpiled at the edge of the well pad and buried in the cut slopes of the pad during interim reclamation.
- Trees smaller than 3 inches in diameter, slash, and brush will be chipped, shredded or mulched and incorporated into the topsoil for later use in interim reclamation.
- Remaining brush will be brush-hogged or scalped at ground level prior to ground disturbance.
- Topsoil will be segregated and stockpiled at the edge of the workspace. Topsoil is defined as the top 6 inches of soil. Vehicle/equipment traffic will be prevented from crossing topsoil stockpiles.
- If the location becomes prone to wind or water erosion, Encana will take appropriate measures to prevent topsoil loss from wind. Such measures may include using tackifiers or water to wet the topsoil stockpile to create a crust across the exposed soil to prevent soil loss.
- Culverts (24 to 36-inch) will be installed, as needed, along the new and upgraded access roads from the well pads to the arterial route. Culverts will be sized and installed in accordance with BLM Gold Book standards (USDI/USDA 2007) and BLM 9113-1 (Roads Design Handbook) and BLM 9113-2 (Roads National Inventory and Condition Assessment Guidance and Instructions Handbook).
- A closed-loop system will be used. Cuttings will be stored on-site in above-ground storage tanks. Cuttings will be disposed at an approved waste disposal facility.
- The closed-loop system storage tanks will be sized to ensure confinement of all fluids and will provide sufficient freeboard to prevent uncontrolled releases.
- A 20-millimeter thick liner will be installed under tanks, pumps, ancillary facilities, and truck loading/unloading areas associated with the closed-loop system.

- Drilling fluids will be stored on-site in above-ground storage tanks. Upon termination of drilling operations, the drilling fluids will be recycled and transferred to other permitted closed-loop systems or returned to the vendor for reuse, as practical. Residual fluids will be disposed at an approved waste disposal facility.
- The water-based solution that flows back to the surface during and after completion operations will be placed in storage tanks on the location. Flowback water will be confined to a storage tank for a period not to exceed 90 days after initial production and will be disposed at an approved waste disposal facility.
- Any spills of non-freshwater fluids will be immediately cleaned up and removed to an approved disposal site.
- Self-contained, chemical toilets will be provided for human waste disposal. The toilet holding tanks will be pumped, as needed, and the contents thereof disposed of in an approved sewage disposal facility. Toilets will be on-site during all operations.
- Garbage, trash, and other waste materials will be collected in a portable, self-contained, and fully-enclosed trash container during drilling and completion operations. The accumulated trash will be removed, as needed, and will be disposed of at an authorized sanitary landfill. No trash will be buried or burned on location.
- Immediately after removal of the drilling rig, all debris and other waste materials not contained in the trash container will be cleaned up and removed from the well location.
- No chemicals subject to reporting under SARA Title III in an amount equal to or greater than 10,000 pounds will be used, produced, stored, transported, or disposed of annually in association with the drilling, testing, or completing of this well.
- No extremely hazardous substances, as defined in 40 CFR 355, in threshold planning quantities, will be used, produced, stored, transported, or disposed of in association with the drilling, testing, or completing of this well.
- The amount of open trench will be minimized ahead of pipe laying and backfilling. No more than ½ mile of trench or the amount of trench that can be worked in a day will be open at any given time. Backfilling operations will be performed within a reasonable amount of time of the lowering operation to ensure the trench is not left open for more than 24 hours. Trenches left open overnight will be fenced with a temporary fence or other methods approved by the Authorized Officer. The ends of the trench will be sloped (3:1) to allow animals to escape.
- Escape ramps/crossovers will be constructed every 1,320 feet. In areas where active grazing is taking place escape ramps/crossovers will be placed every 500 feet. The ends of the open trench will be sloped each night with a 3:1 slope.
- Established livestock and wildlife trails will be left in place as a crossover. Escape ramps/crossovers will be constructed with a minimum 3:1 slope at each end of the crossover. Crossovers will be a minimum of 10 feet wide and not fenced.
- The end of the pipe will be plugged to prevent animals from crawling in.
- Before the trench is closed, it will be inspected for animals. Any trapped wildlife or livestock will be promptly removed and released at least 150 yards from the trench.

- All existing improvements (such as fences, gates, and bar ditches) will be repaired to previous or better than pre-construction conditions. Cut fences will be tied to H-braces prior to cutting and openings will be protected as necessary during construction to prevent the escape of livestock. A temporary closure will be installed on the same day as the fence is cut. Following reclamation, the fence will be reconstructed to BLM specifications.
- Cover from top of pipe to ground level will be a minimum of 36 inches through typical soil and rock and a minimum of 48 inches at drainage of road crossings. Inspection will be conducted to verify that minimum cover is provided, the trench bottom is free of rocks and debris, external pipe coating is not damaged, and the pipe is properly fitted and installed into the ditch.
- Rocks and limbs removed during clearing will be scattered across the workspace in a random arrangement using rubber-tired equipment.
- Open pits will be netted and vent caps placed on all open pipes to prevent bird entry and nesting. If construction is scheduled to begin within the typical migratory bird-breeding season of May 15 to July 31, an FFO-approved bird nest survey must be conducted within the proposed action area.
- Permanent erosion control measures will be installed after the workspace has been re-contoured. Encana will construct waterbars on all disturbed areas to the spacing and cross sections specified by the Authorized Officer.
- The disturbed areas will then be reseeded with a BLM/FFO approved seed mix. The proposed Lybrook D32-2306 would be reseeded with a Piñon-Juniper seed mix while the Lybrook I30-2306 would be reseeded with a Sagebrush-Grass seed mix as described in the respective reclamation plans. Seeding will be accomplished within 120 days of construction completion, weather permitting. Upon evaluation after the second growing season, seeding will be repeated if a satisfactory stand is not obtained. Cut and fill slopes will be hand seeded with hydro-mulch excelsior netting and/or mulch with netting.
- It will be the operator's responsibility to monitor, control, and eradicate all invasive, non-native plant species within the proposed project area throughout the life of the proposed project. The operator will contact the BLM/FFO regarding acceptable weed-control methods. If the operator does not hold a current Pesticide Use Permit, a Pesticide Use Permit will be submitted prior to pesticide application. Only pesticides authorized for use on BLM lands will be used. The use of pesticides will comply with federal and state laws. Pesticides will be used only in accordance with their registered use and limitations. The operator will contact the BLM/FFO prior to using these chemicals.
- Production equipment will be placed on location in such a manner to minimize long-term disturbance and maximize interim reclamation. As practical, access will be provided by a teardrop-shaped road through the production area so that the center may be re-vegetated.
- A berm will be constructed completely around any production facilities that contain fluids (i.e., production tanks, produced water tanks, etc.). These berms will be constructed of compacted subsoil, corrugated metal, or equivalent, be impervious, and hold 110 percent of the capacity of the largest tank.

- Production facilities would be painted Juniper Green to blend with the natural color of the landscape and would be located, to the extent practical, to reasonably minimize visual impact. Equipment subject to safety considerations would not be painted.
- Engines would be equipped with mufflers and barriers or other sound-proofing measures would be implemented, if needed, to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the jurisdiction of the FFO NTL 03-1 FFO.

Site-Specific Design Features for the Lybrook I30-2306

- A silt trap will be installed at the south edge of the pad between Corner 5 and the midpoint between Corners 5 and 6.
- The midline of Corner 4 will be high walled at a 1:1 ratio.
- Water will be diverted around the pad and silt traps installed as needed upon interim reclamation.
- A silt trap will be installed in the northeast corner (Corner 2).
- A 24-inch minimum culvert will be installed where the new well pad access road meets the main road that is the existing roadway.

Site Specific Design Features for the Lybrook D32-2306

- Corner 3 of the well pad will be rounded to minimize cut/fill.
- Water will be diverted around the pad and silt traps installed as needed upon interim reclamation.
- A 24-inch minimum culvert will be installed where the new well pad access road meets the main road that is the existing roadway.
- The road will be upgraded to the Lybrook E29-2306 location.

2.2 No Action

The BLM NEPA Handbook (H-1790-1; USDI/BLM 2008) states that for EAs on externally initiated proposed actions, the no action alternative is generally to reject the proposal or deny the application. This option is provided in 43 CFR 3162.3-2 (h) (2). This alternative would deny the approval of the APDs and ROWs and the current land and resource uses would continue to occur in the proposed project area. The no action alternative provides a useful baseline for comparison of environmental effects (including cumulative effects) and demonstrates the consequences of not meeting the need for the action.

2.3 Alternatives Considered but Eliminated

Several configurations of the proposed well pads, pipelines, and roads were considered and evaluated by the applicant, BLM, and natural and cultural resources experts using desktop tools and in-field examination. Two preliminary locations were identified but eliminated given the potential to impact cultural resources. A third preliminary location was identified but also eliminated because it would not have been technically feasible to drill and because of the presence of jurisdictional waters of the United States.

Encana proposed the Lybrook L29-2306 (1935 FSL and 282 FWL) that was evaluated by the BLM and applicant in January 2013. This location was eliminated because portions of the pad were staked in

ephemeral drainages and stormwater flowing from the sandstone mesa to the south onto the pad would be difficult to manage. The pad size could not be decreased nor could the pad be shifted to avoid impacting drainageways. The L29-2306 was then relocated (2009 FSL and 164 FWL) and evaluated in June 2013 by the BLM and applicant. This second location would have required rounding one corner significantly to avoid impact to cultural resources and a drainage flowing down the working side. The drainage would have required armoring and additional design features to protect the pad from erosion. Additionally, the access road to the location would have required a 60-inch culvert. The proposed Lybrook I30-2306 location was then developed and is presented as part of the proposed action.

Encana proposed the M29-2306 location that was evaluated by the BLM in June 2013. This pad was located on a lower terrace of Sisnathyl Mesa and would have required over 19 feet of fill over sandstone along one side of the pad. Given these topographical impacts, this location was eliminated from detailed consideration and the Lybrook D32-2306 was developed and is presented as part of the proposed action. The initial proposed access road for the Lybrook D32-2306 would have crossed two relatively large ephemeral drainages. During the planning process, the route was modified to avoid these drainages and to follow an existing two-track road.

No other alternatives were identified that would create less disturbance and still achieve the purpose and need of the proposed action.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the environment that would be affected by implementation of the alternatives described in Chapter 2. Aspects of the affected environment described in this section focus on the relevant major resources or issues.

Under the no action alternative, the proposed action would not be implemented. The no action alternative would result in the continuation of the current land and resource uses in the project area. This alternative will not be evaluated further in this EA.

Field resource investigations of the proposed action were conducted on August 27 and September 4, and 16, 2013 by natural resources specialists from Ecosphere Environmental Services (Ecosphere). Cultural resource surveys were conducted by La Plata Archaeological Consultants, LLC (LAC) on July 17 and 22, and between September 12 and 20, 2013. The on-site was conducted on September 12, 2013 and attended by representatives from Encana, Ecosphere, LAC, and the BLM/FFO.

The analysis area for this EA is defined as the project footprint of the proposed Lybrook D32-2306 and I30-2306 well pads, access roads, and pipelines.

3.1 Air Resources

3.1.1 Affected Environment

The proposed action would be located in Sandoval County, New Mexico. Additional general information on air quality in the area is contained in Chapter 3 of the Farmington PRMP/FEIS. In addition, new information about greenhouse gases (GHG) and their effects on national and global climate conditions has emerged since this document was prepared. Ongoing scientific research has identified the potential impacts of GHG emissions such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_X), water vapor, and several trace gases on global climate. Through complex interactions on a global scale, GHG emissions may cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and burning of fossil carbon sources have caused GHG concentrations to increase measurably, and may contribute to overall climatic changes—typically referred to as global warming.

Much of the information referenced in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as Air Quality Technical Report; USDI/BLM 2013). This document summarizes the technical information related to air resources and climate change associated with oil and gas development, and the methodology and assumptions used for analysis.

The U.S. Environmental Protection Agency (USEPA) has the primary responsibility for regulating air quality, including six nationally regulated ambient air pollutants (criteria pollutants). These criteria

pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone, particulate matter (PM), particulate matter with a diameter between 2.5 and 10 micrometers (PM_{10}) and particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$), sulfur dioxide (SO_2), and lead. The USEPA has established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The NAAQS are protective of human health and the environment. The USEPA has approved the New Mexico's State Implementation Plan and New Mexico enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands within Bernalillo County. Air quality is determined by atmospheric pollutants and chemistry, dispersion meteorology, and terrain; included are applications of noise, smoke management, and visibility. Climate is the composite of generally prevailing weather conditions of a particular region throughout the year, averaged over a series of years. The USEPA has proposed or completed actions recently to implement Clean Air Act requirements for greenhouse gas emissions. Climate has the potential to influence renewable and non-renewable resource management.

Air Quality

Criteria Air Pollutants

The Air Quality Technical Report describes the types of data used for describing the existing conditions of criteria pollutants, how criteria pollutants are related to the activities involved in oil and gas development, and providing a table of current national and state standards (USDI/BLM 2013). The USEPA Green Book web page reports that all counties in the analysis area—San Juan, McKinley, Rio Arriba, and Sandoval Counties in New Mexico and La Plata County, Colorado—are in attainment of all NAAQS, as defined by the Clean Air Act. The area also does not violate any New Mexico Ambient Air Quality Standards (NMAAQS). The current criteria pollutant "design concentrations" in the analysis area are described below. Design concentrations are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. Table 3-1 shows monitored design values for ozone in recent years for each of the three San Juan County ozone monitoring stations.

Table 3-1. Reported ozone values for San Juan County ozone monitoring stations

State Air Monitoring Station	8-hour Ozone Design Value (parts per million)				NAAQS
	2007-2009	2008-2010	2009-2011	2010-2012	2008
Substation	0.067	0.063	0.063	0.067	0.075
Bloomfield	0.061	0.060	0.061	0.067	0.075
Navajo Lake	0.069	0.066	0.068	0.071	0.075

Note: NAAQS = National Ambient Air Quality Standard Standards

Source: USEPA 2012

Table 3-2 summarizes monitored design values for other criteria pollutants in San Juan County.

Table 3-2. Criteria pollutant design value concentrations monitored in San Juan County

Pollutant	Design Value	Averaging Time	NAAQS	NMAAQS
NO_2	13 parts per billion (ppb)	Annual	53 ppb	50 ppb
NO_2	39 ppb	1-hour	100 ppb [(1)]	0.10 ppm (24-hour)
PM_{10}	Data incomplete	24-hour	150 µg/m^{3}, [(2)]	150 µg/m^{3}, [(3)]
$PM_{2.5}$	4.5 µg/m^3	Annual	12 µg/m^{3}, [(4)]	60 µg/m^{3}, [(3)]
$PM_{2.5}$	14 µg/m^3	24-hour	35 µg/m^{3}, [(1)]	
SO_2	0.001 ppm	Annual	None	0.02 ppm
SO_2	20 ppb	1-hour	75 ppb [(5)]	None
SO_2	0.008 ppm	24-hour	None	0.10 ppm

Note: NAAQS = National Ambient Air Quality Standard Standards; NMAAQS = New Mexico Ambient Air Quality Standards; NO_2 = nitrogen dioxide; ppb = parts per billion; µg/m^3 = micrograms per cubic meter; ppm = parts per million

Source: USEPA 2012

[1] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb.

[2] µg/m^3 refers to micrograms per cubic meter of air. Not to be exceeded more than once per year, on average over 3 years.

[3] The NMAAQS is a standard for total suspended particulate matter.

[4] Annual mean, averaged over 3 years.

[5] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.

In 2005, the USEPA estimated that there was less than 0.01 ton of lead per square mile emitted in the analysis area, which is less than 2 tons total (USDI/BLM 2013). There is no monitoring conducted for lead and CO in northwestern New Mexico. However, concentrations of these pollutants are expected to be low in rural areas; therefore, not monitored.

Hazardous Air Pollutants

The Air Quality Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (USDI/BLM 2013). The USEPA has identified 187 toxic air pollutants as HAPs. In March 2011, the USEPA published the fourth in a series of National Scale Air Toxics Assessments (NATAs) that quantifies HAP emissions for 2005 by U.S. counties. The purpose of the NATA is to identify areas where HAP emissions result in high health risk. Computer models are used to develop estimates of risk of cancer or other health impacts. NATA presents risk hazard indexes for cancer, neurological, and respiratory problems for each county and census tract. Because techniques have changed over the years, the NATA is not comparable to those previously issued. The USEPA also cautions that because data availability varies from state to state, the results are not necessarily comparable from one geographic area to another. The 2005 NATA estimated the total cancer risk for the analysis area as 25 to 50 per one million and the estimated tract level total respiratory hazard index was 0 to 1. The USEPA estimates the average national cancer risk for 2005 was 50 per one million, meaning 1 person out of every 20,000 had an increased likelihood of contracting cancer from breathing air toxics from outdoor sources if exposed to 2005 emission levels over their lifetime. A respiratory hazard index below 1 indicates that exposures in the area do not exceed reference levels that would have adverse effects for human health.

Climate

The analysis area is located in a semi-arid climate regime, typified by dry windy conditions and limited rainfall. Summer maximum temperatures are generally in the range of 80 or 90 degrees Fahrenheit (°F), and winter minimum temperatures are generally in the teens to 20s. Temperatures occasionally reach above 100°F in June and July, and have dipped below 0°F in December and January. Precipitation is divided between summer thunderstorms associated with the southwest monsoon and winter snowfall as Pacific weather systems drop south into New Mexico.

Table 3-3 shows climate normals for the 30-year period from 1981 to 2010 for the Farmington, New Mexico area.

Table 3-3. Climate normals for the Farmington area, 1981-2010

Month	Average Temperature[1]	Average Maximum Temperature[1]	Average Minimum Temperature[1]	Average Precipitation (inches)
January	30.5	40.8	20.3	0.53
February	35.8	46.8	24.8	0.59
March	43.2	56.1	30.3	0.78
April	50.4	64.7	36.2	0.65
May	60.4	74.8	46.1	0.54
June	69.8	85.1	54.5	0.21
July	75.4	89.6	61.2	0.90
August	73.2	86.5	59.8	1.26
September	65.4	79.1	51.7	1.04
October	53.3	66.4	40.1	0.91
November	40.5	52.2	28.8	0.68
December	31.0	41.2	20.7	0.50

Source: USDI/BLM 2013

[1] Degrees Fahrenheit

3.1.2 Impacts from the Proposed Action

Methodology and assumptions for calculating air pollutant and GHG emissions are described in the Air Resources Technical Report (USDI/BLM 2013). This document incorporates the sections discussing the modification of calculators developed by the BLM to address emissions for one horizontal oil well. The calculators give an approximation of criteria pollutant, HAPs, and GHGs emissions to be compared to regional and national emissions levels (USDI/BLM 2013). Also incorporated into this document are the sections describing the assumptions used in developing the inputs for the calculator (USDI/BLM 2013).

Direct and Indirect Impacts

Criteria Pollutants

Table 3-4 shows estimated emissions from one proposed horizontal oil well for criteria pollutants, volatile organic compounds (VOC) and GHGs (USDI/BLM 2013). For comparison, Table 3-5 shows total

human-caused emissions for each of the counties in the FFO and La Plata County, Colorado, based on USEPA's 2008 emissions inventory (USEPA 2011).

Table 3-4. Criteria pollutant and volatile organic compound emissions estimated for construction of one horizontal oil well (average 25 days to drill and complete)

Activity	NOx	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	CH_4	CO_2
One time operations (tons)								
Construction	5.5	1.5	0.5	2.5	0.25	0.1	0.007	598.85
Completion	0.5	0.1	0.03	0.025	0.025	-	-	55.00
Interim Reclamation	0.006	0.006	0.006	0.001	-	0.003	-	1.24
Final Reclamation	0.006	0.006	0.006	0.001	-	0.004	-	1.66
Ancillary Operations (tons)								
Workover	0.129	0.04	0.01	0.01	0.01	-	-	10.59
Road Maintenance	-	-	-	-	-	-	-	0.26
Road Traffic	-	-	-	-	-	-	-	0.06
Annual operations (tons/year)								
Oil Haul Truck and small truck (100 bbl/day)	0.009	0.006	0.0012	0.0009	0.0008	-	0.0001	3.88
Total	**6.13**	**1.64**	**0.55**	**2.54**	**0.29**	**0.11**	**0.01**	**671.54**

Note: NO_X = nitrous oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} = particulate matter with an diameter between 2.5 and 10 micrometers; $PM_{2.5}$ = particulate matter with a diameter of 2.5 micrometers or less; SO_2 = sulfur dioxide; CH_4 = methane; CO_2 = carbon dioxide; bbl = barrels

Source: USDI/BLM 2013

Oil storage tanks on the well location may result in venting VOC. Oil well production is generally presented as barrels per day produced. The emissions calculator estimated that for every barrel per day produced there may be 0.12 tons of VOC vented per year.

The average horizontal oil well in the planning area produces approximately 100 barrels per day. One hundred barrels per day is estimated to result in 12 tons of VOC emissions per year. Oil storage tanks would be subject to current USEPA regulations regarding the capture or flaring of VOC emissions.

Table 3-5. Analysis area human caused emissions in tons/year, 2008

County	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2
McKinley	12,595.0	31,885.2	37,509.0	66,590.7	6,977.5	1,659.8
Rio Arriba	4,276.6	27,352.9	45,841.5	46,321.6	4,746.2	89.1
San Juan	35,651.7	54,549.5	46,994.9	69,655.7	8,108.3	11,471.0
Sandoval	4,780.1	33,290.5	31,733.6	36,232.3	4,056.3	123.4
Total	**57,303.4**	**147,078.1**	**160,079**	**218,800.3**	**23,897.3**	**13,343.3**

Note: NO_X = nitrous oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} = particulate matter with an diameter between 2.5 and 10 micrometers; $PM_{2.5}$ = particulate matter with a diameter of 2.5 micrometers or less; SO_2 = sulfur dioxide

Source: USEPA 2008 National Emissions Inventory

Table 3-6 displays the percent increase in total emissions in the analysis area from the proposed action to construct and operate one horizontal oil well.

Table 3-6. Percent Increase in Analysis Area Emissions per well

	NO_X	CO	VOC	PM_{10} (1)	$PM_{2.5}$ (1)	SO_2 (1)
Total Emissions tons/year	57,303.4	147,078.1	160,079.0	218,800.3	23,897.3	13,343.3
Horizontal Oil Well Emissions tons/year	6.13	1.64	12.55 (2)	2.54	0.29	0.11
Percent Increase	**0.011**	**0.0011**	**0.0078**	**0.0012**	**0.0012**	**0.00082**

Note: NO_X = nitrous oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} = particulate matter with an diameter between 2.5 and 10 micrometers; $PM_{2.5}$ = particulate matter with a diameter of 2.5 micrometers or less; SO_2 = sulfur dioxide

[1] Values derived from average emissions for any well drilling in the analysis area. Calculated results available upon request.

[2] Current USEPA regulations require operators to reduce VOC emissions by 95 percent if their oil storage tanks emit over 6 tons of VOC emissions per year.

Hazardous Air Pollutants

The formulas used for calculating HAPs in the calculators are very imprecise. For many processes it is assumed that emission of HAPs will be equivalent to 10 percent of VOC emissions. Therefore, the estimated HAP emissions of 1.25 tons per year should be considered a very gross estimate. Most of the VOC emissions estimated for one horizontal oil well result from venting from oil storage tanks. Current USEPA regulations require operators to reduce VOC emissions by 95 percent if their oil storage tanks emit over 6 tons of VOC emissions per year. A reduction of 95 percent of oil storage tank VOC emissions would reduce the estimated HAP emissions to 0.12 tons per year.

Total Greenhouse Gases

The available statewide GHG summary (NMED 2010) combines GHG emissions from CO_2 and methane (CH_4). To compare the GHG emissions from the proposed action estimated by the calculator with statewide GHG emissions, CO_2e (carbon dioxide equivalent) emissions for both CH_4 and CO_2 were summed. The total statewide GHG emission estimate for 2007 was 76,200,000 metric tons CO_2e (76.2

million metric tons; NMED 2010). The estimated CO_2e metric tons emissions from one horizontal oil well (609.2 metric tons) would represent a 0.0008 percent increase in New Mexico CO_2 emissions.

Cumulative Impacts

The FFO manages federal hydrocarbon resources in San Juan, Sandoval, Rio Arriba, and McKinley counties in New Mexico. There are approximately 23,522 wells in the San Juan Basin. About 16,435 of the wells in these counties are federal wells. Analysis of cumulative impacts for the reasonable development scenario of oil and gas wells on public lands in the FFO was presented in the 2003 RMP. This included modeling of impacts on air quality. A more detailed discussion of Cumulative Effects can be found in the Air Resources Technical Report (USDI/BLM 2013).

The primary activities that contribute to levels of air pollutant and GHG emissions in the Four Corners area are electricity generation stations, fossil fuel industries, and vehicle travel. The Air 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 2013). It includes a summary of emissions on the national and regional scale by industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally), and transportation.

The emissions calculator estimated that there could be very small direct and indirect increases in several criteria pollutants, HAPs, and GHGs as a result of implementing the proposed alternative. The very small increase in emissions that could result would not be expected to result in exceeding the NAAQS for any criteria pollutants in the analysis area.

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

The Air Resources Technical Report (USDI/BLM 2013) discusses the relationship of past, present, and future predicted emissions to climate change and the limitations in predicting local and regional impacts related to emissions. It is currently not feasible to know with certainty the net impacts from particular emissions associated with activities on public lands.

3.2 Water Resources/Quality – Surface and Groundwater

3.2.1 Affected Environment

The analysis area is located in the Upper Colorado River Hydrologic Region and is within of the Largo sub-watershed. The surface drainage of the analysis area generally flows south draining into an unnamed tributary of Venado Canyon. There are no perennial surface water resources such as rivers, lakes, ponds, or streams, and there are no wetlands or springs within the analysis area.

There are no jurisdictional waters of the U.S. within the proposed Lybrook D32-2306. There is one jurisdictional water of the U.S. in the Lybrook I30-2306 well pad. The drainage is located in the well pad and construction zone at Corner 5 and flows north. The drainage has an ordinary high water mark of 2 feet wide and 3 inches deep.

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

The primary aquifers in the BLM/FFO area are the sandstone based Uinta-Animas and the Mesaverde. Groundwater is readily available in most of the BLM/FFO area and is of fair to poor quality. A search of the New Mexico State Engineers Office—Water Administration and Technical Engineering Resource System database for the proposed project area and vicinity (1-mile radius) was performed. There is record of one water wells located within a 1-mile radius of the proposed analysis area; however, there is no record of completion (NMOSE 2013)

3.2.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Potential impacts to surface water and shallow groundwater resources could occur from stormwater runoff and the accidental spill of chemicals, produced water, or flowback fluids. The potential for these impacts would be long term for the life of the proposed action.

The proposed action would temporarily expose an estimated 16.17 acres of soil as a sediment source entering area drainage ways. Vegetation cover is moderate throughout the project area. Exposure of soils, particularly on slopes, would lead to an increase in an undetermined but likely small amount of sediment transport, particularly during and following storm events. Slight alterations in project area drainage patterns may also lead to an increase in sediment transport. These increases in sediment transport would persist for several years until the disturbed areas are stabilized. The potential for sediment transport into the drainages would be minimized through the implementation of best management practices and other preventive measures, such as re-establishment of vegetation and proper site hydrological diversions.

Water for drilling and completions would be sourced from a private water well that has been permitted by the State of New Mexico. The well has been assigned the POD Number SJ 01979-S4 by the New Mexico Office of the State Engineer. Approximately 1.3 million gallons of water would be used for drilling and completions per well.

Minimal amounts of hazardous materials (i.e., gas, diesel, etc.) would be used and stored on location. There would be the potential for accidental spills or releases of these materials that could impact local water quality. The proposed wells would be drilled using a closed-loop system to contain drill cuttings

and fluids. All chemicals stored on-site would be properly contained. On-site containment structures such as containment dikes, containment walls, and drip pans would be sufficiently impervious and would be maintained to prevent a discharge to waters of the U.S. Any spills of non-freshwater fluids would be immediately cleaned up and removed to an approved disposal site in accordance with federal and state regulations.

Stimulation (i.e., hydraulic fracturing or "fracking") is a process used to maximize the extraction of underground resources by allowing oil or natural gas to move more freely from the rock pores to production wells that bring the oil or gas to the surface. Fluids, commonly made up of water (99 percent) and chemical additives (1 percent), are pumped into a geologic formation at high pressure during hydraulic fracturing (USEPA 2004). Chemicals added to stimulation fluids may include friction reducers, surfactants, gelling agents, scale inhibitors, acids, corrosion inhibitors, antibacterial agents, and clay stabilizers. When the fracking pressure exceeds the rock strength, the fluids open or enlarge fractures that typically extend several hundred feet away from the well bore, and may occasionally extend up to 1,000 feet from the well bore. After the fractures are created, a propping agent (usually sand) is pumped into the fractures to keep them from closing when the pumping pressure is released. After fracturing is completed, a portion of the injected fracturing fluids returns to the wellbore and is recovered for future fracturing operations (USEPA 2004) or disposal. Stimulation techniques have been used in the United States since 1949 and in the San Juan Basin since the 1950s. Over the last 10 years, advances in multi-stage and multi-zone hydraulic fracturing have allowed development of gas fields that previously were uneconomic, including the San Juan Basin.

Hydraulic fracturing is a common process in the San Juan Basin and applied to nearly all wells drilled. The producing zone targeted by the proposed action is well below any underground sources of drinking water. The Mancos Shale formation is also overlain by a continuous confining layer. The geological confining layer is the Lewis Shale formation that is located above both the Mancos Shale and Mesaverde formations and provides an impermeable layer that isolates the Mancos Shale and Mesaverde formations from both identified sources of drinking water and surface water. On average, total depth of the proposed well bore would be about 5,000 feet below the ground surface. Fracturing in the Basin Mancos formation is not expected to occur above depths of 4,000 feet below the ground surface. Fracturing could possibly extend into the Mesaverde formation overlying the Basin Mancos; however, the formation has not been identified as an underground source of drinking water based on its depth and relative high levels of TDS. No impacts to surface water or freshwater-bearing groundwater aquifers are expected to occur from hydraulic fracturing of this proposed well.

Potential impacts to groundwater resources could occur from the proposed well bores. The potential for impacts to groundwater from the well bore would be long term for the life of the well. Adherence to Conditions of Approval and design features, such as adequate casing, cementing, and other drilling and completion methods are intended to minimize effects to water quality.

Casing specifications would be designed by Encana and a casing program would be submitted to the New Mexico Oil Conservation District. Surface casing would be set to 500 feet. The casing and cementing would stabilize the wellbore and provide protection to any overlying freshwater aquifers by isolating hydrocarbon zones from overlying freshwater aquifers. Prior to approving an APD, a BLM geologist

would identify all potential subsurface formations that would be penetrated by the wellbore. This includes all groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures.

Once the geologic analysis is completed, the BLM would review 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 would be on location during the setting of critical casing and cementing intervals. Before hydraulic fracturing takes place, all surface casings and some deeper, intermediate zones are required to be cemented from the bottom of the cased hole to the surface. The cemented well would be pressure tested to ensure there are no leaks and a cement bond log is run on certain strings of casing to ensure the cement has bonded to the casing and the formation.

Cumulative Impacts

Reasonably foreseeable development within the Largo sub-watershed may include an estimated additional 1,811 oil and gas wells and related facilities. Surface-disturbing activities that would be associated with these actions may affect an estimated 6,756 acres (USDI/BLM 2003a, page 4-7). The PRMP/FEIS determined that the primary cumulative impacts on water quality would result from surface disturbance, which would generate increased sediment yields (USDI/BLM 2003a, pages 4-123 and 4-124). Cumulative effects to water resources from the proposed action would be maximized shortly after construction begins and would decrease over time as reclamation efforts progress.

The proposed action would cumulatively contribute approximately 16.17 acres of disturbance within the watershed. Cumulative impacts to surface waters would be related to short-term sedimentation or flow changes. Surface-disturbing activities other than the proposed action that may cause accelerated erosion include (but are not limited to) construction of roads, other facilities, and installation of trenches for utilities; road maintenance such as grading or ditch-cleaning; public recreational activities; vegetation manipulation and management activities; prescribed and natural fires; and livestock grazing.

3.3 Upland Vegetation and Noxious Weeds

3.3.1 Affected Environment

The proposed Lybrook D32-2306 well pad, access road, and pipeline ROW are located in a very open canopy piñon-juniper (*Pinus edulis-Juniperus osteosperma*) woodland with an understory of big sagebrush (*Artemisia tridentata*), Bigelow sage (*Artemisia bigelovii*), James' galleta (*Pleuraphis jamesii*), blue grama (*Bouteloua gracilis*), and broom snakeweed (*Gutierrezia sarothrae*). Large patches of sagebrush-dominated areas occur within the proposed project area. Ground cover was visually estimated at 40 percent throughout the project area. There are approximately 200 piñon and juniper trees located in the proposed project area.

The proposed Lybrook I30-2306 well pad, access road, and pipeline ROW are located in an area dominated by big sagebrush with a scattered piñon and juniper trees. Other plant species present in the project area include rubber rabbitbrush (*Ericameria nauseosa*), Bigelow sage, James' galleta, blue grama, and broom snakeweed. Ground cover was visually estimated at 15 to 20 percent throughout the project area. There are approximately 100 piñon and juniper trees located in the proposed project area.

No noxious weeds listed by the BLM/FFO or the State of New Mexico were observed in the project area.

3.3.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Direct impacts would include removal of vegetation during site clearing activities. Construction of the proposed action would result in the removal and modification of approximately 16.17 acres of vegetation including removal of approximately 300 piñon and juniper trees. Potential impacts pertain to changes in species composition and density, and an increased potential for invasive species to establish. Following reclamation, there would be long-term changes in the density and composition of project area vegetation communities. Wooded areas would be converted to shrub- and grass-dominated areas. Trees may not re-establish in the area for several decades. Disturbed areas would be expected to re-vegetate in two or more years. There would be a long-term loss of approximately 6.6 acres of vegetation for well access and operation.

Invasive species are generally tolerant of disturbed conditions, and disturbed soils at project sites may provide an opportunity for the introduction and establishment of non-native invasive species. During construction and operation, noxious weed sources could be introduced to disturbed areas from vehicles, equipment, people, wind, water, or other mechanisms. There would be a long-term potential for non-native invasive weeds to establish in the area. Encana would be responsible for monitoring and controlling any non-native invasive weed species within the well pads and associated ROW for the life of the project.

Re-vegetation of construction zones on well pads, alongside access roads, and the pipeline ROWs would be initiated by Encana within 120 days of well completion and pipeline construction. All vegetation removed during site-clearing activities would be mowed and incorporated into stockpiled topsoil. Trees 3 inches or greater in diameter would be cut and de-limbed. The Lybrook D32-2306 well pad and pipeline would be reseeded a piñon-juniper community seed mix while the Lybrook I30-2306 well pad and pipeline would be reseeded with a sagebrush-grass community seed mix.

Cumulative Impacts

Within the FFO planning area, there are approximately 633,400 acres of piñon-juniper habitat type (USDI/BLM 2003a, page 3-31). Based on the acres of plant community types within the planning area and the estimated total disturbance of future activities, less than 1 percent of the piñon-juniper woodland community would be disturbed within the planning area over 20 years from reasonably foreseeable future actions (USDI/BLM 2003a, page 3-31 and 4-7). The proposed action would cumulatively contribute approximately 6.6 acres of long-term vegetative disturbance in the planning area.

3.4 Wildlife

3.4.1 Affected Environment

The proposed action is not located within a BLM wildlife specially designated area (SDA). There are no unique habitats within the analysis area. The proposed Lybrook D32-2306 project area is located in open canopy piñon-juniper woodland. The proposed Lybrook I30-2306 project area is located in an area dominated by big sagebrush with a scattered piñon and juniper trees. Wildlife common to these habitats include elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), fox (*Vulpes* sp.), black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), and reptiles (snakes and lizards). Wildlife or signs observed in the project areas included elk, mule deer, desert cottontail, black-tailed jackrabbit (*Lepus californicus*), and a kangaroo rat (*Dipodomys* sp.) burrow.

3.4.2 Impacts of the Proposed Action

Direct and Indirect Impacts

Two parameters are considered when evaluating habitat loss—direct habitat loss and effective habitat loss. Direct habitat loss occurs through the removal of vegetation, which reduces the extent or quality of habitat in terms of food and cover. Vegetation removal strips the affected area of its value to wildlife; therefore, direct habitat loss can be quantified by comparing the area of habitat lost to the amount retained. The amount of habitat available to wildlife is called effective habitat. The effectiveness of habitat is lost when a species reduces use or avoids an area. Loss of effective habitat area can exceed direct habitat loss. Effective habitat loss can occur from habitat fragmentation, disturbance, and interference with movement. The impacts of habitat fragmentation are related to the loss of large contiguous areas of habitat and the relative increase in habitat “edge” in smaller areas. Construction of roads and other development, as well as human and vehicular traffic on existing roads, can cause habitat fragmentation. Such disturbance can cause animals to shift their activity or alter their behavior.

The proposed action would result in the removal and modification of approximately 16.17 acres of vegetation including approximately 300 piñon and juniper trees. Vegetation communities within the proposed project area provide forage and cover for big game and other wildlife species. Since the vegetation removed would not be replaced with the same species and because the removal of vegetation in this previously undisturbed area would result in habitat fragmentation, an alteration of available wildlife habitat and utilization is anticipated. Impacts to wildlife habitat would include short-term loss of natural vegetation and long-term changes in composition of vegetation. The majority of direct habitat loss would be short term as areas reclaimed would recover their value as wildlife habitat. However, there would be a long-term loss of approximately 6.6 acres for well operation and access. Most species observed or expected to inhabit the area are generalists and would be minimally affected by the changes in vegetation composition.

Mule deer and elk have been shown to avoid natural gas wells, roads, and areas immediately surrounding them, resulting in a loss of effective habitat. Hebblewhite summarized that the average zone of influence reported in eight different studies extended about 1,000 meters (3,281 feet) from roads and wells. The nature and extent of this avoidance is dependent upon the type of vegetation, particularly the amount of

cover present, topography, the volume of traffic, and whether or not the vehicles stop or continue moving; however, responses varied within seasons and between species (2011). Disturbance is a primary factor in effective habitat loss as it can alter the ways wildlife use or move through an area and could push individual animals from preferred habitat into less suitable habitat. Such displacement would likely be localized around the source of the disturbance (i.e., equipment noise, human presence, etc.). Data collected by the BLM and New Mexico Department of Game and Fish in the Rosa Wildlife SDA between 1994 and 2012 indicate a positive correlation between increasing number of gas wells and accompanying roads and the decline in mule deer fawn to doe ratios.

Since there is so much variability between studies, and no studies specific to the FFO have been completed, a conservative buffer of 400 meters (1,312 feet) was selected to quantify the potential effective habitat loss resulting from the proposed action. Based on a 400 meter buffer of the proposed action, indirect wildlife habitat loss could affect up to approximately 570 acres. Avoidance by wildlife would depend on the species, time of day, time of year, human activity level, topography, and cover type. It should also be noted that the zone of influence around roads and well pads does not imply 100 percent avoidance (Hebblewhite 2011). Impacts from effective habitat loss would be greatest during construction and drilling and would decrease over time in correlation to human and vehicular activity levels.

During construction, drilling, and completion, there would be short-term impacts to area wildlife because of human and vehicular activity and associated noise. Wildlife in the area would be displaced to adjacent habitat or may temporarily avoid the project area during construction activities. Once the project is complete, wildlife would likely return to the area. It is possible that small wildlife, particularly burrowing species, may be killed during construction, drilling, and completion. During operation, the level of human and vehicular activity in the analysis area would decrease substantially. However, one light-duty vehicle would continue to access the area on near daily basis. Heavy-duty vehicles (semi-trucks) would access the well sites 1 to 2 times a day for approximately 6 months after which traffic trips would decrease to approximately 1 trip per month. Long-term impacts from vehicle traffic on roads could include incidental mortality to wildlife. Animal-vehicle collisions are variable depending on the time of day, speed and volume of traffic, local topography, structural features of the road, and the size and behavior of the individual species. The proposed access roads would also facilitate entry to areas not previously open to vehicular travel, potentially resulting in increases in legal and illegal hunting.

Wildlife could come into contact with chemicals or fluids stored on-site. Use of a closed-loop system would minimize potential impacts to wildlife from exposure to chemicals or fluids during drilling and completion. During operation, any open pits would be netted and vent caps placed on all open pipes to prevent bird entry and nesting. Any spills would be promptly cleaned up, and Encana maintains an emergency response plan. All chemicals or fluids stored on-site would be properly contained and would have secondary containment.

Cumulative Impacts

Reasonably foreseeable development within the Largo sub-watershed may include an estimated additional 1,811 oil and gas wells and related facilities, and 147 miles of new roads. Surface-disturbing activities that would be associated with these actions may affect an estimated 6,756 acres of wildlife habitat (USDI/BLM 2003a, page 4-7 and 4-8). Other reasonably foreseeable actions such as continued livestock

grazing, vegetation treatments, and community development would cumulatively impact wildlife through direct and effective habitat loss. The proposed action would cumulatively contribute approximately 6.6 acres of direct and up to 570 acres of indirect wildlife habitat loss in the planning area.

3.5 Special Management Species

3.5.1 Affected Environment

In accordance with BLM Manual 6840, the BLM manages certain sensitive species not federally listed as threatened or endangered in order to prevent or reduce the need to list the species as threatened or endangered in the future. There are also 18 state-listed threatened or endangered species with potential to occur in Sandoval County, New Mexico. Table 3-7 lists the special management species that have the potential to occur in the analysis area. A Biological Survey Report for each proposed well pad project was prepared and is provided in Appendix C. The Biological Survey Reports provide the basis for the findings listed in Table 3-7.

Table 3-7. Species with special management status with potential to occur in the analysis area

Species	Conservation Status	Habitat Associations	Potential to Occur in Analysis Area
Mammals			
Spotted bat (*Euderma maculatum*)	State Threatened; BLM Sensitive	The preferred habitat is meadows in subalpine coniferous forest; rocky cliffs are important for roosting. Also recorded in a wide variety of habitats, from riparian and piñon-juniper woodlands to ponderosa pine and spruce-fir forests.	Potential foraging habitat in the analysis area. Not observed during the biological surveys.
Townsend's big-eared bat (*Corynorhinus townsendii*)	Federal Species of Concern; BLM Sensitive	Roosts mostly in caves or mines; at night can roost in abandoned buildings. In summer species occurs widely across the state and can be found over desert-scrub, desert-mountains, oak-woodland, piñon-juniper, and coniferous forests.	Suitable foraging habitat in the analysis area. Not observed during the biological surveys.
Birds			
Bendire's thrasher (*Toxostoma bendirei*)	BLM Sensitive	Typically inhabits sparse desert shrubland and open woodland with scattered shrubs.	Potential habitat occurs in the analysis area. None were observed during the biological field surveys.

Species	Conservation Status	Habitat Associations	Potential to Occur in Analysis Area
Golden eagle (*Aquila chrysaetos*)	BLM Sensitive	In the West, mostly open habitats in mountainous, canyon terrain. Nests primarily on cliffs and in trees.	The analysis area provides potential foraging habitat. No potential nesting habitat located in the analysis area. None were observed during the biological field surveys.
Gray vireo *(Vireo vicinior)*	State Threatened	Inhabits mixed piñon-juniper and oak scrub communities and arid chaparral in hot climates.	Potential habitat occurs within analysis area. No potential nesting habitat located in the analysis area. None were observed during the biological field surveys.
Piñon jay *(Gymnorhinus cyanocephalus)*	BLM Sensitive	Primarily associated with piñon-juniper habitat.	Piñon-juniper woodland in the analysis area is open canopy. Suitable habitat occurs in the analysis area.

Source: USDI/BLM 2008b; 2012. NHNM 2013 and BISON-M 2013.

3.5.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Two parameters are considered when evaluating habitat loss—direct habitat loss and effective habitat loss. Direct habitat loss occurs through the removal of vegetation, which reduces the extent or quality of habitat in terms of food and cover. Vegetation removal strips the affected area of its value to wildlife; therefore, direct habitat loss can be quantified by comparing the area of habitat lost to the amount retained. The amount of habitat available to wildlife is called effective habitat. The effectiveness of habitat is lost when a species abandons or avoids an area. Loss of effective habitat area can exceed direct habitat loss. Effective habitat loss can occur from habitat fragmentation, disturbance, and interference with movement. The impacts of habitat fragmentation are related to the loss of large contiguous areas of habitat and the relative increase in habitat "edge" in smaller areas. Construction of roads and other development, as well as human and vehicular traffic on existing roads, can cause habitat fragmentation. Such disturbance can cause animals to shift their activity or alter their behavior.

Impacts to special management species resulting from the proposed action may affect individuals, but are not expected to result in population-level impacts.

The Lybrook D32-2306 and I30-2306 sites offer suitable foraging habitat for spotted bat and Townsend's big-eared bat. No suitable roosting habitat would be removed by the proposed project. Impacts to these bat species would be limited to avoidance of the area during nighttime drilling activities when they may incidentally forage in the area. These impacts would be short term.

The piñon-juniper woodlands in the analysis area provide potential habitat for gray vireo and piñon jay. Piñon jays were observed in the Lybrook D32-2306 project area during the biological survey. No nests were observed in the project area during the biological survey. The open canopy nature of the woodlands

in the analysis area is more representative of foraging habitat, rather than gray vireo or piñon jay nesting habitat.

Direct impacts would include the modification of approximately 16.17 acres of habitat for gray vireo, piñon jay, and Bendire's thrasher. Approximately 300 piñon and juniper trees of various ages and sizes would be removed by the proposed action, resulting in a long-term loss of potential primarily foraging habitat for gray vireo and piñon jay, and foraging and nesting habitat for Bendire's thrasher. There would be a long-term reduction of approximately 6.6 acres of suitable habitat for these bird species for well access and operation. Pre-construction surveys would be conducted to identify any active nests within the proposed project area should construction occur between May 15 and July 31.

Based on the vegetation communities in the project and action areas and on the distance to known golden eagle nesting territories, golden eagle may incidentally occur in the project or action area. No potential golden eagle nesting habitat would be removed or modified by the proposed action. Direct impacts would include the modification of about 16.17 acres of golden eagle foraging habitat. Approximately 6.6 acres of suitable foraging habitat would be converted to an industrial use for the proposed well access and operation. Approximately 300 piñon and juniper trees of various ages and sizes would be removed by the proposed action, resulting in a long-term loss of potential perch sites. This loss of perch habitat is not expected to adversely affect the foraging abilities of this raptor species, given the abundance of suitable sites in the surrounding area. After reclamation of the proposed project area, there would be a short-term change in vegetation density and composition and this change could affect the prey base for golden eagle. Additional impacts may include avoidance of the project area during construction, drilling, and operation due to disturbance and activity from human and vehicle presence and associated noise. Impacts from loss or modification of habitat would be long term.

Cumulative Impacts

The FFO would continue to manage non-federally listed species according to BLM policies and guidelines, with the goal of contributing to the conservation of these species to reduce the potential for being listed under the Endangered Species Act (ESA) of 1973, as amended (USDI/BLM 2003a, 4-111). For reasonably foreseeable actions on federal lands, direct impacts to nesting special status raptor species would be avoided through the BLM's siting criteria. Development on federal and private lands would result in the removal or modification of potential foraging habitat. These effects would be related to availability of undisturbed habitat and the amount of disturbance that would occur within the project area.

The PRMP/FEIS determined that up to 5.5 percent (128,000 acres) of vegetation in the planning area could be impacted cumulatively by oil and gas development (USDI/BLM 2003a, page 4-125). Other reasonably foreseeable actions within the planning area that could impact special status species would include livestock grazing, agriculture, commercial and residential development, mining, and vegetation management. The proposed action would not contribute appreciably to a cumulative habitat loss for BLM special management species within the planning area. There would be a cumulative loss of approximately 6.6 acres of Bendire's thrasher, gray vireo, piñon jay, and golden eagle foraging habitat. Because the analysis area is undisturbed, the construction of the proposed action would result in habitat fragmentation and an increase in edge habitat. Approximately 0.72 mile of new road would be added to the travel network in the planning area.

3.6 Migratory Birds

3.6.1 Affected Environment

Under the Migratory Bird Treaty Act and Executive Order 13186, federal agencies are required to consider impacts to migratory birds from management activities. The BLM migratory bird conservation policy for the planning area is detailed in Instruction Memorandum No. NM-F00-2010-001 (USDI/BLM 2010). This management policy establishes a consistent approach for addressing migratory bird populations and habitats when by making project level implementation decisions. The management policy also outlines best management practices and design features to avoid or minimize impacts.

While all migratory songbirds are protected by law, certain species have been determined to be at greater risk than others. More than 350 avian species occur in San Juan County and the surrounding area administered by the BLM/FFO, which includes portions of Sandoval County. Data collected through breeding bird surveys coordinated by the USFWS and private sector efforts have provided the basis for the New Mexico Partners in Flight (NMPIF) organization to develop bird "watch lists" and the USFWS list of Birds of Conservation Concern. The NMPIF has also identified priority species of birds by habitat type for the state of New Mexico. The FFO area lies within the Colorado Plateau physiographic region, as identified by the NMPIF. The proposed project area contains two of the habitat types—Great Basin desert shrub (sage-grass) and piñon-juniper woodland.

The Bird Conservation Plan developed for the State of New Mexico by the NMPIF lists the sage thrasher (*Oreoscoptes montanus*) and sage sparrow (*Amphispiza belli*) as a "highest priority" species for conservation in the Great Basin desert shrub habitat. Priority species in piñon-juniper woodland habitat include the gray vireo, piñon jay, and juniper titmouse *(Baeolophus ridgwayi)*. Most of the priority bird species identified by the NMPIF also occur on the USFWS Division of Migratory Bird Management list of "Birds of Conservation Concern 2008" within the Bird Conservation Region 16–Southern Rockies/Colorado Plateau. Birds included on this list are those "species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973" (USFWS 2008).

A variety of bird species may be found in the proposed project area such as Bendire's thrasher, loggerhead shrike (*Lanius ludovicianus*), and vesper sparrow (*Pooecetes gramineus*). Certain birds nest almost exclusively in piñon-juniper habitats including the juniper titmouse, western scrub jay (*Aphelocoma californica*), and bushtit (*Psaltriparus minimus*). Mountain chickadees (*Parus gambeli*), black-throated gray warblers (*Dendroica nigrescens*), and blue-gray gnatcatchers (*Polioptila caerulea*) also occur in this community (NMPIF 2007).

3.6.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Executive Order 13186 calls for increased efforts to fully implement the Migratory Bird Treaty Act. In keeping with this mandate, the BLM consulted the NMPIF Bird Conservation Plan for the State of New Mexico and the USFWS list of Birds of Conservation Concern. A review of these documents—

specifically as they pertain to the Colorado Plateau physiographic area—indicates there are three "priority" avian species with a known range of distribution in the FFO planning areas that utilize the piñon-juniper woodland habitat and eight priority species that utilize the sage-grass habitat within the Great Basin desert shrub habitat.

Various types of perturbations and/or anthropogenic activity may affect these species. These species and a brief assessment of the effects of the proposed action on their habitat are provided in Table 3-8.

Table 3-8. Migratory bird species of concern potentially occurring within the project area and effects from the proposed action

Species	Habitat Type	Effects
Grasshopper sparrow (*Ammodramus savannarum*)	Sage-grass	May be positively affected due conversion to grassland.
Sage sparrow[1] (*Amphispiza belli*)	Sage-grass	May be positively affected due conversion to grassland.
Burrowing owl (*Athene cunicularia*)	Sage-grass	No effect; nests in abandoned prairie dog burrows.
Ferruginous hawk (*Buteo regalis*)	Sage-grass/ piñon-juniper interface	No effect; no suitable habitat in the project area.
Mountain plover (*Charadrius montanus*)	Sage-grass	No effect; no suitable habitat in the project area.
Long-billed curlew (*Numenius americanus*)	Sage-grass	May be positively affected due to conversion to grassland.
Sage thrasher[1] (*Oreoscoptes montanus*)	Sage-grass	May be positively affected due to conversion to grassland.
Bendire's thrasher (*Toxostoma bendirei*)	Sage-grass	May be positively affected due to conversion to grassland.
Juniper titmouse (*Baeolophus ridgwayi*)	Piñon-juniper	Secondary cavity nester; some loss of nesting habitat.
Piñon jay (*Gymnorhinus cyanocephalus*)	Piñon-juniper	Colony nester in piñon; loss of piñon may impact.
Gray vireo (*Vireo vicinior*)	Piñon-juniper	Nests in juniper; reduction of juniper may be detrimental.

[1] "High Priority" bird species that are on the NMPIF Priority Species List, but not on the USFWS Birds of Conservation Concern 2008 list.

Direct impacts to migratory birds would include the disturbance and modification of approximately 16.17 acres of undisturbed desert scrub vegetation and piñon-juniper woodland. There would be a long-term loss of approximately 6.6 acres of habitat which would be converted to an industrial use. Migratory birds would be impacted by disturbance during construction, drilling, and completion; these impacts would be short term. During production impacts to migratory birds would be related to an increase in habitat fragmentation and disturbance from periodic traffic for maintenance and fluid removal.

Impacts to migratory birds would be greater should construction occur during the breeding season of May 15 through July 31. Construction, drilling, and completions during this period could result in nest destruction or may cause some nest abandonment in adjacent areas. Pre-construction surveys would be

conducted to identify any active nests within the proposed project area should construction occur between May 15 and July 31. Migratory birds could come into contact with chemicals or fluids stored on-site. Open pits will be netted and vent caps placed on all open pipes to prevent bird entry and nesting. Any spills would be promptly cleaned up. Although individual migratory birds could be impacted by the proposed action, no population level impacts are expected.

Cumulative Impacts

Other reasonably foreseeable actions within the planning area that could impact migratory birds would include livestock grazing, agriculture, commercial and residential development, mining, wildfire, and vegetation management. Cumulative impacts to migratory birds from the proposed action would result from the long-term changes in density and composition of approximately 16.17 acres, including the removal of approximately 300 piñon and juniper trees. The proposed action would contribute to cumulative habitat fragmentation within the planning area from the construction of approximately 0.72 mile of new road. The proposed action would contribute negligible impacts to migratory birds when combined with past, present, and future actions.

3.7 Cultural Resources

3.7.1 Affected Environment

The proposed project area is located within the archaeologically rich San Juan Basin of northwestern New Mexico. In general, the prehistory of the San Juan Basin can be divided into five major periods: PaleoIndian (ca. 10000 B.C. to 5500 B.C.), Archaic (ca. 5500 B.C. to A.D. 400), Basketmaker II-III and Pueblo I-IV periods (A.D. 1 to 1540), and the historic (A.D. 1540 to present) that includes Native American as well as later Hispanic and Euro-American settlers. A detailed description of these various periods and select phases within each period is provided in the Farmington PRMP/FEIS (USDI/BLM 2003a).

Cultural sites vary considerably, and can include but are not limited to simple artifact scatters, domiciles of various types with a myriad of associated features, rock art and inscriptions, ceremonial/religious features, and roads and trails.

The entire area of potential effect for the proposed action was archaeologically surveyed by LAC at a BLM Class III level (100 percent) and reports were prepared and submitted to the BLM in accordance with the *Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities* (USDI/BLM 2005). The cultural resource survey results are included in two reports (LAC 2013 -6ee [BLM 2014(I)005F] and LAC 2013-6ff [BLM 2014(I)008F]) that cover the well pad, access roads, and pipelines for Lybrook D32-2306 and Lybrook I30-2306, respectively.

During the survey of the Lybrook D32-2306 project, one new archaeological site was encountered and recorded (LA 177281). The site is recommended as being eligible for nomination to the National Register of Historic Places.

During the survey of the Lybrook I30-2306 project area, two new sites were recorded during the field work: LA177374 and LA177375. Both sites are recommended as potentially eligible or eligible for inclusion in the National Register of Historic Places.

3.7.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Direct impacts normally include alterations to the physical integrity of a cultural site. If a cultural site is significant for other than its scientific information, direct impacts may also include the introduction of audible, atmospheric, or visual elements that are out of character for the cultural site. A potential indirect impact from the proposed action is the increase in human activity or access to the area with the increased potential of unauthorized removal or other alteration to cultural sites in the area.

Significant cultural sites (e.g., National Register eligible/listed) are being avoided with the implementation of design features, such as but not limited to, reduction of construction areas, temporary barriers, and site monitoring. These design features are detailed in the BLM Cultural Resource Record of Review, attached to the COA in the APDs and ROW grants. The proposed action is not known to physically threaten any traditional cultural property, prevent access to sacred sites, prevent the possession of sacred objects, or interfere or otherwise hinder the performance of traditional ceremonies/rituals. The proposed action would have no direct or indirect impact on significant cultural sites.

Cumulative Impacts

The proposed action would have no negative cumulative impact on cultural resources, as significant cultural sites would be avoided. A positive cumulative effect is the additional scientific information yielded by the archaeological surveys.

3.8 Visual Resources

3.8.1 Affected Environment

Visual resources are the various elements of the landscape including color, texture, form, line, dominance, scale, diversity, and continuity that compose the visual character of a place. Both natural and manmade features can contribute to the composition of an area or viewshed. The visual resources in the proposed project area are characterized by rolling hills and sandstone-capped ridges covered in low gray-green vegetation or light brown grasslands, and scattered dark green piñon and juniper trees. Low buttes and mesas add diagonal lines to the otherwise horizontal landscape. Scattered clusters of piñon-juniper vegetation add green and grays to the browns, reds, whites, and yellows of the soils.

The BLM classifies visual resources through a Visual Resource Inventory (VRI). The VRI has three components: scenic quality, sensitivity, and distance zone. Scenic quality is a measure of the visual appeal of a tract of land. In the VRI process, BLM-managed lands are given an A, B, or C rating based on the apparent scenic quality. Scenic quality is determined by using seven key factors: (1) landform, (2) vegetation, (3) water, (4) color, (5) adjacent scenery, (6) scarcity, and (7) cultural modification. Areas

with the most visual appeal are rated A, while areas with the least visual appeal are rated C. The project area is within an area rated C for scenic quality.

Sensitivity is a measure of the public concern for scenic quality. During the sensitivity rating, public lands are assigned high, medium, or low sensitivity by analyzing six indicators of public concern: (1) type of user, (2) amount of use, (3) public interest, (4) adjacent land uses, (5) special areas, and (6) other factors. The project area is within an area rated low for sensitivity.

The distance zone analysis is conducted to determine the relative visibility from travel points or observation points. The distance zone for this area is foreground/middleground meaning the area can be seen from travel routes of observation points within a distance of 3 to 5 miles. This indicates activities and development may be able to be viewed in detail. These components resulted in the area being assigned a VRI Class IV.

Visual resources are managed by assigning a visual Resource Management (VRM) Class. The objective for each VRM Class describes how that area should be managed. The project area is within a VRM Class IV. The objective of this class is to provide for activities that require major modification of the landscape. The level of change to the landscape can be high, and management activities may dominate the view and be the major focus of attention. There are no designated scenic areas within the project area.

3.8.2 Impacts from the Proposed Action

Direct and Indirect Impacts

During construction, drilling, and completion, the effects of disturbed ground, machinery, and equipment would be readily visible in the foreground/middleground from roads in the immediate area. During drilling operations, equipment on the site would include the drilling rig, stockpiles of drill pipe and casing, a closed-loop system and aboveground tanks for collecting cuttings and fluid, mud shakers to separate the cuttings from the fluid, generators to provide power to the drill rig, and office trailers equipped with sleeping quarters for essential personnel. Drilling activities would occur continuously for approximately 2 weeks per well and would require on-site supervision 24 hours per day. In addition, light-producing activities would occur primarily during a 14 to 21-day period during drilling per well when three light towers would be installed at the rig. Completion activities would be conducted during daylight hours only. However, the location would flare for 24 hours per day during flowback, which would generally last 20 days. During completion approximately 15 low-profile 500 barrel tanks would be on-site for water storage. The proposed action would result in short-term impacts to visual resources during construction, drilling, and completion until the area has been reclaimed.

Production facilities would consist of wellheads, metering units, separators, aboveground condensate and produced water tanks (2 tanks per well), and compressors. For artificial lift conventional pumping units (pump jacks) and/or gas lift systems would be installed.

The level of change in the visual landscape following reclamation would be moderate in form, line, texture, and color as the area is undisturbed and generally wooded.

Cumulative Impacts

Cumulative impacts to visual resources can occur when projects are visible within the same field of view as other developments or impacted landscapes. Existing disturbances have contributed to the current VRI classification for the project area. Other reasonably foreseeable activities in the proposed project area that would affect visual quality include vegetation treatments; road construction and other development including other well pads and well connect pipelines, and associated facilities; and residential and commercial development. The proposed action would result in minor cumulative impacts to visual resources in the area when combined with past, present, and future actions.

3.9 Traffic and Transportation

3.9.1 Affected Environment

The transportation infrastructure in the proposed project area includes an extensive road network used to access oil and gas development facilities, residences, and local commercial establishments. These roads were built and are maintained by the New Mexico Department of Transportation (NMDOT), San Juan County, and Sandoval County depending on the land ownership and agreements among these agencies.

U.S. Highway 550 is located from 1.5 to 2.25 air miles north of the analysis area. The primary routes accessing the proposed action are Star Lake Road and several maintained and unmaintained dirt roads. No roads that would be used to access the proposed action components carry weight limitations.

Recent traffic counts on U.S. Highway 550 by NMDOT are listed in Table 3-9 in Average Annual Daily Traffic (AADT) levels (NMDOT 2012). Traffic levels on U.S. Highway 550 showed a decrease of approximately 18 percent in average annual traffic levels between 2009 and 2011. A recent study conducted by TRIP (TRIP 2013) shows an increase of vehicle miles traveled in New Mexico by 58 percent between 1990 and 2011. The report also suggests that vehicle miles traveled in New Mexico will increase 40 percent by 2030. Traffic data are not available for BLM or BIA roads.

Table 3-9. Traffic counts of U.S. Highway 550 near the project area

Year	U.S. Highway 550 (AADT measured at Blanco Trading Post)
2009	6287
2010	6212
2011	5177

3.9.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Workers would be on-site 10 hours per day for 6 days per week and for the duration of well pad and access road construction. During drilling, workers would be on-site 24-hours per day for up to 21 days per well (typically 12 days). Completion activities would occur during daylight hours only. Traffic levels

within the project area would increase for the duration of construction, drilling, completion, pipeline construction, and reclamation.

Vehicles accessing the proposed well pads would include light-duty trucks such as pick-ups and welding rigs and heavy-duty vehicles such as water trucks, 2-ton bobtails, and semi-trucks. It is unlikely that both locations would be developed at the same time, given that the applicant is only employing one drilling rig. Depending on each stage of the proposed action (i.e., construction, drilling, completion), traffic levels could vary widely. Typically, traffic levels would have a low and high range given the variability of each well pad location and the well drilled. Generally, during mobilization/demobilization there would be an increase in average daily traffic above that estimated for most stages of the proposed action. During mobilization/demobilization, equipment, tanks, pipe, sand, and other materials would be moved in/out of the well pad area; therefore, most of the traffic would be heavy-duty vehicles.

Mobilization/demobilization would normally take 2 days for each process and would occur at the stage of the project (e.g., construction, drilling, etc.). The highest increase in daily traffic levels would occur during the completion stage during which trucks hauling in sand, water, and other materials would be accessing the site. Table 3-10 lists the activity, type of vehicle, and number of daily round trips that are estimated to occur under the proposed action. Traffic estimates are based on a conservative timeframe for each stage and the high end of the range. The traffic estimates in Table 3-10 are based on construction of one well pad/access road and drilling and completion of one well. Regardless of how many wells are drilled from the pad, traffic estimates for road and pipeline construction, and reclamation would not be increase.

Table 3-10. Estimated traffic levels resulting from the proposed action

Activity	Length (days)	Total Number Round Trips	Average Daily Round Trips
Construction	18	40	2
Drilling	12	354	30
Completion	10	1240	124
Flow testing	20	489	24
Well-tie pipeline construction	21	180	9
Reclamation	30	257	9

Based on the AADT measured at Blanco Trading Post on U.S. Highway 550 (Table 3-9), the proposed action would increase daily traffic levels on U.S. Highway 550 by less than 1 percent during construction and reclamation and by about 2.4 percent during completion when the highest traffic levels would occur. BLM and roads that spur from U.S. Highway 550 and lead to the proposed well pads would be subject to a greater increase in traffic levels since these roads have lower traffic levels than the highway. Increased traffic, particularly heavy trucks, would result in wear and tear on the dirt roads, along with increased maintenance of the road network in the proposed project area. These impacts would be short term for the duration of construction.

There are no residences within 1 mile of the proposed action. However, area residents or other motorists may experience delays other traffic disruptions during the work week depending on the stage of

development of the proposed action. Increased traffic may pose collision hazards for workers and public motorists. Fugitive dust may impair worker and motorist visibility. These impacts would be short term, occurring for the duration of activities. All road crossings would be manned with flaggers and spotters during heavy construction close to the area, and during mobilization and demobilization. Orange flagging and barriers would be put in place to restrict public access to the work site. Water would be applied to roads, if needed, to minimize fugitive dust. Following reclamation, existing roads would be rehabilitated if needed.

During production for the life of the proposed action there would be light- and heavy-duty vehicles accessing the proposed wells for monitoring, maintenance, and liquid removal. Initially a well would be expected to produce water, which would decline rapidly in volume over approximately 6 months. Produced water would be stored on-site in tanks and removed via truck to a disposal facility. Table 3-11 lists the number of truck trips and average daily/monthly trips per well for a 3-year period. In addition, one pickup would access the well pad daily for the duration of production.

Table 3-11. Average daily truck trips per well for 3-year period

Timeframe	Truck Trips	Average Daily Trips
Month 1	73	2
Month 2	63	2
Month 3	48	2
Month 4	39	1
Month 5	34	1
Month 6	30	1
Month 7-12	28	1 per month
Year 2	19	1.5 per month
Year 3	12	1 per month

Cumulative Impacts

Encana personnel would access the well pads on a regular basis (up to 6 times per week) to inspect and monitor the location. Trucks would also access the locations on a regular basis to remove liquids. The PRMP/FEIS projected approximately 147 miles of new roads within the Largo sub-watershed (USDI/BLM 2003a, page 4-8). The proposed project would add about 0.72 mile of new road to the overall cumulative disturbance in the area. This increase to the road network and the anticipated increase in traffic levels in the analysis area would result in cumulative impacts within the scale of development and effects analyzed in the 2003 PRMP/FEIS (USDI/BLM 2003a) when added to past, present, and reasonably foreseeable activities.

3.10 Livestock Grazing

3.10.1 Affected Environment

The BLM/FFO manages 167 grazing allotments with 351 grazing authorizations that permit cattle, sheep, and horse grazing within the planning area. Of the 351 grazing authorizations, 317 are permitted under Section 3 of the Taylor Grazing Act. Additional authorizations under Section 15 permit grazing on 30 allotments in the Lindrith, New Mexico area.

The proposed action would be located within the boundaries of the Venado (5112) BLM/FFO grazing allotment. Table 3-12 lists details of this allotment.

Table 3-12. Details of grazing allotments in the analysis area

Allotment Number	Livestock Number	Livestock Type	Period Begin Date	Period End Date	AUM[1]
5112	79	Cattle	03/01	02/28	806

[1] AUM = animal unit month

3.10.2 Impacts from the Proposed Action

Direct and Indirect Impacts

Surface disturbance associated with construction of the proposed action would remove approximately 16.17 acres of vegetation, resulting in a reduction in forage and a change to the vegetative species composition. Impacts to grazing resources would occur from the direct short-term loss of less than 1 animal unit month (AUM) at an estimated 20 acres per AUM. Reclaimed areas would be expected to re-vegetate within 1 to 2 years following reclamation. There would be a long-term loss of approximately 0.3 AUM resulting from the conversion of 6.6 acres to an industrial use for the well pads and access roads. Reseeding of disturbed areas with the approved seed mix that is composed of grasses and palatable shrubs, may result in an increase in available forage within the affected allotments. This increase is not expected to be measurable.

Cattle and the occasional horse may occur in or near the proposed analysis area, depending on the time of year. Livestock could also become trapped in the open trench and long sections of the open trench could present barriers to livestock movement. There would be a potential for livestock collisions with equipment and vehicles working in the area. However, livestock would be expected to avoid the area due to increased noise and activity. Gaps would be made as needed in topsoil or subsoil stockpiles to allow for livestock crossing. Pipeline trenches would be inspected for livestock prior to laying pipe and back filling; trenches would not be left open for more than 24 hours.

Cumulative Impacts

Other reasonably foreseeable activities within the planning area that would impact forage resources include off-highway vehicle traffic, vegetation treatments, and grazing. The PRMP determined that total surface disturbance from oil and gas development in the planning area would affect about 1.6 percent of

the San Juan Basin. Added to other surface disturbance from urban development, the overall effect of removing rangeland acreage from production would still be minimal when compared to the acreage of available forage (USDI/BLM 2003a, pages 4-126 to 4-127). When added to past, present, and reasonable foreseeable activities within the grazing allotments, the proposed action would not result in measurable changes to the allotments carrying capacity or to available AUMs.

3.11 Socioeconomics and Environmental Justice

3.11.1 Affected Environment

Social and economic indicators are used to measure the effects of oil and gas development to the human environment. The human environment is unique, in that the extent of the geographic area included in the baseline is determined by the flow of wages and investment rather than geographic or political boundaries. Socioeconomic changes occur in the communities and economies where, for example, the employees would spend their wages or where the businesses would experience changes to their sales. Therefore, the geographic area for the socioeconomic baseline extends beyond the boundaries of the proposed action because the monetary and social changes associated with oil and gas development extend to communities where employees reside and spend their wages.

Regionally speaking, the affected environment for the proposed action includes San Juan, Rio Arriba, Sandoval, and McKinley counties. This affected area was selected because the proposed development located within Sandoval County would have employees who reside throughout the region and spend their wages in the Farmington metropolitan area (San Juan County) and City of Gallup (McKinley County), and Bernalillo (Sandoval County). Bernalillo is considered part of the Albuquerque metropolitan area. Furthermore, direct and indirect spending for construction supplies and equipment would also extend across the four-county region.

Indicators for community socioeconomic baseline conditions in the affected area include population trends, employment, and income. These indicators, when compared to national and state statistics, give a picture of a community's social and economic well-being.

Table 3-13 shows the overall population growth for the state; county region. The population of the four-county region in 2010 was about 375,000 individuals. Sandoval and San Juan counties include the cities of Bernalillo, Rio Rancho, and Farmington. These areas have almost two-thirds of the region's population.

Table 3-13 also lists the median household income for the affected region (USCB 2012; UNM-BBER 2012). Median household income measures the relative material wealth in a community. Both Sandoval and San Juan counties have higher median household incomes than the rest of New Mexico.

Table 3-13. Population of Affected Region, 2000 to 2030

County	2000	2010	Population Change 2000-2010	Median Household Income (2011)	Annual Unemployment Rate (2011)

New Mexico	1,819,046	2,065,826	12%	$41,963	9.8%
McKinley	74,798	71,802	-4%	$31,417	10.9%
Rio Arriba	41,190	40,371	-2%	$40,366	16.5%
Sandoval	89,908	132,434	32%	$56,545	8.3%
San Juan	113,801	130,170	13%	$48,943	6.6%

Sources: USCB 2012; ACS 2012; UNM-BBER 2012; City-data.com 2012.

While the affected area lagged behind the rest of the nation in entering the 2008 national recession, the recession slowed economic growth and increased unemployment rates for all communities in the project area. Rio Arriba County's unemployment rate doubled between 2007 and 2011. Sandoval County experienced the smallest increase in unemployment rate after the recession began and Sandoval County consistently had the lowest unemployment rate in the region (see Table 3-13).

The region exhibits a diversified economy, dominated by the service sectors with an increasing professional and technological sector presence (Headwaters Economics 2008; UNM-BBER 2012). Healthcare, education, and social assistance are the largest employment sectors. Total mining employment in the five-county area is estimated at about 6,600 jobs or about one-third of the mining employment in New Mexico. About 40 percent of mining jobs in the affected area are in oil and natural gas extraction, and about 60 percent are in coal mining (Headwaters 2012). Therefore, in 2011, it is estimated there were about 2,600 jobs in the oil and gas development industry in the affected area in 2011. The greatest portion of these jobs is located in Sandoval County. Between 1998 and 2010, nearly 15,000 jobs were added to the region's economy, about 300 of which were in the mining and mineral extraction sector (Headwaters 2012).

In 2010, tax revenue from oil and gas production in New Mexico contributed about $1.7 billion to the state, tribal, and local tax base. Tax revenue from oil and gas accounted for about 15 percent of New Mexico's General Fund. Oil and gas is the fourth largest tax revenue source in the state (Starbuck-Downes 2011; Energy Advances New Mexico 2011). Tax revenue from oil and gas production in New Mexico goes toward schools, social services, infrastructure improvements, conservation and restoration efforts, and development of sustainable resources. County ad valorem tax revenues are distributed to cover debt services, school infrastructure improvements, county health and social services, and community colleges.

President Clinton's Executive Order 12898 on February 11, 1994 requires that "each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the U.S."

The minority population percentage and poverty rate for the four county affected areas as compared to the rest of the United States and New Mexico is summarized in Table 3-14.

Table 3-14. Minority population and poverty rates for four county region

Geography	Minority Population	Family Poverty Rate	Individual Poverty Rate

Geography	Minority Population	Family Poverty Rate	Individual Poverty Rate
United States	23.7%	11.1%	15.2%
New Mexico	25.3%	15.3%	20.2%
McKinley	81.1%	26.2%	30.8%
Rio Arriba	24.6%	15.7%	20.2%
Sandoval	26.9%	10.6%	14.0%
San Juan	42.9%	17.6%	22.0%

Sources: ACS 2012; USCB 2012.

San Juan and McKinley counties have a substantially higher minority population and McKinley County has a substantially higher poverty rate than the state of New Mexico as a whole. Therefore, it is necessary to consider potential disproportionate impacts to minority and low-income populations of the proposed action.

3.11.2 Impacts from the Proposed Action

Direct and Indirect Impacts

The proposed action would result in short-term direct and indirect beneficial impacts to the economy of the affected area. These impacts would be realized by the employment of workers and purchasing of equipment and supplies to construct the proposed well pads, roads, and pipelines as well as for services and parts for ongoing well production and maintenance. Indirect impacts would occur from workers purchasing from local businesses in the four county region and the taxes associated with purchases and oil production. Since these are exploratory wells, the potential tax revenue generated by the oil production is uncertain. The indirect impacts would be relatively small and beneficial to federal, state, and local governments. Since the jobs and revenues associated with the proposed action would be generated by oil and natural gas production, the size of the benefits could be larger than the actual number of jobs and tax dollars generated. This is because they would offset some of the jobs and revenues that have been lost in the affected area because of the recent decline in natural gas production in the San Juan Basin.

There would be no disproportionate adverse impacts to minority or low-income from the proposed action. It is likely that there would be indirect economic benefits to these populations associated with increased tax revenues to state and county governments from increased oil and natural gas production that would support increased employment opportunity, as well as social services and programs that support these vulnerable populations.

Cumulative Impacts

Impacts to socioeconomics within the affected area from the proposed action would be short term and not expected to contribute measurably on a cumulative basis. There would be no measurable or disproportionate adverse impacts to minority or low-income populations under the proposed action.

3.12 Public Health and Safety

3.12.1 Affected Environment

Public health and safety concerns are related to vehicle travel on area roads and public and worker safety around oil and natural gas wells, pipelines, or other production facilities. Worker safety concerns include working near loud equipment, heavy equipment and moving parts, and flammable and/or explosive material. Other health and safety concerns identified include the risk of pipeline rupture, leaks, or explosion.

There is a risk of accidental spills and illegal dumping of non-hazardous and hazardous materials. Contamination of surface waters, near-surface drinking water aquifers, and soil resources caused by surface degradation due to accidental spills and leaks of chemicals and waste products are also of concern. Potential impacts to surface water and shallow groundwater resources are addressed in detail in Section 3.2–Water Resources.

The proposed oil wells would be located in the vicinity of other wells, pipeline ROWs, other oil and gas facilities, and a network of dirt surface access roads. Public risk associated with well drilling includes increased traffic on public roads, wildfire, pipeline leakage, rupture, fire, and explosion. Additional public health and safety risks include spills of wastes, chemicals, or hazardous materials. Roads in the area are generally unimproved dirt surface and are used to access natural gas facilities. These roads may become hazardous or impassable during periods of inclement weather.

3.12.2 Impacts from the Proposed Action

Direct and Indirect Impacts

The proposed action would be completed in a manner consistent with all applicable OSHA regulations and appropriate industry standards to minimize risk of accidents. Impacts to the general public would be minimized by controlling access to all work and operation areas. All road crossings would be manned with flaggers and spotters during heavy construction close to the area and during mobilization and demobilization. Orange flagging and barriers would be put in place to restrict public access to the work site. All roadway speed limits would be observed to reduce potential for traffic accidents. Additionally, hauling of materials or equipment would follow NMDOT regulations. Water would be applied to roads, if needed, to minimize fugitive dust. Following construction, existing roads would be rehabilitated, if needed.

Disposal of any liquid and solid waste generated during construction, operation, and maintenance activities would be done at permitted facilities. Encana would implement measures for safe handling and storage of materials. In the event of a hazardous material spill, releases would be contained and disposed in accordance with federal and state regulations. The proposed well pads and pipelines would be constructed and operated to meet all industry standards and applicable state and federal requirements.

Therefore, there would be short-term direct or indirect public health and safety risks during well pad and pipeline construction, drilling, and completion of the proposed wells. Long-term public health and safety

risks would be minimal and associated with production equipment operation and travel for routine maintenance.

Cumulative Impacts

Other reasonably foreseeable activities in the analysis area that could affect public health and safety include construction and operation of pipelines, well pads, and associated facilities; mining; prescribed fire; and vehicular travel on unimproved dirt roads. The construction and operation of the proposed wells and pipelines would contribute negligibly to public health and safety concerns when considered with past, present and reasonably foreseeable actions in the FFO planning area.

3.13 Noise

3.13.1 Affected Environment

Noise is defined as unwanted or annoying sound that is associated with human activity and interferes with or disrupts normal activities (USDI/BLM 2003a, page 3-93). The response of individuals to similar noise events is diverse and influenced by the type of noise; perceived importance of the noise and its appropriateness in the setting, time of day, and type of activity producing the noise; and sensitivity of the individual. Noise is measured in decibels (dB). Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB are felt as discomfort inside the human ear (USDI/BLM 2003a, page 3-93).

Noise levels created by construction and production equipment is variable depending on factors such as the type and model of equipment, the operation being performed, and the condition of the equipment. Noise levels dissipate with distance from the source based on weather conditions, natural and manmade barriers, topography, time of day, and other factors.

Noise levels at a distance of 50 feet from the source for typical oil and gas activities are approximately 83 hourly A-weighted sound level in decibels (dBA) for well drilling, 71 dBA for produced water injection facilities, and 89 dBA for gas compressor facilities (USDI/BLM 2003a, page 3-93).

The BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the Jurisdiction of the FFO (NTL 03-1 FFO) stipulates noise levels in 62 specially designated areas or in cases where noise could be a nuisance to residents or recreationists (USDI/BLM 2003a, page 3-93). The policy establishes a noise standard of 48.6 dB for oil and gas lease operations that operate more than 8 hours per day for more than 1 week. This noise standard must not be exceeded within 500 feet of a noise sensitive area boundary. The noise standard does not apply to transient operations.

3.13.2 Impacts from the Proposed Action

Direct and Indirect Impacts

There are no private residences within 1 mile of the proposed well pads, access roads, or well-tie pipelines. No noise sensitive receptors occur in the analysis area or within 1 mile. The general public traveling through the area may be inconvenienced by increased noise levels, particularly during construction, drilling, and completion. Noise levels may disturb wildlife and livestock, causing them to avoid the area where work is being conducted. Noise impacts for well pad and road construction, drilling,

and completion would be short term in duration. The long-term direct noise impacts would be associated with well-head or artificial lift.

Cumulative Impacts

During production, well head compression or artificial lift equipment may be used for the proposed wells. This equipment would result in increased noise levels in the analysis area. When operating at 100 percent load, noise from small wellhead compressors range from 91 to 107 dBA at the source. During operation, noise from these compressors would range from 44 to 68 dBA at a distance of 500 feet (USDI/BLM 2003a; page 4-118). Encana would meet all the requirements of the NTL 03-1 FFO.

4. SUPPORTING INFORMATION

4.1 Tribes, Individuals, Organizations, or Agencies Consulted

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4.3 References

Biota Information System of New Mexico (BISON-M). 2013. BISON-M home page. Online: http://www.bison-m.org.

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

Energy Advances New Mexico. 2011. "Tax Revenue Fact Sheet." Available online at: http://www.energyadvancesnewmexico.com/files/fact-sheets/12NMP1290_Tax_Fact_Sheet.pdf.

Engler, Dr. T.W., Dr. B.S. Brister, Dr. H. Chen, Dr. L.S. Teufel. 2001. Oil and Gas Resource Development for San Juan Basin, New Mexico. New Mexico Institute of Mining and Technology. Socorro, New Mexico.

Headwaters Economics. 2008. "Fossil Fuel Extraction as a County Economic Development Strategy: Are Energy-Focusing Counties Benefiting?" Available online at: http://headwaterseconomics.org/energy/western/fossil-fuel-extraction/. Accessed on May 16, 2013.

Headwaters Economics. 2012. "The Status of New Mexico's Oil and Gas Industry." Available online at http://headwaterseconomics.org/energy/western/new-mexico-oil-and-gas/. Accessed on November 25, 2012.

Hebblewhite, M. 2011. Effect of Energy Development on Ungulates in Energy Development, editor David E. Naugle. Island Press, Washington, DC, USA.

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

Natural Heritage New Mexico (NHNM). 2013. NMBiotics Database. Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM. Online: http://nhnm.unm.edu.

New Mexico Environment Department (NMED). 2010. Inventory of New Mexico Greenhouse Gas Emissions: 2000-2007. Available online at: http://www.nmenv.state.nm.us/cc/index.html.

New Mexico Department of Transportation. AADT data. 2012 Available online at: http://dot.state.nm.us/content/dam/nmdot/Data_Management/NM_AADT_Listing.pdf.

New Mexico Partners in Flight (NMPIF). 2007. New Mexico Bird Conservation Plan Version 2.1. C. Rustay and S. Norris, compilers. Albuquerque, New Mexico.

New Mexico Office of the State Engineer (NMOSE). 2013. New Mexico Water Rights Reporting System.

Starbuck-Downes, C. Meghan. 2011. "Economic Impact of New Mexico's Oil and Gas Industry." Report prepared for Brothers and Co. Tulsa, Oklahoma. Available at: http://www.energyadvancesnewmexico.com/files/NMOG_UPDATE_FY11FY12_01282012.pdf. Accessed on November 30, 2012.

Stone, W. J., Lyford, FP, Frenzel, PF, Mizell, N.H., and Padgett, E. T., 1983, Hydrogeology and water resources of San Juan Basin, New Mexico: Socorro, New Mexico Bureau of Mines and Mineral Resources Hydrologic Report 6, 70 p.

TRIP. 2013. New Mexico Transportation by the Numbers: Meeting the State's Need for Safe and Efficient Mobility. Available online at: http://www.tripnet.org/docs/NM_TRIP_by_the_Numbers_Report_Feb_2013.pdf.

University of New Mexico-Bureau or Business and Economic Research (UNM-BBER). 2012. Data Bank. Available at: http://bber.unm.edu/bber_data.html. Accessed on November 30, 2012.

U.S. Census Bureau (USCB). 2012. American Fact Finder Online Database. Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t. Accessed between November 15 and December 13, 2012.

U.S. Department of the Interior and United States Department of Agriculture (USDI/USDA). 2007. Surface and Operating Standards and Guidelines for Oil and Gas Exploration and Development. BLM/WO/ST-06/021+0371/REV 07. Denver, Colorado. 84 pp.

U.S. Department of the Interior, Bureau of Land Management (USDI/BLM). 2002. Biological Assessment: Impacts to threatened and endangered species related to the resource management plan. U.S. Department of the Interior, Bureau of Land Management, Farmington Field Office, Farmington, New Mexico.

USDI/BLM. 2003a. Farmington proposed resource management plan and final environmental impact statement. U.S. Department of the Interior, Bureau of Land Management, Farmington Field Office, Farmington, NM.

USDI/BLM. 2003b. Farmington resource management plan record of decision. U.S. Department of the Interior, Bureau of Land Management, Farmington Field Office, Farmington, NM.U.S.

USDI/BLM. 2005. BLM Manual Supplement H-8100-1. Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities. New Mexico, Oklahoma, and Texas.

USDI/BLM. 2008. NEPA Handbook H 1790 1 [BLM 1/30/2008]. Washington, D.C.

USDI/BLM. 2008b. Special status species management. Instruction Memorandum No. NM-200-2008-001. Bureau of Land Management, Farmington Field Office, Farmington, New Mexico.

USDI/BLM. 2010. Instruction Memorandum No. NM-F00-2010-001. Migratory Bird Treaty Act—BLM/FFO Interim Management Policy. Bureau of Land Management, Farmington Field Office, Farmington, New Mexico.

USDI/BLM. 2013. Air Resources Technical Report for Oil and Gas Development. New Mexico, Oklahoma, Texas, and Kansas. Bureau of Land Management, New Mexico State office. Santa Fe, New Mexico.

U.S. Environmental Protection Agency (USEPA). 2004. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reserves. Office of Ground Water and Drinking Water (4606M). EPA 816-R-04-003.

USEPA. 2008. National Emissions Inventory. http://www.epa.gov/ttn/chief/net/2008inventory.html

USEPA. 2011. 2005 National-Scale Air Toxics Assessment. Summary of Results. Available at: http://www.epa.gov/ttn/atw/nata/. 2005.

USEPA. 2012. Air Trends: Design Values. Available at: http://www.epa.gov/airtrends/values.html.

U.S. Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. [Online version available at http://www.fws.gov/migratorybirds/].

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

Van Valkenburgh, R.F. 1974. Navajo Sacred Places and Short History of the Navajo People. Garland American Indian Ethnohistory Series, Navajo Indians, 3 vols. Garland Publishing, Inc., New York and London.

Appendix A – Maps and Photographs

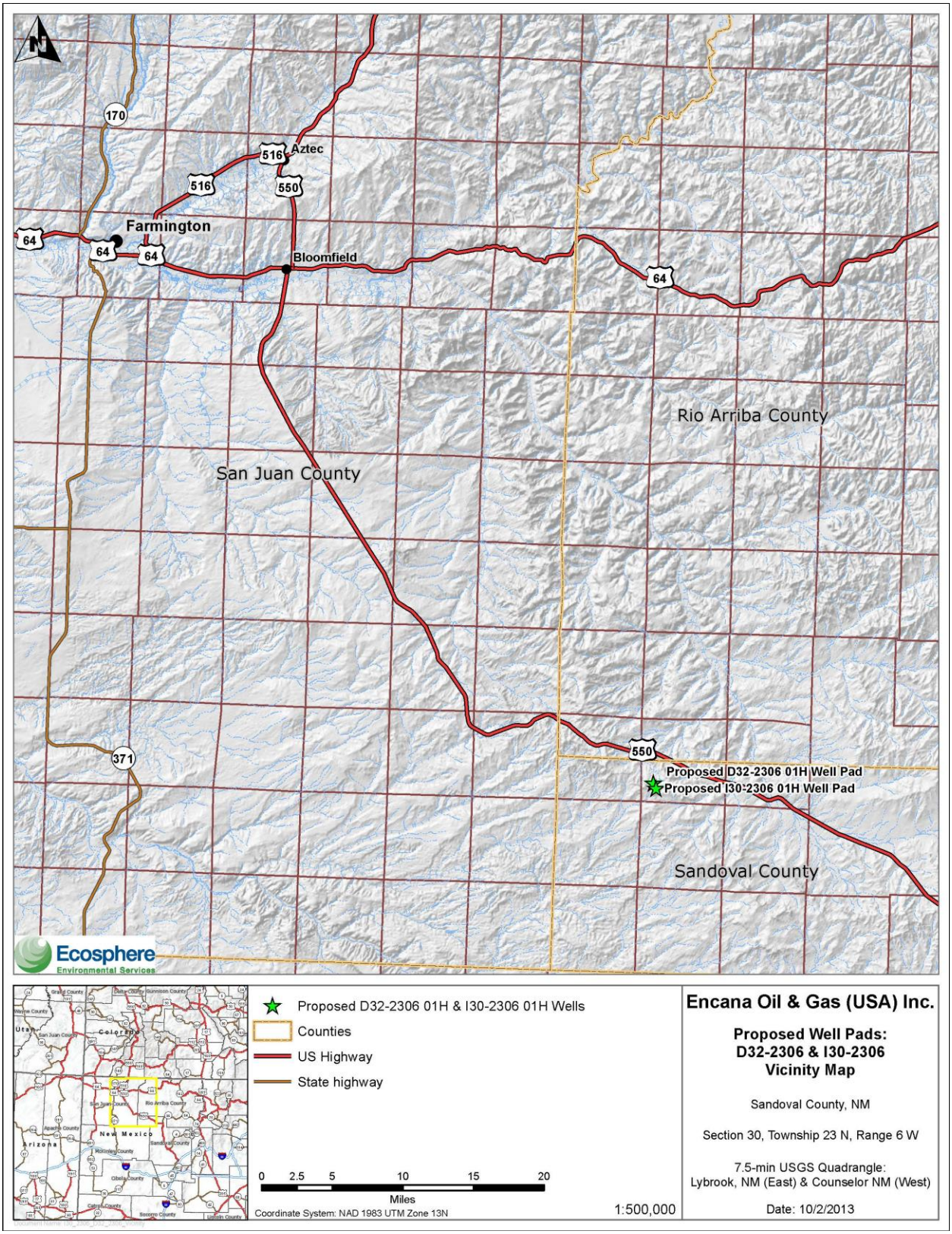

Figure 1. Proposed Lybrook I30-2306 and D32-2306 Vicinity Map

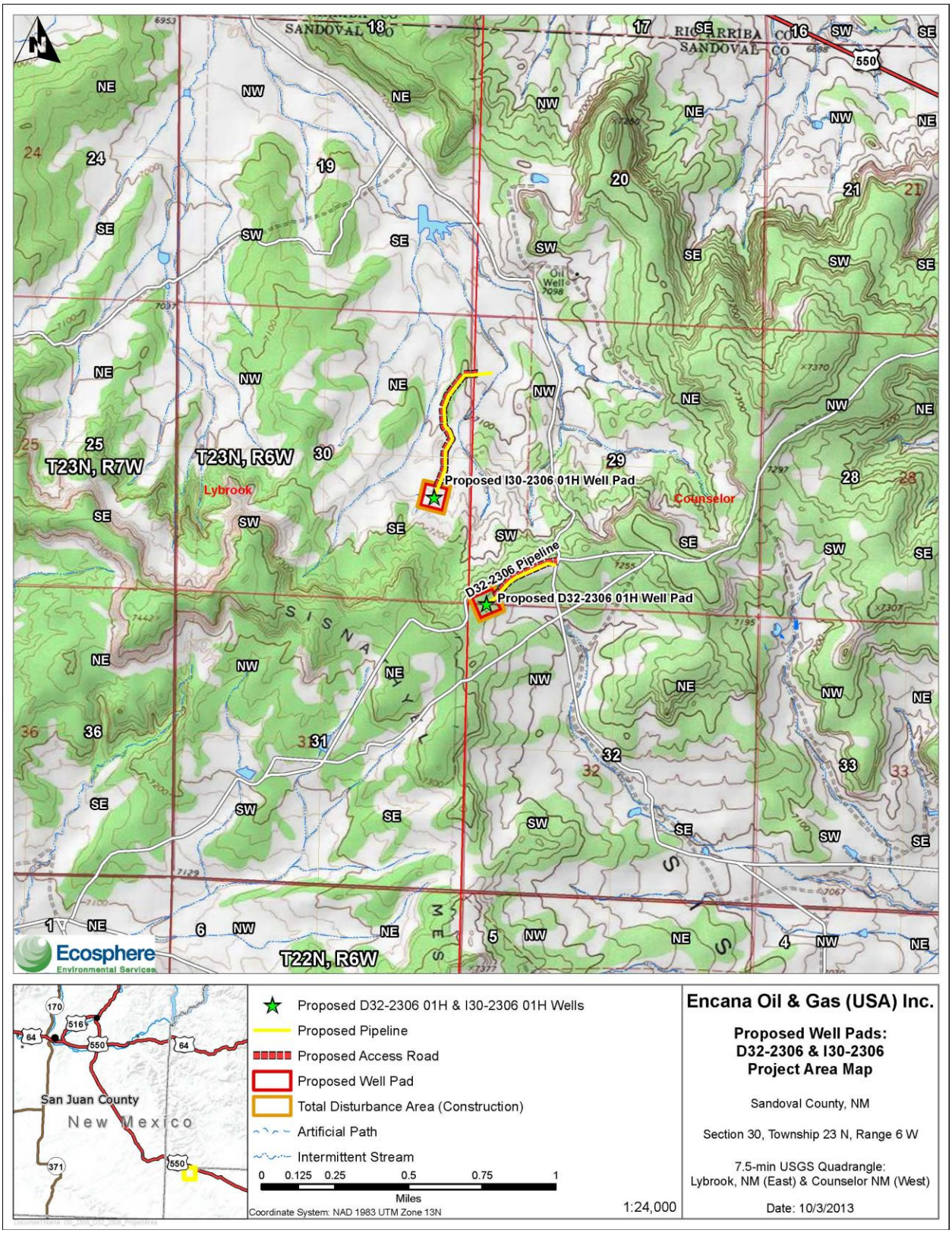

Figure 2: Proposed Lybrook I30-2306 and D32-2306 Project Area Map

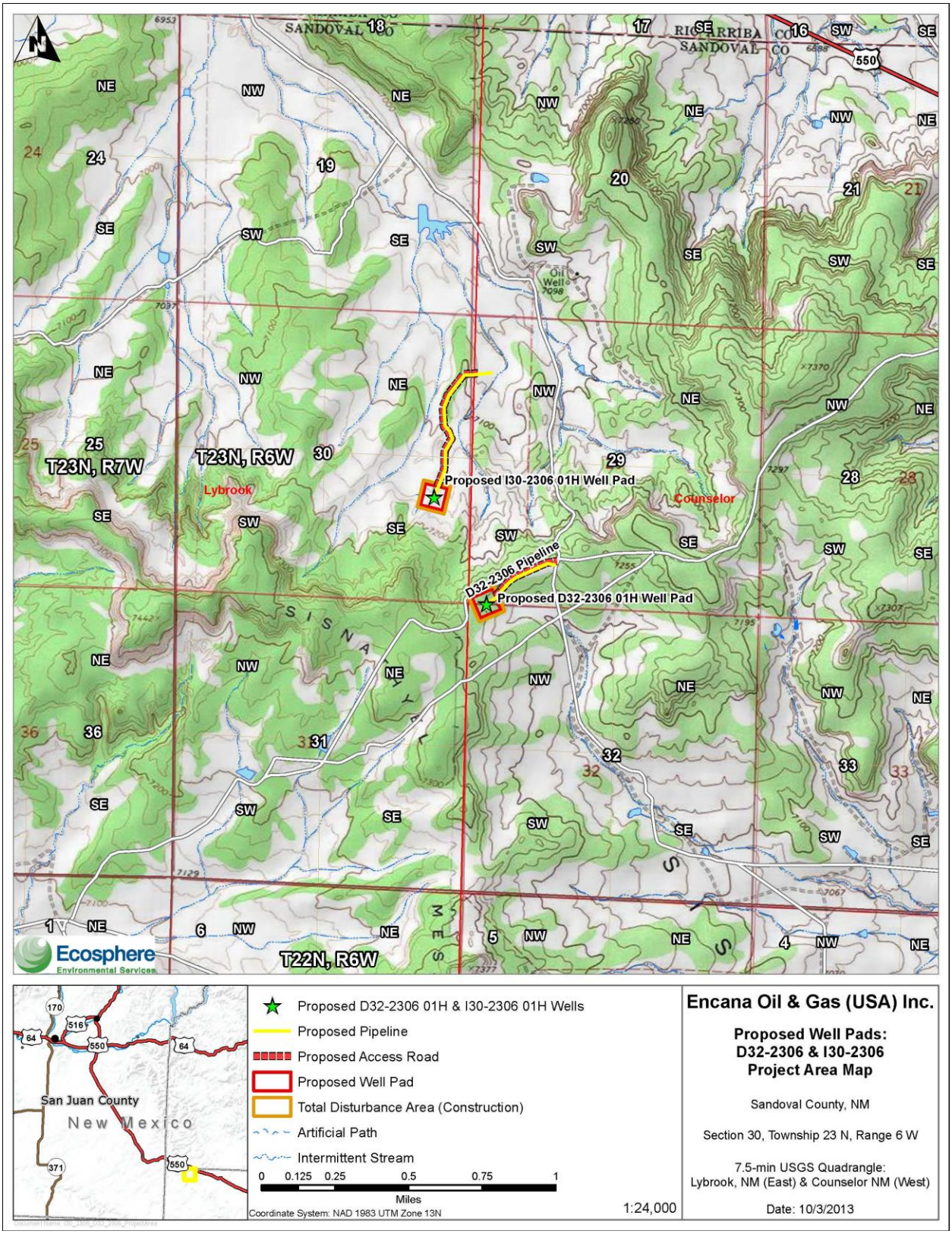

Figure 3: Proposed Lybrook I30-2306 and D32-2306 Site Detail Map

Photograph 1: Lybrook D32-2306 01H (northeast corner 6) looking southwest

Photograph 2: Lybrook D32-2306 01H (northwest corner 5) looking southeast

Photograph 3: Lybrook D32-2306 01H (southeast corner 3) looking northwest

Photograph 4: Lybrook D32-2306 01H (southwest corner 2) looking northeast

Photograph 5: Lybrook D32-2306 01H from the beginning of the access road/pipeline ROW

Photograph 6: Lybrook I30-2306 01H (northeast corner 2) looking southwest

Photograph 7: Lybrook I30-2306 01H (northwest corner 6) looking southeast

Photograph 8: Lybrook I30-2306 01H (southeast corner 3)

Photograph 9: Lybrook I30-2306 01H (southwest corner 5) looking northeast

Photograph 10: Lybrook I30-2306 01H from the end of the access road/pipeline ROW looking north

Appendix B – Application for Permit to Drill

Appendix C – Conditions of Approval

Appendix D – Biological Survey Reports