United States Department of the Interior
Bureau of Land Management

Environmental Assessment DOI-BLM-NM-F010-2014-0262

Logos Operating, LLC's Dilectione Mea No. 003H and No. 004H Horizontal Oil Well Project

September 2014

U.S. Department of the Interior
Bureau of Land Management
Farmington District
Farmington Field Office
6251 N. College Blvd., Ste. A
Farmington, NM 87402
Phone: (505) 564-7600
FAX: (505) 564-7608

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

TABLE OF CONTENTS

1. Purpose and Need for Action 1
   1.1. Background 1
   1.2. Purpose and Need for Action 2
   1.3. Decision to be Made 2
   1.4. Conformance with Applicable Land Use Plan(s) 2
   1.5. Relationship to Statutes, Regulations or Other Plans 2
   1.6. Scoping, Public Involvement, and Issues 3
2. Proposed Action and Alternative(s) 6
   2.1. Proposed Action 6
   2.2. No Action 11
   2.3. Alternatives Considered but Eliminated from Detailed Study 11
3. Affected Environment and Environmental Consequences 12
   3.1. Air Resources 12
   3.2. Cultural Resources 17
   3.3. Upland Vegetation 18
   3.4. Wildlife 19
   3.5. Special Status Species 22
   3.6. Water Resources 24
4. Supporting Information 26
   4.1. Tribes, Individuals, Organizations, or Agencies Consulted 26
   4.2. List of Preparers 26
   4.3. References 26

Appendix A. Maps 30
Appendix B. Plats 33
Appendix C. Surface Reclamation Plan 34

This page intentionally left blank.

1. PURPOSE AND NEED FOR ACTION

1.1. Background

Logos Operating, LLC (Logos) has submitted two Applications for Permit to Drill (APDs) with the Bureau of Land Management - Farmington Field Office (BLM-FFO) for the Dilectione Mea No. 003H and No. 004H horizontal oil wells and associated access road and pipelines. The proposed project includes the construction of one well pad in order to drill two wells and develop federal mineral resources. Logos would also construct a new resource road to access the proposed well site. Once the wells have been drilled and prove to be viable, Logos would construct well-tie pipelines within the granted Right of Way (ROW) corridor to transport produced mineral resources to existing Logos No. 3 pipeline infrastructure. Logos would receive approved APDs to develop their lease. The proposed action is the approval of the APDs by the BLM-FFO, located in Farmington, New Mexico.

New surface disturbance associated with the proposed project area would be approximately 5.09 acres, total. This would include approximately 4.83 acres of new surface disturbance for the construction of the well pad, 0.02 acre for the construction of the new resource road, and 0.23 acre for the construction of the pipeline corridor. New surface disturbance associated with the well pad would be reclaimed to a BLM-approved working area. Production equipment will be placed on the location in such a manner to allow proper safe access to produce and service the well/facilities while minimizing long-term disturbance and maximizing interim reclamation. As practical, access will be provided by a tear-drop shaped road through the production area. All new surface disturbances associated with the pipeline corridor would be reclaimed during interim reclamation.

Oil and natural gas, vital components of the nation's energy supply, account for approximately 36 and 25 percent of total energy consumed in the U.S., respectively (U.S. Energy Information Administration 2012). Natural gas is used in homes, commercially, in industry, and in the transportation sector. Common uses for natural gas include space heating, water heating, cooling, cooking, waste treatment and incineration, metals preheating, drying and humidification, glass melting, food processing, fueling industrial boilers, vehicle fueling, and electricity generation. Gases such as butane, ethane, and propane can be extracted from natural gas to be used for products such as fertilizers and pharmaceuticals. Natural gas can also be used to create methanol, which is utilized in the production of formaldehyde, acetic acid, fuel cell sources, and additives for cleaner burning gasoline (Natural Gas Supply Association 2010). Most oil goes into fuels, including gasoline, jet fuel, and home-heating oil. Additionally, non-fuel compounds extracted from oil are used to develop lubricants; asphalt for roads; tar for roofing; waxes for food wrapping; solvents for paints; cosmetics and dry-cleaning products; plastics; and foams (U.S. Energy Information Administration 2012).

Most of the oil and natural gas found in North America is concentrated in distinct basins. The BLM-FFO management area is within the San Juan Basin, one of the most prolific gas-producing basins in the country. Currently, the San Juan Basin produces small amounts of oil (BLM 2003a).

Taxes and royalties on oil, natural gas, and carbon dioxide production contribute approximately 25 percent of New Mexico's general fund, and the oil and gas industry is one of the largest private sector employers in the state (New Mexico Bureau of Geology and Mineral Resources 2012). Additionally, the federal government receives royalties, or a share of the production income, for extracted federal minerals. In 2011, federal natural gas royalties totaled over 2 billion dollars (Office of Natural Resources Revenue 2012).

1.2. Purpose and Need for Action

The purpose of the proposed action is to allow Logos reasonable access to BLM managed lands to develop their mineral lease.

The need for the proposed action is established by the BLM's responsibility under the Mineral Leasing Act of 1920, as amended (30 USC [United States Code] 181 et seq.) to respond to the APDs.

1.3. Decision to be Made

Based on the information in this environmental assessment (EA), the BLM-FFO will decide whether or not to issue APDs, and if so, under what terms and conditions. Under the National Environmental Policy Act (NEPA) (Public Law [PL] 91-90, 42 USC 4321 et seq.), the BLM-FFO must determine if there are any significant environmental impacts associated with the proposed actions warranting further analysis in an Environmental Impact Statement (EIS). The BLM-FFO Field Manager is the responsible officer who will decide either:

- To approve the APDs with design features as submitted;
- To approve the APDs with additional mitigations;
- To analyze the effects of the proposal in an EIS; or
- To deny the APDs.

1.4. Conformance with Applicable Land Use Plan(s)

Pursuant to 40 Code of Federal Regulations (CFR) 1508.28 and 1502.21, this site-specific environmental assessment (EA) tiers to and incorporates by reference the information and analysis contained in the Farmington Proposed Resource Management Plan/Final Environmental Impact Statement [(PRMP/FEIS) BLM 2003a]. This EA is in conformance with the management goals set forth in the Resource Management Plan (RMP) for the Farmington Field Office (FFO) of the BLM, which was approved by the Record of Decision (ROD) signed September 29, 2003, and updated in December 2003 (BLM 2003b). Specifically, this action is in conformance with the following objectives: 1. It is the policy of the BLM to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs, consistent with national objectives of an adequate supply of minerals at reasonable market prices; and, 2. To the extent possible, new Rights-of-Way (ROWs) will be located within or parallel to existing ROWs or ROW corridors to minimize resource impacts. At the same time, the BLM strives to ensure that mineral development is carried out in a manner that minimizes environmental damage and provides for the rehabilitation of affected lands (2003b, 2-2). The PRMP/FEIS, RMP, and ROD are available for review at the BLM Farmington Field Office, 6251 College Blvd., Suite A, Farmington, NM, or electronically at:

http://www.nm.blm.gov/ffo/ffo_home.html

1.5. Relationship to Statutes, Regulations or Other Plans

Logos would comply with applicable federal, state, and local laws and regulations. Necessary permits and approvals for the proposed project would be obtained prior to project implementation.

Many requirements regulating specific environmental elements are found in the appropriate elements sections of this EA (Chapter 3). Several permits, licenses, consultations, or other requirements are discussed below.

1.5.1. Clean Water Act

Recognizing the potential for the continued or accelerated degradation of the Nation's waters, the U.S. Congress enacted the Clean Water Act (CWA), formerly known as the Federal Water Pollution Control Act (33 USC 1344). The objective of the CWA is to maintain and restore the chemical, physical, and biological integrity of the waters of the United States. The proposed action is in conformance with the CWA (33 USC 1251 et seq.).

Under Section 401 of the CWA, an applicant for a federal license or permit to conduct an activity that may result in a discharge into a water of the U.S. must provide the federal agency with a Section 401 certification declaring that the discharge would comply with the CWA. The certification would be granted by the New Mexico Environment Department (NMED).

Under Section 402 of the CWA, the U.S. Environmental Protection Agency (EPA) regulates storm water discharges from industrial and construction activities under the National Pollution Discharge Elimination System (NPDES) program. Permits are required if discharge results in a reportable quantity for which notification is required (pursuant to 40 CFR 117.21, 40 CFR 302.6, or 40 CFR 110.6) or if the discharge contributes to a violation of a water quality standard.

Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredged or fill material into the waters of the U.S., including wetlands. The U.S. Army Corps of Engineers (USACE) has jurisdiction over "waters of the U.S." These jurisdictional waters include those that have a "significant nexus" to traditional navigable waters. The BLM-FFO and USACE Durango Regulatory Office have determined that jurisdictional waters may include USGS watercourses (i.e., "blue lines" on USGS 1:24,000 topographic maps).

1.5.2. National Historic Preservation Act

Compliance with Section 106 responsibilities of the National Historic Preservation Act are adhered to by following the BLM – New Mexico SHPO protocol agreement, which is authorized by the *National Programmatic Agreement between the BLM*, the *Advisory Council on Historic Preservation*, and the *National Conference of State Historic Preservation Officers*, and other applicable BLM handbooks.

1.5.3. Clean Air Act

The Clean Air Act of 1972, as amended (CAA; 42 USC 7401 et seq.), establishes national ambient air quality standards (NAAQS) to control air pollution. In New Mexico, the NMED has adopted most of the CAA into the New Mexico Administrative Code (NMAC). The NMED issues construction and operating permits for air quality and enforces air quality regulations and permit conditions.

1.6. Scoping, Public Involvement, and Issues

1.6.1. Scoping and Public Involvement

The Farmington Field Office (FFO) publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions in the field office. The log is located on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html).

An onsite meeting, attended by Logos, BLM-FFO representatives, and an environmental consultant (Adkins Consulting, Inc. [ACI]), was held for the proposed project on April 10, 2014.
A public invitation to the on-site meeting was posted online (http://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_oil_and_gas/ffo_onsites.html); no private citizens or groups attended the meeting. A BLM-FFO Interdisciplinary Team meeting was held on May 12,

2014 April 2014 to discuss the proposed action. At the aforementioned meetings, potential issues of concern were identified by the BLM-FFO and ACI.

Based on the size and scale, routine nature, and potential impacts associated with the proposed action, no additional external scoping was conducted. No public comments were received for the proposed action.

1.6.2. Issues

Issues Analyzed

The following issues were identified during internal scoping as potential issues of concern for the proposed action. These issues will be addressed in this EA.

- How would dust, equipment emissions, and consumption of hydrocarbons associated with the proposed project impact air resources?
- How would surface-disturbing activities associated with construction of the proposed project impact cultural resources?
- How would vegetation-clearing, proposed project activities, and final reclamation associated with the proposed project impact upland vegetation?
- How would vegetation-clearing, proposed project activities, and final reclamation associated with the proposed project impact wildlife, including migratory birds?
- How would vegetation-clearing, proposed project activities, and final reclamation associated with the proposed project impact the following BLM Special Status Species (SSS): Bendire's thrasher (*Toxostoma bendirei*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*) and prairie falcon (*Falco mexicanus*)?
- How vegetation-clearing, proposed project activities and reclamation associated with the proposed project would impact water resources?

Issues Considered but not Analyzed

The following issues were identified during scoping as issues of concern that would not be impacted by the proposed action or that have been covered by prior environmental review. These issues will not be analyzed in this EA.

Endangered Species Act Species

The Endangered Species Act (ESA) of 1973 requires all federal departments and agencies to conserve threatened, endangered, and critical and sensitive species and the habitats on which they depend, and to consult with the U.S. Fish and Wildlife Service (USFWS) on all actions authorized, funded, or carried out by the agency to ensure that the action will not likely jeopardize the continued existence of any threatened and endangered species or adversely modify critical habitat. Consultation with the USFWS, as required by Section 7 of the ESA, was conducted as part of the Farmington PRMP/FEIS (Consultation No. 2-22-01-I-389) to address cumulative effects of RMP implementation. The consultation is summarized in Appendix M of the PRMP/FEIS. Water used to construct, produce, and maintain the proposed wells would be acquired from the New Mexico Office of the State Engineer (NMOSE) point of diversion (POD) authorization number SJ-2105 (Blanco Trading Post) and/or POD SJ-00077 (Hilltop); no unaccounted-for water depletions within USFWS-listed fish habitat would occur. Therefore, there is no need for additional Section 7 consultation.

Native American Religious Concerns

For the proposed actions, identification efforts for Native American Religious Concerns were limited to a review of existing published and unpublished literature (e.g., Van Valkenburgh 1941, 1974; Brugge 1993; Kelly, et al. 2006), development of the site-specific Class III survey report prepared for the proposed action (Western Cultural Resource Management, Inc. [WCRM] Report WCRM(F)1306 [Morgan 2014]), and a review by the BLM's cultural resources program regarding the presence of Traditional Cultural Properties (TCPs) identified through ongoing BLM tribal consultation efforts. There are currently no known remains that fall within the purview of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 USC 3001) or the Archaeological Resources Protection Act (ARPA; 16 USC 470) within the proposed project area. The proposed action would not impact any known TCPs, 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 (AIRFA; 42 USC 1996) or Executive Order (EO) 13007.

Paleontology

The San Juan Basin in northwestern New Mexico is rich in paleontological resources. The BLM used the Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands (Instruction Manual 2008-009) to identify areas with a high potential to produce significant fossil resources (BLM 2008d). Under this system, all lands within the BLM-FFO management area were designated as Class 5 (Very High Potential) for paleontological resources. Class 5 areas require an assessment of paleontological resources at the project level (BLM 2009). If a paleontological site is discovered during the construction phase of the proposed project, the site would be avoided by personnel, personal vehicles, and company equipment. Therefore, no impacts to paleontological resources are anticipated as a result of the proposed project.

2. PROPOSED ACTION AND ALTERNATIVE(S)

2.1. Proposed Action

The proposed action is the BLM-FFO approval of the two APDs and three Right-of-Way (ROW) Grants associated with Logos' Dilectione Mea No. 3H and No. 4H horizontal oil wells. The proposed action includes the construction of a new well pad, resource road, and subsurface, well-tie pipeline on public lands managed by the BLM in order to drill and develop federal mineral resources administered by the BLM-FFO. The proposed project would commence after the APDs and ROW Grants are issued.

Construction plats associated with the proposed project are provided in Appendix B. Photographs of the proposed project area are provided in the Surface Reclamation Plan (Appendix C).

2.1.1. Location of Proposed Project Area

Maps of the proposed project area are provided in Appendix A. The proposed project area is plotted on a topographic map (Appendix A.1) and aerial imagery (Appendix A.2).

The proposed project area is located within the BLM-FFO management area on public lands in Rio Arriba County, New Mexico. The proposed project area is located approximately 43.0 miles southeast of Bloomfield, 15.6 miles east of Nageezi, and 2.8 miles north of Counselor. The proposed project is located within the southwest quarter of Section 3, Township 23 North, Range 6 West, New Mexico Principle Meridian (NMPM).

The general region surrounding the proposed project area is characterized by ridges and mesas transected by relatively flat lowland valleys. The project area is set in the alluvial plain of Haynes Canyon, approximately 0.65 mile southwest of the confluence of Haynes and Escrito Canyons. Ground elevation at the proposed well head is approximately 6,716 feet above mean sea level (AMSL).

2.1.2. Description of Proposed Project

For a detailed description of design features and construction practices associated with the proposed action, refer to the APDs on file at the BLM-FFO. Construction plats associated with the proposed project are found in Appendix B and provide additional details. Photographs of the proposed project area are provided in the Surface Reclamation Plan (Appendix C).

Design Features and Best Management Practices

Logos would adhere to the stipulations attached to approved APDs and ROW Grants from the BLM-FFO. The following general design features and best management practices (BMPs) would occur.

Control of Waste

Liquid and solid wastes would be disposed of at an appropriate waste-disposal site. The proposed project area would be maintained in a sanitary condition. Hazardous substances would be handled and disposed of according to federal law. Waste resulting from construction activities would be removed from the proposed project area and disposed of in an authorized area, such as an approved landfill.

Protection of Paleontological Resources

If a paleontological site is discovered, the BLM would be notified and the site would be avoided by personnel, personal vehicles, and company equipment. Workers would be informed that it is illegal to collect, damage, or disturb some such resources, and that such activities are punishable by criminal and/or administrative penalties.

Protection of Cultural Resources

All cultural resource stipulations would be followed as indicated in the Cultural Resource Records of Review, attached to the stipulations in an approved APD. These stipulations could include, but would not be limited to, temporary or permanent fencing or other physical barriers, monitoring of earth disturbing construction, reduction of the proposed project areas and/or establishment of specific construction avoidance zones, and employee education.

Employees, contractors, and sub-contractors associated with the proposed project would be informed by Logos that cultural sites are to be avoided by personnel, personal vehicles, and company equipment. These individuals would 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 ARPA.

In the event of a cultural discovery during construction, Logos would immediately stop all construction activities in the immediate vicinity of the discovery and immediately notify the archaeological monitor, if present, or the BLM. The BLM would then evaluate or cause the site to be evaluated. Should a discovery be evaluated as significant (e.g., eligible for the National Register of Historic Places [NRHP] or protected under NAGPRA or ARPA), it would be protected in place until mitigating measures could be developed and implemented according to guidelines set by the BLM.

Protection of Flora and Fauna, including SSS and Livestock

Because the proposed action would disturb more than 4.0 acres of vegetation, if construction activities would occur during the migratory bird breeding season (May 15 through July 31), a migratory bird nest survey of the proposed project area would take place one to two days prior to construction. This survey would be conducted by a BLM-FFO-approved biologist following BLM-FFO protocol. If, during the nest survey or during construction, active nests are located within or adjacent to the proposed project area, the BLM-FFO biologist would be notified and project activities would not be permitted until fledging has occurred. If postponement is not an option, the operator would contact the USFWS's Migratory Bird Permit Office regarding permitting.

Should any active raptor nests be observed within one-third mile of the proposed project area or should any additional SSS (listed by the USFWS or BLM) be observed within the proposed project area prior to or during project implementation, construction would cease and the BLM-FFO would be immediately contacted. The BLM-FFO would then ensure evaluation of the resource. Should a discovery be evaluated as significant (protected under the ESA, etc.), it would be protected in place until mitigation could be developed and implemented according to guidelines set by the BLM.

Logos would notify the grazing lease operator(s) at least 10 business days prior to beginning the construction phase of the proposed project in order to ensure that there would be no conflicts between construction activities and livestock grazing operations. Logos would not cease or delay construction unless directed by the authorized BLM-FFO officer. Any livestock grazing improvements disturbed by construction activities would be repaired to the condition they were in prior to disturbance. Repairs, if needed, would take place immediately following construction.

The following design features would apply to the proposed project:

- All construction and/or maintenance resulting in surface disturbance would be done in accordance to the BLM Surface Operating Standards and Guidelines for Oil and Gas Development, Fourth Edition-Revised 2007 (The Gold Book).
- Backfilling operations would be performed within a reasonable amount of time to ensure that a pipeline trench is not left open for more than 24 hours. If a trench is left open overnight, it will be fenced with a temporary fence or a night watchman will be utilized.

- If used, all pits would meet State of New Mexico, Oil Conservation Division (NMOCD) pit guidelines and requirements, NMAC 19.15.17.

- Logos would install a culvert as necessary (minimum 24-inch-diameter) on the southeast side of the well pad at corner 5 directing flow in a west-southwesterly direction. Erosion control and water management features would be designed and constructed in accordance with BLM Gold Book Standards.

Protection of Topsoil

Topsoil, which would be stripped from the surface during the construction phase of the proposed project, would be stored and protected until it is redistributed during reclamation. The topsoil would be stored separately from subsoil or other excavated material within the permitted project area. The topsoil would be free of brush and tree limbs, trunks, and roots. Vehicle/equipment traffic would not be allowed to cross topsoil stockpiles. The topsoil would be protected using wattles or other BMPs so that erosion is minimized. If topsoil is stored for a length of time such that nutrients are depleted from the topsoil, amendments would be added to the topsoil as advised by an appropriate agent/contractor.

Protection of the Public

The hauling of equipment and materials for the proposed project on public roads would comply with Department of Transportation regulations. No toxic substances would be stored or used within the proposed project area. Logos would have inspectors present during construction. Any accidents involving persons or property would immediately be reported to the BLM-FFO. Logos would notify the public of potential hazards by posting signage, as necessary.

Prevention and Control of Weeds

Prior to construction equipment entering the proposed project area, construction equipment would be inspected for noxious weeds and cleaned.

It would be Logos' responsibility to monitor, control, and eradicate all invasive, non-native plant species within the proposed project area throughout the life of the project. Logos' weed-control contractor would contact the BLM-FFO regarding acceptable weed-control methods. If the contractor does not hold a current Pesticide Use Permit, a Pesticide Use Permit would be submitted prior to pesticide application. Only pesticides authorized for use on BLM lands would be used. The use of pesticides would comply with federal and state laws. Pesticides would be used only in accordance with their registered use and limitations. Logos' weed-control contractor would contact the BLM-FFO prior to using these chemicals.

Protection of Air Resources

BMPs for dust suppression would be utilized within the proposed project area to reduce fugitive dust during the construction phase of the proposed project. Water application, using a rear-spraying truck or other suitable means, would be the primary method of dust suppression within the proposed project area. Any additional dust-suppression practices would include the BLM-standard BMPs found in the Gold Book (BLM and USFS 2007) and the BMPs outlined in the stipulations attached to an approved APD.

Additional Design Features and BMPs

Vehicles would be restricted to proposed disturbance areas and existing areas of surface disturbance, such as existing roads and well pads.

Worker safety incidents would be reported to the BLM-FFO as required under Notice to Lessees (NTL) - 3A (USGS 1979). Logos would adhere to company safety policies, Occupational Safety and Health Administration regulations, and Department of Transportation regulations.

Logos would comply with Onshore Oil and Gas Order No. 2, issued under Onshore Oil and Gas Operations (43 CFR 3160).

Construction and maintenance activities would cease when soil or road surfaces become saturated to the extent that construction equipment is unable to stay within the proposed project area and/or when activities would cause irreparable harm to roads, soils, or watercourses.

Erosion-control and water-management features, such as berms, culverts, diversion ditches, and waterbars, would be applied as specified by the BLM-FFO Authorized Officer. Installation and maintenance of erosion-control features would be done in accordance to BLM Gold Book standards. Additional resource protection design features and mitigation associated with construction are listed above, in “Design Features and Best Management Practices”, or would be established upon reclamation following construction and drilling activities.

Proposed Project Phases

Under the proposed action, the following phases would occur.

Construction Phase

Once the APDs and ROW Grants are approved, well site and pipeline construction can begin. The BLM-FFO would be notified at least 48 hours prior to the start of construction.

Within the proposed project area, all vegetation would be cleared, and approximately the top 6 inches of topsoil would be salvaged and stockpiled. Vegetation removed during construction, including slash/brush, would be chipped or mulched and incorporated into the topsoil as additional organic matter.

Logos would construct a 400-foot by 400-foot well pad with a 50-foot construction buffer zone around the perimeter of the pad. Corner number two would be rounded. The well pad would be constructed from the earthen materials present on-site and gravel brought in from off-site. No concrete or other foreign materials would be brought in for use in construction of the well pad. Construction would involve preparing a level area for the equipment that would drill and complete the wells. Following removal of vegetation and stockpiling of viable soil material, the pad would be graded using standard, cut-and-fill techniques of construction using a bulldozer, grader, front-end loader, and/or backhoe. Construction of the well pad would require between 3.9 and 0.5 feet of cut on the south side of the location, and between 2.9 and 0.6 feet of fill on the north side of the location.

A resource road approximately 21.86 feet long will be designed and constructed in accordance with BLM Gold Book Standards, BLM 9113-1 (Roads Design Handbook), and BLM 9113-2 (Roads Inventory and Condition Assessment Guidance and Instructions Handbook). Average clearing width for resource road development is 30 feet. Final travel surface width on resource roads is approximately 14 feet.

The well-tie pipelines would be constructed within a single trench. The pipelines would be placed within a granted 40-foot-wide pipeline corridor ROW. The proposed pipeline corridor would parallel the proposed resource road for approximately 21.86 feet, and would continue cross county for the remaining length to station 2+68.04. Additional, related appurtenances, such as above ground valve assembly and above and below ground cathodic protection, would be installed within the proposed pipeline corridors as necessary.

Trenching activities would be conducted using a trencher or backhoe. The trenches would be 16 inches in width if a trencher is used or 24 inches in width if a backhoe is used. After a pipe has been welded and coated, a side-boom tractor would be used to place the pipe into a trench. The pipelines would be buried to a minimum depth of 3 feet.

After trenching and pipe placement in the trench, the soils excavated from the trench would be returned and compacted to prevent subsidence. The trench would be compacted after approximately two feet of fill is placed within the trench and after the ground surface has been leveled.

Prior to the pipeline being placed in service, the pipes would be pressure tested. Pipeline markers would be installed along the proposed pipeline corridors within the line of sight, without voiding safety measures.

Within 90 days of installation, aboveground structures not subject to safety requirements would be painted Covert Green to blend with the surrounding landscape and reduce visual resource impacts.

Erosion control and/or water management features would be installed, as necessary. Additional resource protection design features and mitigation associated with construction are listed above, in “Design Features and Best Management Practices”.

Interim Reclamation

Following construction activities, interim reclamation would occur within all new disturbance areas associated with the proposed project. The BLM-FFO would be notified at least 48 hours prior to surface reclamation activities.

During this phase, a bulldozer and a tractor with seeding capabilities would be used for reclamation purposes.

In areas that would be reclaimed within the proposed project area, slopes would be re-contoured to pre-construction topographical contours, if possible. Additionally, stockpiled topsoil would be redistributed and the surface would be ripped and seeded. The well pad would be reclaimed to a BLM-approved working area. All new surface disturbances associated with the pipeline corridor would be reclaimed.

During the April 2014 pre-disturbance onsite meeting, it was determined that the Sagebrush/Grass vegetation community best represents the proposed project area. Details of the interim reclamation process (including species included in the seed mixture) are provided in the Surface Reclamation Plan (Appendix C).

Operation

During the operation phase of the proposed project, Logos personnel would perform routine or emergency maintenance on the proposed well location. One light-duty vehicle would continue to access the area on near daily basis. Heavy-duty vehicles (semi-trucks) would access the well site 1 to 2 times a day for approximately 6 months after which traffic trips would decrease to approximately 1 trip per month.

Final Reclamation and Abandonment

Once the well site is no longer necessary and would not be expected to be utilized in the foreseeable future, it would be abandoned. Abandonment of the wells would be carried out under current BLM regulations. Aboveground facilities would also be removed.

Final reclamation would occur within any portion of the project area that would be disturbed to bare soil during the abandonment phase of the proposed project, if these areas meet the acreage requirements for reclamation. These acreage requirements are summarized below:

- If final abandonment activities would disturb less than or equal to 0.1 acre to bare soil, the area(s) would be expected to revegetate naturally (no reclamation or monitoring activities will be required).
- If final abandonment or relinquishment earthwork results in less than 1 acre, but more than 0.1 acre of bare soil, Logos will initiate the Vegetation Reclamation Plan in accordance with Procedure A of the BLM-FFO Bare Soil Reclamation Procedures (2013a).

- If 1 or more acre of bare soil results from earthwork required in preparation for final abandonment, Logos will follow Vegetation Reclamation Plan in accordance with Procedure B of the BLM-FFO Bare Soil Reclamation Procedures (2013a).

2.1.3. Proposed Surface Disturbance

Surface disturbance associated with the proposed project would encompass approximately 5.09 acres, total. This would include approximately 4.83 acres for construction of the well pad, 0.02 acres for the construction of a new resource road, and 0.23 acres for construction of the pipeline corridor. Depictions of the surface-disturbing activity locations are provided in Appendices A (Proposed Development Map) and B (Plats).

Table 1. Proposed Project Surface Impacts

Surface Disturbance Description (Approximate Stationing)	Existing/Previously Permitted/Proposed Surface Disturbance	New Surface Disturbance (acres)
Well Pad		
400-foot by 400-foot location with 50-foot construction buffer zone; rounded corner 2	-	4.83 acres; new disturbance
Resource Road		
0+00 to 0+21.86	-	21.9’ long x 30’ wide (0.02 acres; new disturbance)
Well-tie Pipeline Corridor		
0+00 to 0+21.86 (parallel to resource road disturbance)	21.9’ long x 15’ wide (0.01 acres; new access overlap)	21.9’ long x 25’ wide (0.01 acre; new disturbance)
0+21.86 to 2+68.04 (cross country)	-	246.2’ long x 40’ wide (0.23 acres; new disturbance)
Total Project Surface Disturbance	**0.01 acre**	**5.09 acres**

2.2. No Action

Under the No Action Alternative, the APDs and ROW Grants associated with the proposed Dilectione Mea No. 3H and No. 4H wells would not be approved. The proposed well pad, resource road, and subsurface, well-tie pipeline would not be constructed. Current land and resource uses would continue to occur in the proposed project area.

2.3. Alternatives Considered but Eliminated from Detailed Study

No alternatives have been developed that would result in significantly fewer impacts or any clear advantages over the proposed action.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Under the No Action alternative, current land and resource issues within the proposed project area would continue; there would be no new impacts from oil and gas development. The No Action alternative will serve as the baseline for comparing the environmental impacts of the analyzed alternatives, and will not be further evaluated in this EA (BLM 2008b).

3.1. Air Resources

3.1.1. Affected Environment

The proposed project is located in Rio Arriba 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 (GHGs), and their effects on national and global climate conditions has emerged since this document was prepared. On-going scientific research has identified the potential impacts of GHG emissions such as carbon dioxide (CO_2) methane (CH_4); nitrous oxide (N_2O); 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 back 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 Resources Technical Report; (U.S. Department of Interior Bureau of Land Management, 2014)). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

The Environmental Protection Agency (EPA) 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 (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and lead (Pb). EPA has established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The NAAQS are protective of human health and the environment. EPA has approved New Mexico's State Implementation Plan and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands and within Bernalillo County. Air quality is determined by atmospheric pollutants and chemistry, dispersion meteorology and terrain, and also includes 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. EPA 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 Resources Technical Report describes the types of data used for description of the existing conditions of criteria pollutants, how the criteria pollutants are related to the activities involved in oil and gas development, and provides a table of current National and state standards. EPA's Green Book web page (U.S. Environmental Protection Agency, 2013) reports that all counties in the Farmington Field Office area are in attainment of all National Ambient Air Quality Standards (NAAQS) as defined by the Clean Air Act. The area is also in attainment of all state air quality standards (NMAAQS*).* The current

status of criteria pollutant levels in the Farmington Field Office are described below. Total emissions of criteria pollutants from each source sector were calculated by adding together the emissions from the four counties that are located in FFO: San Juan, McKinley, Rio Arriba, and Sandoval.

"Design Concentrations" are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2012 design concentrations of criteria pollutants are listed below in Table 2. There is no monitoring for CO and lead in San Juan County, but because the county is relatively rural, it is likely that these pollutants are not elevated. PM10 design concentrations are not available for San Juan County.

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

Pollutant	2012 Design Concentration	Averaging Time	NAAQS	NMAAQS
O_3	0.071 ppm	8-hour	0.075 ppm[1]	
NO_2	13 ppb	Annual	53 ppb[2]	50 ppb
NO_2	38 ppb	1-hour	100 ppb[3]	
$PM_{2.5}$	4.7 µg/m^3	Annual	12 µg/m^3[3,4]	60 µg/m^3[3,6]
$PM_{2.5}$	14 µg/m^3	24 hour	35 µg/m^3[3,3]	150 µg/m^3[3,6]
SO_2	19 ppb	1-hour	75 ppb[5]	

[1] Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
[2] Not to be exceeded during the year
[3] 98th percentile, averaged over 3 years
[4] Annual mean, averaged over 3 years
[5] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
[6] The NMAAQS is for Total Suspended Particulate (TSP)

In 2005, the EPA estimates that there was less than 0.01 ton per square mile of lead emitted in FFO counties, which is less than 2 tons total (U.S. Environmental Protection Agency, 2012). Lead emissions are not an issue in this area, and will not be discussed further.

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

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

Although the AQI in the region has reached the level considered unhealthy for sensitive groups on several days almost every year in the last decade, there are no patterns or trends to the occurrences (Table 3). On 8 days in the past decade, air quality has reached the level of "unhealthy" and on two days, air quality reached the level of "very unhealthy". In 2009 and 2012, there were no days that were "unhealthy for sensitive groups" or worse in air quality. In 2005 and 2013, there was one day that was "unhealthy" during each year. In 2010, there were five "unhealthy" days and two "very unhealthy days".

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

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

Hazardous Air Pollutants

The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (U.S. Department of Interior Bureau of Land Management, 2014). The EPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. A review of the results of the 2005 NATA shows that cancer, neurological and respiratory risks in San Juan County are generally lower than statewide and national levels as well as those for Bernalillo County where urban sources are concentrated in the Albuquerque area (U.S. Environmental Protection Agency, 2012).

Climate

The analysis area is located in a semiarid 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 zero in December and January. Precipitation is divided between summer thunderstorms associated with the southwest monsoon and winter snowfall as Pacific weather systems drop south into New Mexico. Table 4 shows climate normals for the 30-year period from 1981 to 2010 for the Farmington, New Mexico, area.

Table 4. Climate Normals for the Farmington Area, 1981-2010

Month	Average Temperature (^{O}F [1])	Average Maximum Temperature (^{O}F)	Average Minimum Temperature (^{O}F)	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: data collected at New Mexico State Agricultural Science Center - Farmington
[1] degrees Fahrenheit

The Air Resources Technical Report summarizes information about greenhouse gas emissions from oil and gas development and their effects on national and global climate conditions. While it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change.

3.1.2. Impacts from the Proposed Action

Methodology and assumptions for calculating air pollutant and greenhouse gas emissions are described in the Air Resources Technical Report (USDI/BLM 2013b). 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, HAP, and greenhouse gas (GHG) emissions to be compared to regional and national emissions levels. Also incorporated into this document are the sections describing the assumptions used in developing the inputs for the calculator (U.S. Department of Interior Bureau of Land Management, 2014).

Direct and Indirect Impacts

Criteria Pollutants

Table 6 shows estimated emissions from one proposed horizontal oil well for criteria pollutants, volatile organic compounds (VOC) and greenhouse gas (GHG). For comparison, Table 5 shows total human-caused emissions for each of the counties in the FFO and La Plata County, Colorado, based on USEPA's 2011 emissions inventory (U.S. Environmental Protection Agency, 2014).

Table 5. Criteria Pollutant and VOC 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	CH4	CO2
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/yr)								
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**

Oil storage tanks on the well location may result in venting of 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 EPA regulations regarding the capture or flaring of VOC emissions.

Table 6. Analysis Area Emissions in Tons/Year, 2011

County	NO_X (1)	CO (2)	VOC (3)	PM_{10} (4)	$PM_{2.5}$ (5)	SO_2 (6)
McKinley	11,952.9	17,007.8	3,891.2	70,096.4	7,645.2	1,381.1
Rio Arriba	12,012.3	27,344.6	19,149.8	33,761.2	4,130.6	60.4
San Juan	42,231.5	63,568.9	26,110.8	76,638.3	9,201.0	5,559.3
Sandoval	4,143.8	19,513.9	4,373.1	39,343.0	4,510.8	109.3
Total	**70,340.5**	**127,435.2**	**53,525.0**	**219,838.9**	**25,487.6**	**7,110.0**

(1) NO_X – nitrogen oxides
(2) CO – carbon monoxide
(3) VOC – volatile organic compounds
(4) PM_{10} – particulate matter with an aerodynamic diameter equal to or less than 10 microns
(5) $PM_{2.5}$ – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
(6) SO_2 – sulfur dioxide

Table 7 displays the percent increase in total emissions in the analysis area from the proposed action to construct and operate one horizontal oil well.

Table 7. Percent Increase in Analysis Area Emissions from the Proposed Action

	NO_X[1]	CO[2]	VOC[3]	PM_{10}[4,5]	$PM_{2.5}$[5,6]	SO_2[5,7]
Total Emissions	70,340.5	127,435.2	53,525.0	219,838.9	25,487.6	7,110.0
Conventional Gas Well Emissions	6.13	1.64	12.55[8]	2.54	0.29	0.11
Percent Increase	**0.009**	**0.001**	**0.02**	**0.001**	**0.001**	**0.002**

[1] NO_X – nitrogen oxides
[2] CO – carbon monoxide
[3] VOC – volatile organic compounds
[4] PM_{10} – particulate matter with an aerodynamic diameter equal to or less than 10 microns
[5] Values derived from average emissions for any well drilling in the analysis area. Calculated results available upon request.
[6] $PM_{2.5}$ – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
[7] SO_2 – sulfur dioxide
[8] Current EPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over six 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/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 EPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over 6 tons of VOC emissions per year. A reduction of 95% of oil storage tank VOC emissions would reduce the estimated HAP emissions to 0.12 tons/year.

Total Greenhouse Gases

The available statewide GHG summary combines GHG emissions from CO_2 and CH_4. To compare the GHG emissions from the Proposed Action estimated by the calculator with statewide GHG emissions, CO_2e 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; (New Mexico Environment Department, 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. There are approximately 21,150 active oil and gas wells in the San Juan Basin. About 14,843 of the wells in these counties are Federal wells. Analysis of cumulative impacts for reasonable development scenarios and RFDS 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 (U.S. Department of Interior Bureau of Land Management, 2014).

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

3.2.1. Affected Environment

The proposed project is located within the archaeologically rich San Juan Basin of northwest New Mexico. In general, the history 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 (aka Anasazi; A.D. 1-1540), and the historic (A.D. 1540 to present), which includes Native American as well as later Hispanic and Euro-American settlers. Detailed descriptions of these various periods are provided in the Bureau of Land Management Farmington Field Office Final Environmental Impact Statement (2003) and will not be reiterated here. Additional information can also be found in an associated documented, Cultural Resources Technical Report (CRTR; SAIC 2002).

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 (APE) for the Proposed Action was archaeologically surveyed by WCRM at a BLM Class III (100 percent) level. The archaeological report was 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* (BLM 2005).

The Class III inventory identified 2 isolated occurrences (IOs) within the APE WCRM(F)1306 [Morgan 2014]; BLM Report 2014(III)057F). No TCPs are known to exist in the APE.

3.2.2. 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., NRHP 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 Cultural Resource Record of Review, attached to an approved APD. The proposed action is not known to physically threaten any TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere or otherwise hinder the performance of traditional ceremonies/rituals. The proposed action will have no direct or indirect impact on significant cultural sites.

Cumulative Impacts

There will be no negative cumulative impact on cultural resources as significant cultural sites are being avoided. A positive cumulative effect is the additional scientific information yielded by the archaeological survey.

3.3. Upland Vegetation

3.3.1. Affected Environment

The analysis area is located within the United States Environmental Protection Agency (USEPA) designated Arizona/New Mexico Plateau Level III ecoregion. The Arizona/New Mexico Plateau occurs primarily in Arizona, Colorado, and New Mexico, with a small portion in Nevada. This ecoregion is approximately 45,870,500 acres (185,632 square kilometers), and the elevation ranges from 2,165 to 11,949 feet AMSL. The ecoregion's landscapes include low mountains, hills, mesas, foothills, irregular plains, alkaline basins, some sand dunes, and wetlands. This ecoregion is a large transitional region between the semiarid grasslands to the east, the drier shrublands and woodlands to the north, and the lower, hotter, less vegetated areas to the west and south. Vegetation communities include shrublands with big sagebrush, rabbitbrush, winterfat, shadscale saltbush, and greasewood; and grasslands of blue grama, western wheatgrass, green needlegrass, and needle-and-thread grass. Higher elevations may support piñon pine and juniper forests. The ecoregion includes the urban areas of Santa Fe and Albuquerque. Important land uses include irrigated farming, recreation, rangeland, wildlife habitat, and some natural gas production (Griffith, et al. 2006).

The general region surrounding the proposed project area is characterized by sagebrush shrubland valleys and sandstone canyons. The proposed project area is situated in a relatively flat area dominated by big sagebrush (*Seriphidium tridentatum*) and blue grama (*Bouteloua gracilis*), with a minor component of Russian thistle (*Salsola tragus*), rabbitbrush (*Chrysothamnus* sp.) and New Mexican prickly pear cactus (*Opuntia phaeacantha*). No trees were documented within the action area.

3.3.2. Impacts from the Proposed Action

Direct and Indirect Impacts

During the construction phase of the proposed project, all vegetation within the proposed project area would be cleared. The proposed action would result in the removal of approximately 5.09 acres of Sagebrush/Grass Community. The proposed well pad will be reclaimed to a BLM-approved working area. All new surface disturbances associated with the proposed pipeline corridor will be reclaimed during interim reclamation. The newly constructed resource road would be maintained in accordance with BLM standards.

During final reclamation, Logos would fully reclaim any portions of the proposed project area that would be disturbed to bare soil as a result of final abandonment earthwork activities (if such areas total greater than 0.1 acre).

During interim and final reclamation, the BLM Sagebrush/Grass Community Seed Mixture would be utilized; the species included in this mixture are included in the Surface Reclamation Plan (Appendix C). Reestablished vegetation would consist of native grass, forb, and shrub species included in the seed mixture, as well as native species that are not deliberately planted. It is also possible that invasive, nonnative species could become established within the proposed project area, as such species could be transported by project equipment and tend to thrive in disturbed areas. Following the reclamation process, the resulting vegetation communities could differ from the native plant communities surrounding the proposed project area. Within reclaimed areas, it is not expected that the vegetation communities would return to native conditions within 20 years (BLM 2003a, 4-18).

The deposition of fugitive dust generated during vegetation-clearing activities and during wind events could reduce photosynthesis and productivity of the surrounding vegetation (Thompson, et al. 1984; Hirano, et al. 1995), increase water loss in plants near the proposed project area (Eveling and Bataille 1984), and result in injury to leaves of surrounding vegetation.

Cumulative Impacts

The spatial analysis area is the proposed project area and immediately adjacent lands. Within the spatial analysis area, the following vegetative disturbances have occurred or are anticipated to occur in the reasonably foreseeable future:

- The Strawberry No. 1 well site operated by Dugan Production Corp. is located approximately 0.2 mile northeast of the proposed well pad area.
- Rio Arriba County Road 379 is located to the east of the analysis area and provides primary access to the area.
- Active wildlife and livestock grazing occurs in the area. The proposed project area is located within Rancho Largo Community grazing allotment No. 5119 managed by the BLM-FFO.

Indirectly, fugitive dust or deposition associated with existing roads, well pads, utility corridors, and public use in the immediate area could impact the vegetation within the analysis area, and could continue to do so throughout the life of the proposed project. Aside from those discussed above, no additional impacts to vegetation are expected within the analysis area for the reasonably foreseeable future.

The proposed project would contribute to direct and indirect vegetation disturbance and fugitive dust and/or deposition within the spatial analysis area.

3.4. Wildlife

3.4.1. Affected Environment

Migratory Birds

Executive Order 13186 dated January 17, 2001 calls for increased efforts to more fully implement the Migratory Bird treaty Act of 1918. In keeping with this mandate, the BLM/FFO has issued an interim policy to minimize unintentional take as defined by the EO 13186 and to better optimize migratory bird efforts related to BLM/FFO activities (BLM 2010). In keeping with this policy, a list of priority birds of conservation concern which occur in similar eco-regions as the proposed action area was compiled through a review of existing bird conservation plans including:

- Fish and Wildlife Service (USFWS) Birds of Conservation Concern (BCC)
- New Mexico Partners in Flight (NMPIF) New Mexico Bird Conservation Plan
- Comprehensive Wildlife Conservation Strategy for New Mexico (CWCS)
- Gray Vireo Recovery Plan

- The North American Waterbird Conservation Plan
- Recovery plans and conservation plans/strategies prepared for federally-listed candidate species.

The selected species have a known distribution in the BLM-FFO area and may be affected by various types of perturbations. These species and a brief assessment of their habitat are identified in Table 9. During the biological survey of the proposed project area, no priority birds of conservation concern were observed or heard.

Table 9. Priority Birds of Conservation Concern with Potential to Occur in the Project Area

Species Name	Habitat Associations	Potential to Occur in the Project Area
Black-throated sparrow (*Amphispiza bilineata*)	Xeric habitats dominated by open shrubs with areas of bare ground.	Suitable habitat documented within the action area for species to occur.
Brewer's sparrow (*Spizella breweri*)	Closely associated with sagebrush, preferring dense stands broken up with grassy areas.	Suitable habitat documented within the action area for species to occur.
Gray vireo (*Vireo vicinior*)	In northern NM, open stands of piñon pine and Utah juniper (5,800 – 7,200 ft) with a shrub component and mostly bare ground; antelope bitterbrush, mountain mahogany, Utah serviceberry and big sagebrush often present. Broad, flat or gently sloped canyons, in areas with rock outcroppings, or near ridge-tops.	Marginal habitat documented within the action area. Density of woodland may be a limiting factor.
Loggerhead shrike (*Lanius ludovicianus*)	Open country interspersed with improved pastures, grasslands, and hayfields. Nests in sagebrush areas, desert scrub, and woodland edges.	Suitable habitat documented within the action area for species to occur. Lack of improved pastures, grasslands, and hayfields likely limiting factors.
Mountain bluebird (*Sialia currucoides*)	Open piñon-juniper woodlands, mountain meadows, and sagebrush shrublands; requires larger trees and snags for cavity nesting.	Marginal habitat documented within the action area. Density of woodland limiting factor.
Mourning dove (*Zenaida macroura*)	Open country, scattered trees, and woodland edges. Feeds on ground in grasslands and agricultural fields. Roost in woodlands in the winter. Nests in trees or on ground.	Marginal habitat documented within the action area for species to occur. Distance to active agricultural areas and lack of significant woodland habitat likely limiting factors.
Sage sparrow (*Amphispiza belli*)	Large and contiguous areas of tall and dense sagebrush. Negatively associated with seral mosaics and patchy shrublands and abundance of greasewood.	Marginal habitat documented within action area for species to occur. Lack of dense sagebrush likely a limiting factor.
Sage thrasher (*Oreoscoptes montanus*)	Shrub-steppe dominated by big sagebrush.	Suitable habitat documented within the action area for species to occur.
Scaled quail (*Callipepla squamata*)	Brushy arroyos, cactus flats, sagebrush or mesquite plains, desert grasslands, Plains grasslands, and agricultural areas. Good breeding habitat has a diverse grass composition, with varied forbs and scattered shrubs.	Marginal habitat documented within the action area. Lack of grasslands likely a limiting factor.
Swainson's hawk (*Buteo swainsoni*)	A mixture of grassland, cropland, and shrub vegetation; nests on utility poles and in isolated trees in rangeland. Nest densities higher in agricultural areas.	Marginal habitat documented within the action area for species to occur. Lack of habitat diversity within action area likely a limiting factor.
Vesper sparrow (*Pooecetes gramineus*)	Dry montane meadows, grasslands, prairie, and sagebrush steppe with grass component; nests on ground at base of grass clumps.	Marginal habitat within the action area; lack of grassland areas and suitable nesting habitat likely a

		limiting factor.

General Wildlife

The sagebrush shrubland vegetation community found within the proposed project area provides habitat for a variety of vertebrate and invertebrate species. The objectives of the BLM wildlife management program are to “ensure optimum populations and a natural abundance and diversity of fish and wildlife values by restoring, maintaining, and enhancing habitat conditions for consumptive and non-consumptive uses” (BLM 2003a, 2-24).

Wildlife common to the sagebrush shrubland vegetation community includes mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), fox (*Vulpes* sp.), black-tailed jackrabbit (*Lepus californicus*), cottontail rabbit (*Sylvilagus* sp.), and various reptiles (snakes and lizards) and birds. Wildlife or signs observed in the analysis area included black-tailed jackrabbit, common raven (*Corvus corax*), coyote, horned lark (*Eremophila alpestris*), mountain cottontail (*Sylvilagus nuttallii*), and Western scrub-jay (*Aphelocoma californica*).

Prior to the biological survey of the proposed project area, no prairie dog colonies had been recorded within or adjacent to the proposed project area (BLM 2012b). No prairie dogs or their signs were observed during the biological survey of the proposed project area.

3.4.2. Impacts from the Proposed Action

Direct and Indirect Impacts

During the construction phase of the proposed project, all vegetation within the proposed project area would be cleared. The proposed project would result in the removal of approximately 5.09 acres of Sagebrush/Grass Community. The well pad would be reclaimed to a BLM-approved working area. All new surface disturbances associated with the proposed pipeline corridor would be reclaimed during interim reclamation. The proposed project area would be converted to a reseed community following interim reclamation. The impacts to the native vegetation community are described in Section 3.3 (Upland Vegetation).

There is available, similar habitat in the surrounding area that wildlife could utilize. However, the clearing of vegetation would remove potential habitat. The transformation of the proposed project area to a reseed community could remove potential habitat for numerous wildlife species. The proposed activities would result in new surface disturbances; therefore, habitat fragmentation would increase as a result of the proposed project.

If interim reclamation is successful, sagebrush shrubland vegetation community would become re-established within the proposed project area. However, as discussed in Section 3.3 (Upland Vegetation), the re-establishment of a mature, native plant community could require decades, and it is possible that the plant community could never fully recover from disturbance (BLM 2003a, 4-18).

Audial and visual disturbances associated with the proposed project could temporarily deter wildlife (including migratory birds) from utilizing the proposed project area and immediately adjacent lands.

Migratory Birds

Due to the mobility of adult birds, they would be unlikely to be directly harmed by the proposed project. As discussed in Section 2.1.2 (Description of Proposed Project - Protection of Flora and Fauna, Including SSS and Livestock), if the vegetation-clearing phase of construction is scheduled to occur during migratory bird breeding season, a pre-construction migratory bird nest survey would be conducted within

the proposed project area. Therefore, it is unlikely that nests, eggs, or young birds within the proposed project area would be directly harmed. If proposed project activities occur during migratory bird breeding season, birds nesting outside of but near the proposed project area could abandon existing nests as a result of visual and audial disturbances.

General Wildlife

It is possible that burrowing animals could be killed or injured during the construction phase of the proposed project, as equipment digs into the earth and rolls over the surface of the ground.

During the construction phase of the proposed project, terrestrial wildlife could fall into an open pipeline trench and be injured, stressed, or killed. The presence of an open trench could also disrupt normal wildlife movements to and from water and/or food sources. Wildlife could have to skirt the open-trench portions of the proposed pipeline corridor to access water and/or food; this disruption could stress wildlife and result in the loss of valuable energy resources. As discussed in Section 2.1.2 (Description of Proposed Project – Protection of Flora and Fauna, Including SSS and Livestock), design features and BMPs would be implemented during the construction phase of the proposed project to assist in the prevention of injury, stress, or death of wildlife.

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, including migratory birds, through direct and effective habitat loss. The proposed action would contribute to the direct loss of approximately 5.09 acres of wildlife habitat. The intensity of indirect effects would be dependent upon the species, its life history, time of year and/or day and the type and level of human and vehicular activity occurring.

3.5. Special Status Species

3.5.1. Affected Environment

The BLM manages certain species which are not federally listed as threatened or endangered in order to prevent or reduce the need to list them as threatened or endangered in the future. BLM SSS include BLM Sensitive Species and BLM-FFO Special Management Species (SMS).

New Mexico BLM State Directors have developed a list of BLM Sensitive Species for the State of New Mexico (BLM 2011a, BLM 2011b, BLM 2011c, BLM 2012a). In accordance with BLM Manual 6840, the BLM-FFO has prepared a list of BLM-FFO SMS to focus species management efforts toward maintaining habitats under a multiple-use mandate (BLM 2008a, BLM 2008c). BLM-FFO SMS include some BLM Sensitive Species and other species for which the BLM-FFO has determined special management is appropriate (BLM 2008c). The authority for this policy and guidance is established by the ESA; Title II of the Sikes Act, as amended (16 USC 670a-670o, 74 Stat. 1052); FLPMA; and Department of Interior Manual 235.1.1A.

It was determined that the following SSS have the potential to occur or are known to occur within the proposed project area:

- **Bendire's thrasher**: Potential foraging and nesting habitat is available within the proposed project area. No sign of this species was recorded during the biological survey.

- **Ferruginous hawk**: Potential foraging habitat is available within the proposed project area; however, no suitable nesting habitat is present within or adjacent to the proposed project area. No sign of this species was recorded during the biological survey.

- **Golden eagle**: Potential foraging habitat is available within the proposed project area; however, no suitable nesting habitat is present within or adjacent to the proposed project area. No sign of this species was recorded during the biological survey.

- **Prairie falcon**: Potential foraging habitat is available within the proposed project area; however, no suitable nesting habitat is present within or adjacent to the proposed project area. No sign of this species was recorded during the biological survey.

3.5.2. Impacts from the Proposed Action

Direct and Indirect Impacts

There is similar habitat available in the surrounding area that BLM SSS birds could utilize for foraging. However, the proposed project would result in the removal of approximately 5.09 acres of Sagebrush/Grass Community habitat. The proposed well pad would be reclaimed to a BLM-approved working area. All new surface disturbances associated with the proposed pipeline corridor would be reclaimed during interim reclamation. The proposed project area would be converted to a reseed community following interim reclamation. The impacts to sagebrush shrubland vegetation community are described in Section 3.3 (Upland Vegetation). Habitat loss likely reduces the carrying capacity for wildlife, although the exact level of reduction cannot be quantified (BLM 2003a, 4-26 – 4-27). The proposed activities would contribute to habitat fragmentation.

If interim reclamation is successful, Sagebrush/Grass Community would become re-established within the proposed project area. However, as discussed in Section 3.3 (Upland Vegetation), the re-establishment of mature, native plant communities could require decades, and it is possible that plant communities could never fully recover from disturbance (BLM 2003a, 4-18).

Bendire's Thrasher

Due to the mobility of adult birds, it is unlikely that adult birds would be directly impacted by the proposed project.

As discussed in Section 2.1.2 (Description of Proposed Project – Protection of Flora and Fauna, Including SSS and Livestock), if construction activities would occur during the migratory bird breeding season, a pre-construction migratory bird nest survey would be conducted within the associated proposed project area. Therefore, it is unlikely that nests, eggs, or young birds would be directly harmed.

Audial and visual disturbances associated with the proposed project could temporarily deter this species from utilizing the proposed project area and immediately adjacent lands.

Ferruginous Hawk, Golden Eagle, and Prairie Falcon

No nesting habitat for BLM SSS raptor species is available within or adjacent to the proposed project area. Previously recorded golden eagle nest sites are situated within Escrito Canyon, approximately 2.9 miles northeast of the analysis area and 5 miles northeast near the confluence with Cañon Largo. The three raptor species could potentially utilize the proposed project area for foraging. Due to the mobility of adult birds, it is unlikely that these raptors would be directly harmed by activities associated with the proposed project.

Audial and visual disturbances associated with the proposed project could temporarily deter these species from utilizing the proposed project area and immediately adjacent lands.

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 ESA of 1973, as amended (USDI/BLM 2003a, 4-111). For reasonably foreseeable actions on federal lands, direct impacts to SSS would be avoided through the BLM's siting criteria. Development on federal and private land would result in the removal or modification of potential SSS habitat. These effects would be related to availability of undisturbed habitat in the area and the amount of disturbance that would occur within the area. The PRMP/FEIS determined that cumulatively up to 5.5 percent (128,000 acres) of vegetation in the planning area could be impacted by oil and gas development (USDI/BLM 2003a, page 4-125). Other reasonably foreseeable actions within the planning area that could impact SSS would include livestock grazing, agriculture, commercial and residential development, mining, wildfire, and vegetation management.

3.6. Water Resources

3.6.1. Affected Environment

Groundwater

The planning area is underlain by sandstone aquifers and unconsolidated sand and gravel aquifers. The Colorado Plateaus Aquifers are sandstone while the Rio Grande Aquifer system is unconsolidated sand and gravel. The primary Colorado Plateaus Aquifers that underlie the planning area are the Unita-Animas Aquifer, which underlies the vast majority of the San Juan Basin, and the Mesaverde aquifer (USGS 2001a).

The Unita-Animas aquifer is composed primarily of Lower Tertiary rocks in the San Juan Basin. It consists of the San Jose Formation, the underlying Animas Formation and its lateral equivalent, the Nacimiento Formation, and the Ojo Alamo Sandstone. The San Jose Formation is the uppermost significant bedrock formation in the San Juan Basin and primarily consists of permeable, coarse, arkosic sandstone interlayered with mudstone. The Animas and Nacimiento Formations and the Ojo Alamo Sandstone consist primarily of permeable conglomerate and medium to very coarse sandstone interlayered with relatively impermeable shale and mudstone. The thickness of the Unita-Animas aquifer generally increases toward the central part of each basin. In the northeastern part of the San Juan Basin, the maximum thickness of the aquifer is about 3,500 feet (USGS 2001a).

Water used to construct, produce, and maintain the proposed well would be acquired from the Blanco Trading Post Water Well (NMOSE POD No. SJ-2105) and the Hilltop Water Hole (POD SJ-00077).

Surface Water

As discussed in Section 1.5.1 (Clean Water Act), the BLM-FFO and USACE Durango Regulatory Office have determined that USACE-jurisdictional waters may include USGS watercourses. Logos would obtain all necessary permits prior to construction activities taking place.

3.6.2. Impacts from the Proposed Action

Direct and Indirect Impacts

Groundwater

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 well is well below any underground sources of drinking water. The Mancos Shale Formation is 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 Group Formations and provides an impermeable layer that isolates the Mancos Shale and Mesaverde Group Formations from both identified sources of drinking water and surface water. Fracturing could possibly extend into the Mancos Shale Formation; however, the Mancos Shale 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 the proposed well.

Surface Water

The proposed access road/pipeline corridor crosses one intermittent/ephemeral watercourses represented by dashed blue lines on the USGS Counselor, NM 7.5-minute topographic quadrangle. The proposed activities would be authorized under Nationwide Permit 12 (Utility Line Activities) and 14 (Linear Transportation Projects). The proposed activities would not result in the loss of greater than ½ acre of waters of the U.S., and would not alter the course or impede the flow of a USGS watercourse. Water management and erosion control design features are discussed in Section 2.1.2 (Description of Proposed Project).

Cumulative Impacts

The primary cumulative impacts on water quality would result from an increase in the amount of surface disturbance due to increased oil and gas development activity and other earthmoving activities in the Largo sub-watershed of the planning area. The proposed surface disturbances and increased sediment yields, along with an increase in roads that would direct sedimentation to stream crossings, would occur mainly in the high development area. Other vegetation damaging practices, such as OHV use cross-country and in drainage ways, livestock grazing, and vegetation management on non-public lands, could contribute to increased sedimentation.

As population increases in the planning area, domestic water consumption would also increase, but no data are available to quantify the amount.

4. SUPPORTING INFORMATION

4.1. Tribes, Individuals, Organizations, or Agencies Consulted

- Austin Akers, Logos
- David Gonzales, Logos
- Jay Paul McWilliams, Logos
- Tamra Sessions, Logos
- United Field Services
- Western Cultural Resource Management, Inc.

4.2. List of Preparers

- Jim Copeland, Archaeologist – BLM-FFO
- Mike Flaniken, Environmental Protection Specialist – BLM-FFO
- Sarah McCloskey, Biological Consultant – Adkins Consulting, Inc.
- John Hanson, Wildlife Biologist – BLM-FFO
- John Kendall, Wildlife Management Biologist – BLM-FFO
- Amanda Nisula, Planning and Environmental Specialist – BLM-FFO
- Sarah Scott, Natural Resource Specialist – BLM-FFO
- Sheila Williams, District Botanist – BLM-FFO
- Dale Wirth, Branch Chief – BLM-FFO
- Lori Gregory, Biological Consultant – Adkins Consulting, Inc.
- Matthew Zabka, Environmental Specialist – Adkins Consulting, Inc.

- Scott Hall, Realty Specialist, BLM-FFO

4.3. References

Brooks, M.L. and D. Pyke. 2001. Invasive Plants and Fire in the Deserts of North America. In Proceedings of the Invasive Species Workshop: The Role of Fire in the Control and Spread of Invasive Species. Fire Conference 2000: The First National Congress on Fire, Ecology, Prevention and Management, ed. K. Galley and T. Wilson, 1-14. Miscellaneous Publications No. 11. Tallahassee, Florida: Tall Timbers Research Station.

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

Climate Change SIR. 2010. *Climate Change Supplementary Information Report for Montana, North Dakota, and South Dakota, Bureau of Land Management*. Report on Greenhouse Gas Emissions and Climate Change for Montana, North Dakota, and South Dakota. Technical report prepared for the Montana/Dakotas Bureau of Land Management by URS Corporation. URS Project 22241790.

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

EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007. Environmental Protection Agency, Washington, D.C. April 2009.

Eveling, D.W., and A. Bataille. 1984. The effect of deposits of small particles on the resistance of leaves and petals to water loss. Environmental Pollution. 36:229-238.

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

Griffith, G.E., J.M. Omernik, M.M. McGraw, G.Z Jacobi, C.M. Canavan, T.S. Schrader, D. Mercer, R. Hill, and B.C. Moran. 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs). Reston, Virginia: U.S. Geological Survey (map scale 1:1,400,000).

Hirano, T., M. Kiyota, and I. Aiga. 1995. Physical effects of dust on the leaf physiology of Cucumber and Kidney bean plant. Environmental Pollution 89(3):225-261.

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

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

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

Morgan, Sarah M. 2014. *Cultural Resource Inventory of LOGOS Operating Proposed Dilectione Mea 003H and 004H Well Pad, Access Road, and Pipeline, Rio Arriba County, New Mexico.* Western Cultural Resource Management, Inc. (WCRM). Report No. WCRM(F)1306. Farmington, New Mexico.

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

Natural Gas Supply Association. 2010. NaturalGas.org – Uses of Natural Gas. Available at: http://www.naturalgas.org/overview/uses.asp.

Natural Resources Conservation Service (NRCS). 2010. Federal Noxious Weeds. http://plants.usda.gov/java/noxious?rptType=Federal.

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

NMED. 2012. *Northwest New Mexico Monitoring Network Presentation to BLM*. June 26, 2012. Presented by Mark Jones New Mexico Environment Department.

New Mexico Natural Heritage Program. 2005. Available at: http://nmnhp.unm.edu.

New Mexico Office of the State Engineer. 2014. New Mexico Water Rights Reporting System. Online Water Column Report. (Available at: http://nmwrrs.ose.state.nm.us/nmwrrs/waterColumn.html).

New Mexico Rare Plant Technical Council. 1999. *New Mexico Rare Plants*. Albuquerque, NM: New Mexico Rare Plants Home Page. (Available at: http://nmrareplants.unm.edu Latest update: 18 January 2006).

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

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

Thompson, J. R., P.W. Mueller, W. Fluckiger, A.J. and Rutter. 1984. The effects of dust on photosynthesis and its significance for roadside plants. Environmental Pollution 34(2):171-190.

U.S. Department of the Interior (USDI) and U.S. Department of Agriculture (USDA). 2007. *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development*. BLM/WO/ST-06/021+3071/REV 07. Bureau of Land Management. Denver, Colorado.

USDA, Natural Resources Conservation Service (NRCS). 2006. Web Soil Survey. Version 1.1. NRCS. http://websoilsurvey.nrcs.usda.gov/app.

USDI, Bureau of Land Management (BLM). 2003a. *Farmington Proposed Resource Management Plan and Final Environmental Impact Statement*. Farmington, New Mexico.

USDI, BLM. 2003b. *Farmington Resource Management Plan with Record of Decision*. Farmington, New Mexico.

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

USDI, BLM and USDA Forest Service, San Juan Public Lands Center (SJPLC). 2006. *Final Environmental Impact Statement, Northern San Juan Basin Coal Bed Methane Project*. Durango, Colorado.

USDI, BLM, Farmington Field Office. 2010. *Migratory Bird Treaty Act - BLM/FFO Interim Management Policy*. Instruction Memorandum No. NM-F00-2010-001.

USDI, BLM. 2011a. BLM New Mexico Sensitive Birds List. Revised August 2011.

USDI, BLM. 2011b. BLM New Mexico Sensitive Mammals List. Revised July 2011.

USDI, BLM. 2011c. BLM New Mexico Sensitive Molluscs, Crustaceans, and Arthropods List. Revised August 2011.

USDI, BLM. 2012a. BLM New Mexico Sensitive Plants List. January.

USDI, BLM. 2012b. prairie_dog_colonies.shp (Shapefile of recorded prairie dog colonies within the general BLM-FFO region). Provided by BLM-FFO 2012.

USDI, BLM. 2013a. aztec_gilia_habitat (Shapefile of the new Aztec gilia and Brack's fishhook cactus Potential habitat "zone"). Provided by the BLM-FFO September 26, 2013.

U.S. Department of Interior Bureau of Land Management. 2014. *Air Resources Technical Report for Oil and Gas Development.* Santa Fe: U.S. Department of Interior Bureau of Land Management.

USDI, BLM, and U.S. Department of Energy (DOE). 2010. Draft Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States. Chapter 5 (Impacts and Mitigation).

U.S. Energy Information Administration. 2012. Energy in Brief. Available at: http://www.eia.gov/energy_in_brief/major_energy_sources_and_users.cfm.

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

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

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

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

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

U.S. Fish and Wildlife Service (USFWS). 2014. Endangered Species Program, ESA Species List for San Juan County, NM. Information, Protection, and Conservation (iPaC). Available at: http://ecos.fws.gov/ipac/. Accessed February 2014.

U.S. Geological Survey (USGS). 1979. Notice to Lessees and Operators of Onshore Federal and Indian Oil and Gas Leases (NTL-3A). Reporting of Undesirable Events.

USGS. 2001a. “Groundwater Atlas of the United States—Arizona, Colorado, New Mexico, Utah: HA 730-C. Colorado Plateau Aquifer.” http://sr6capp.er.usgs.gov/gwa/ch_c/C-text8.html.

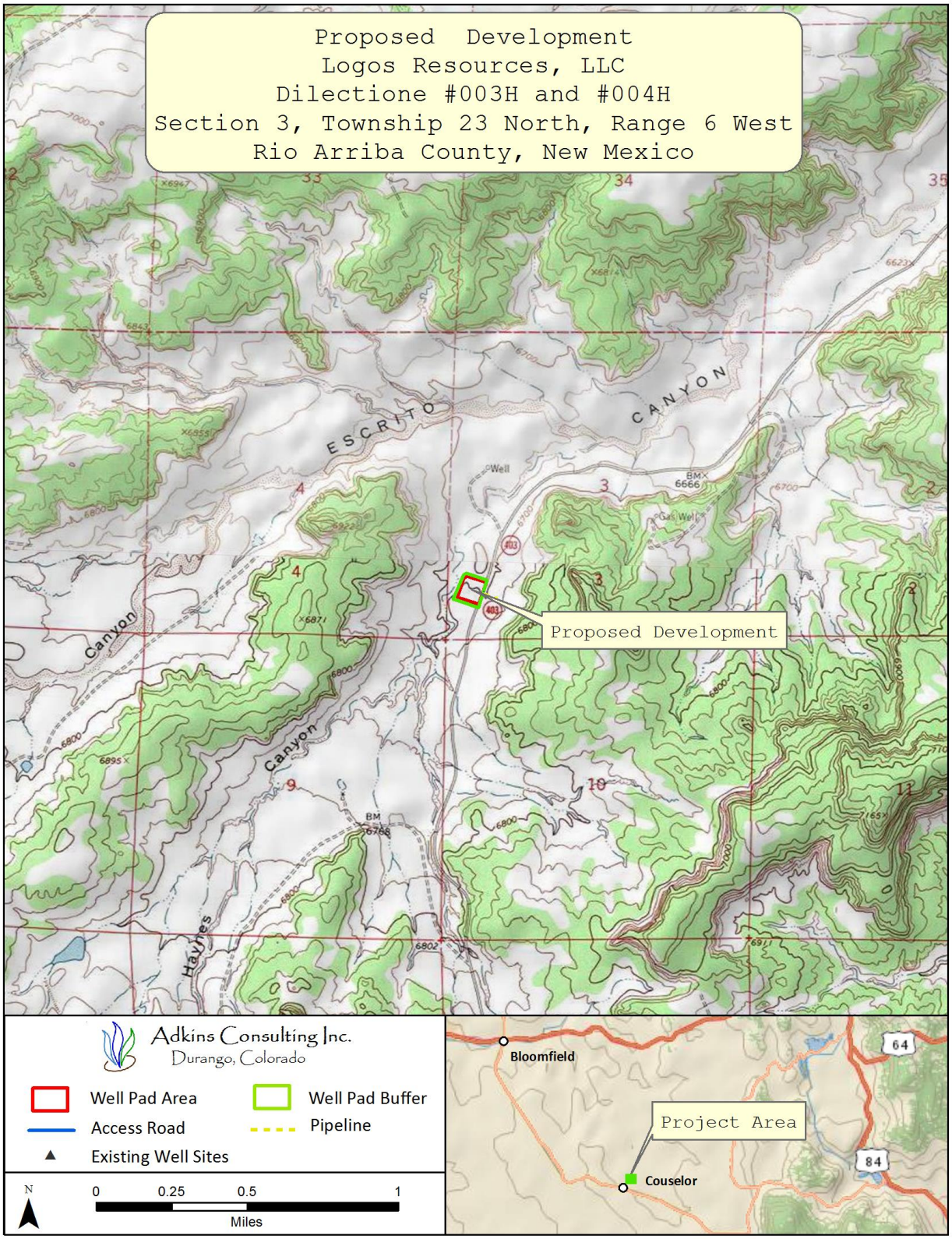
Valkenburgh, Richard F. Van. 1941. *Diné Bikeyah*. Department of the Interior, Office of Indian Affairs, Navajo Services, Window Rock. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

Van Valkenburgh, Richard F. 1974. *Navajo Sacred Places*. Edited by Clyde Kluckhohn. Garland Publishing. New York.

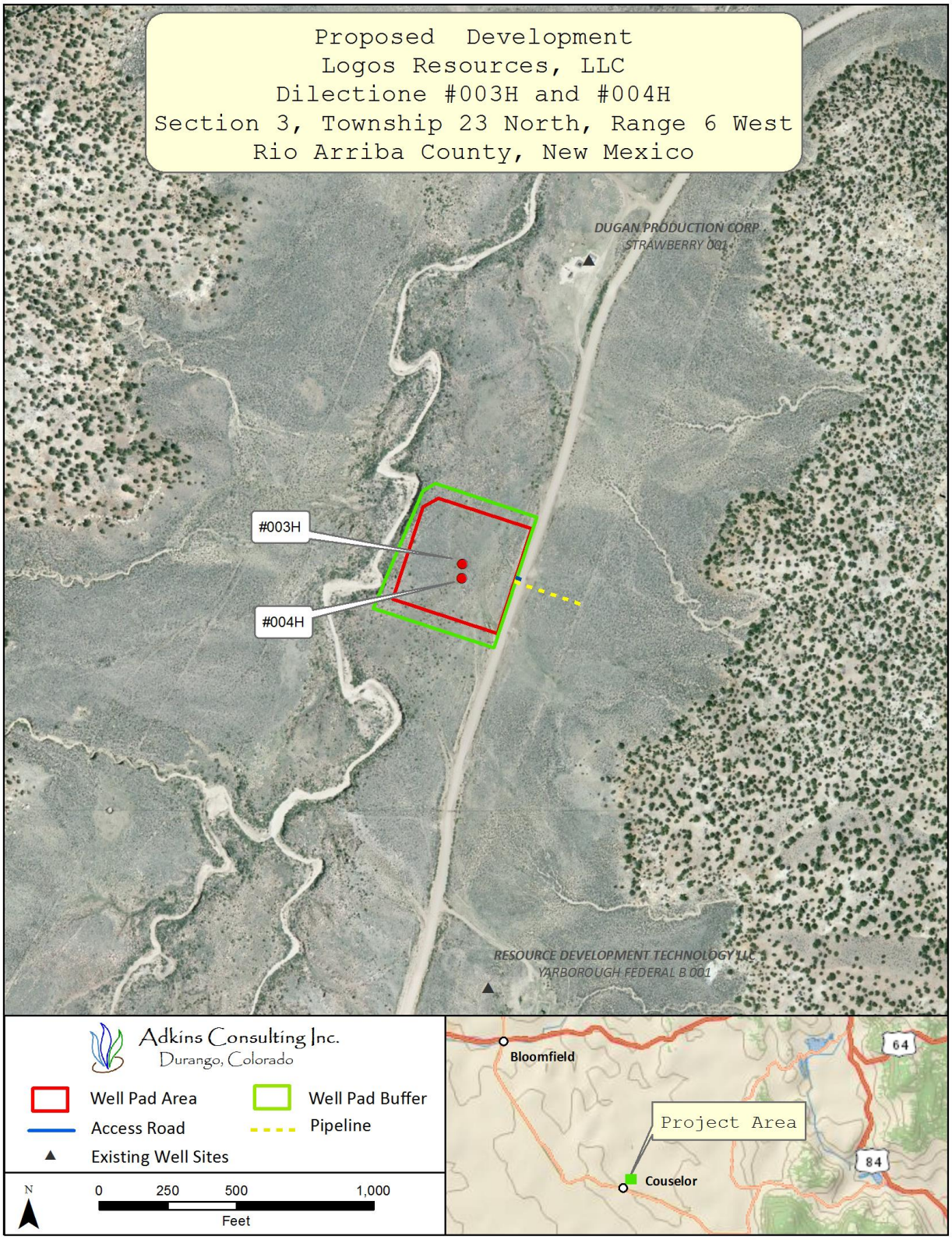
Whitson, Tom D., Larry C. Burrill, Steven A. Dewey, David W. Cudney, B.E. Nelson, Richard D. Lee, and Robert Parker. 1992. Weeds of the West, Revised. Edited by Tom D. Whitson. The Western Society of Weed Science in Cooperation with the Western United States Land Grant Universities Cooperative Extension Services.

APPENDIX A. MAPS

A.1. Project Area Map (Topographic)



A.2. Proposed Development Map



APPENDIX B. PLATS

APPENDIX C. SURFACE RECLAMATION PLAN