Middle Mesa Plan of Development

Environmental Assessment

Bureau of Land Management
Farmington Field Office

Farmington, New Mexico

Prepared By:

Ecosphere
Environmental Services
4801 N. Butler, Suite 15101
Farmington, NM 87401

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ACRONYMS

AADT	Average Annual Daily Traffic
ACEC	Area of Critical Environmental Concern
AIRFA	American Indian Religious Freedom Act of 1978
APD	Application for Permit to Drill
ARPA	Archaeological Resources Protection Act
AUM	animal unit month
bbl	barrel
bcf	billion cubic feet
BLM	Bureau of Land Management
BMP	best management practices
BSR	Biological Survey Report
CAA	Clean Air Act
CDOW	Colorado Division of Wildlife
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH4	methane
CO	carbon monoxide
CO_{2eq}	carbon dioxide equivalent
COA	Condition of Approval
CWA	Clean Water Act
dBA	decibels A weighted
EA	Environmental Assessment
Ecosphere	Ecosphere Environmental Services
EDP	exploration, development, and production
EIS	Environmental Impact Statement
EPCA	Energy Policy and Conservation Action
ESA	Endangered Species Act
FEL	from the east line
FEL	from the east line
FFO	Farmington Field Office
FNL	from the north line
FONSI	Finding of No Significant Impact
FSL	from the south line
FWL	from the west line
FWL	from the west line
GAO	U.S. Government Accountability Office
GHG	greenhouse gas
GIS	Geographic Information System
GMU	Game Management Unit
GPS	Global Positioning System

IM	Instruction Memorandum
IPCC	Intergovernmental Panel on Climate Change
kV	Kilovolt
LAC	La Plata Archaeological Consultants
$\mu g/m^3$	micrograms per cubic meter
MBTA	Migratory Bird Treaty Act
Mcf	thousand cubic feet
mg/m^3	milligrams per cubic meter
mtons	metric tons
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NDIS	Natural Diversity Information Source
NEPA	National Environmental Policy Act
NMAC	New Mexico Administrative Code
NMAQB	New Mexico Air Quality Bureau
NMED	New Mexico Environment Department
NMGFD	New Mexico Game and Fish Department
NMOCD	New Mexico Oil Conservation Division
NMPIF	New Mexico Partners in Flight
NMSA	New Mexico Statutes Annotated
NO_2	Nitrogen dioxide
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System.
NSA	Noise Sensitive Areas
NTL	Notice to Lessee
O_3	Ozone
OSHA	Occupational Safety and Health Act of 1970
OTAQ	Office of Transportation and Air Quality
Pb	Lead
PL	Public Law
PM	Particulate matter
PM_{10}	Particulate matter with an aerodynamic diameter equal to or less than 10 microns
$PM_{2.5}$	Particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
POD	Plan of Development
ppb	parts per billion
ppm	parts per million
PRMP/FEIS	Proposed Resource Management Plan/Final Environmental Impact Statement
RCRA	Resource Conservation and Recovery Act
RFDS	Reasonably Foreseeable Development Scenario
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-way

SARA	Superfund Amendments and Reauthorization Act
SDA	Specially Designated Area
SO_2	Sulfur dioxide
std	ozone standard
STL	seasonal timing limitation
SUIT	Southern Ute Indian Tribe
SWPPP	Stormwater Pollution Prevention Plan
TCP	Traditional Cultural Properties
Tg	million metric tons
USBR	U.S. Bureau of Reclamation
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VRI	Visual Resource Inventory
VRM	Visual Resource Management
Williams	Williams Production Company, LLC

1. INTRODUCTION

The Bureau of Land Management (BLM) Farmington Field Office (FFO) has received a proposal from Williams Production Company, LLC (Williams) for the Middle Mesa portion of the Rosa Unit. Williams has evaluated several future development scenarios of its Rosa Unit in San Juan and Rio Arriba counties. Williams' proposed Rosa Unit Middle Mesa Plan of Development (POD) would utilize horizontal drilling to maximize natural gas extraction from the Basin Mancos pool with less surface disturbance and greater recovery of resources than vertical drilling. To implement the Middle Mesa POD as proposed, a modification to the seasonal closure Condition of Approval (COA) for the Middle Mesa portion of the Williams Rosa Unit would be needed for an approximate 5-year period.

The 2003 Farmington Proposed Resource Management Plan/Final Environmental Impact Statement (PRMP/FEIS; USDI/BLM 2003*a*) established the COA for the Middle Mesa Wildlife Area Specially Designated Area (SDA), which imposes seasonal timing limitation (STL) on construction and drilling from December 1 to March 31 of each year. Williams' oil and natural gas leases covering the Rosa Unit portion of the Middle Mesa Wildlife Area SDA were issued in 1948. The STL is not a lease stipulation as it was developed after Williams' leases were granted.

Williams is proposing the phased development of eight well pads, which would be twinned or co-located with existing vertical well locations, and two stimulation (hydraulic fracturing or fracking) pads within the Middle Mesa Wildlife Area SDA. Horizontal drilling from the eight proposed well pads would result in full development of the Basin Mancos pool in the Middle Mesa portion of the Rosa Unit. Under the proposed POD, Williams would drill with one rig from one well pad at a time during the winter closure period within the SDA. If needed, only one rig move would be made between December 1 and March 31, and would not exceed 1.5 miles. A rig move would happen no more than once per year.

This Environmental Assessment (EA) addresses site-specific resources and/or impacts that are not covered within the PRMP/FEIS as required by the National Environmental Policy Act of 1969 (NEPA), as amended (Public Law [PL] 91-90, 42 United States Code [USC] 4321 et seq.). This EA also addresses the criteria outlined in the U.S. Department of Interior (USDI) Bureau of Land Management (BLM) Instruction Memorandum (IM) 2008-032, Exceptions, Waivers, and Modifications of Fluid Minerals Stipulations and Conditions of Approval, and Associated Rights-of-way Terms and Conditions (USDI/BLM 2007). This EA has been prepared in compliance with all applicable regulations and laws passed subsequent to NEPA, including Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500-1508); USDI requirements (Department Manual 516, Environmental Quality [USDI 2004]); and BLM guidelines in Handbook H-1790-1 (USDI/BLM 2008*b*).

1.1 Background

Williams holds five leases within the Middle Mesa Rosa Unit, which were unitized in 1948. The New Mexico Statutory Unitization Act of 1978 (70-7-1 to 70-7-21) allows for unitized management, operation, and further development of oil and gas properties to achieve greater ultimate hydrocarbon reserve recovery, prevent waste, and protect the rights of all mineral interest owners in each unitized area. The intent of the Act is to substantially increase the recovery of oil and gas above the amount that would be recovered by primary recovery alone.

The Middle Mesa Portion of the Williams Rosa Unit comprises approximately 5,700 acres, of which approximately 4,800 acres are public lands. The Middle Mesa Wildlife Area SDA encompasses a total of 46,052 acres, of which 31,390 acres are public land and 40,317 acres are federal mineral acres. Drilling and development in the Middle Mesa Wildlife Area SDA has been ongoing since the leases were issued. Currently, there are more than 825 wells and 193.6 miles of road within the Middle Mesa Wildlife Area SDA based on BLM/FFO data as of May 1, 2011. Williams' Middle Mesa portion of the Rosa Unit covers approximately 12 percent of the total SDA. Approximately 18.5 miles of roads and 53 well pads containing 98 natural gas wells are located within the Middle Mesa portion of the Rosa Unit.

The PRMP/FEIS evaluated impacts to wildlife within the nine designated Wildlife Area SDAs. Of the 397,000 acres in these SDAs, the analysis estimated a long-term habitat loss of 8,600 acres due to new disturbance. When added to the amount lost to existing development, the total long-term habitat loss was projected to be at least 27,000 acres (USDI/BLM 2003, page 4-112). The ROD approving the final plan acknowledged these, and future projected impacts, and considered them acceptable when balanced against the nation's need for domestic energy sources (USDI/BLM 2003*a*, 2003*b*, page 12).

Access to oil and gas reserves in a particular formation is regulated by regulated by spacing rules established by the New Mexico Oil Conservation Division (NMOCD). On Federal lands, the BLM generally abides by NMOCD rules, but has the authority to establish its own spacing and well density rules. Well spacing units and the option to perform infill drilling affect the mineral resources volume extracted.

Williams applied to the NMOCD for an exception to the gas well density rules within the Rosa Unit for wells producing from the Blanco-Mesaverde Prorated Gas Pool (Case Number 14586). In April 2011, the NMOCD issued Order No. R-13123-A approving 40-acre spacing for the Blanco-Mesaverde formation within the Williams Rosa Unit.

Currently, Basin Mancos gas pool has a standard spacing unit of 320 acres with up to 4 wells per spacing unit (80-acre density) (Orders R-12984 and R-13068). Williams has submitted applications to the NMOCD to allow up to eight Mancos wells per 320-acre spacing unit (40-acre density) in the Rosa Unit, San Juan and Rio Arriba counties (Case Number 15663). To date, no reservoir drainage areas in excess of 10-acres have been observed by Williams in Rosa Unit vertical Basin Mancos wells.

Williams has applied to the NMOCD for a designation of a horizontal project area, which includes the initial participating area expansion acreage, and the uncommitted acreage contained in Sections 33 and 34 of Township 32 North, Range 6 West and Sections 3 and 4 in Township 31 North, Range 6 West (Case Number 14667).

1.2 Purpose and Need for Action

The BLM has received a proposal from Williams for implementation of the Middle Mesa POD to develop the federally administered mineral estate. Implementing the POD, as proposed, would require a modification to the seasonal timing limitation COA for the Middle Mesa Wildlife Area SDA.

The need for the action is to meet the BLM's obligation to allow economic extraction, in an efficient and environmentally compatible manner, the recoverable oil and natural gas reserves known to exist in the

valid mineral leases issued to Williams, as administered by the BLM. The BLM's policy is to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs. The Mineral Leasing Act of 1920, as amended (30 USC 181 et seq.), authorizes the BLM to issue oil and gas leases for the exploration of mineral resources and permits the development of those leases. The need for the action is established by the BLM's authority under the Mineral Leasing Act, the Mining and Minerals Policy Act of 1970 (30 USC 21 et seq.), the Federal Land Policy and Management Act of 1976 (43 USC 1701 et seq.), the National Materials and Minerals Policy, Research, and Development Act of 1980 (30 USC 1601 et seq.), and the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (30 USC 181 et seq.). The existing lease is a binding legal contract that allows development of the mineral estate by Williams.

The objectives of the proposed Middle Mesa Rosa Unit POD are to balance development of the minerals and protection of other resources in a manner consistent with the lease rights granted. The proposed action is designed to develop the resources in an economical manner while optimizing resource extraction, protecting wildlife values, consolidating disturbance, and reducing surface impacts. To achieve these objectives, Williams proposes year-round drilling applying horizontal drilling techniques using a purpose-built drilling rig, drilling multiple wells from one location, and reducing traffic volumes. The COA for the SDA imposes a seasonal restriction on drilling from December 1 to March 31 each year (USDI/BLM 2003*b*, page C-169). BLM's authorization of the requested modification would allow Williams to drill with one rig from one well pad at a time during the SDA winter closure period for a period of approximately 5 years until all proposed wells are completed.

1.3 Conformance with Applicable Land Use Plans and Other Environmental Assessments

Pursuant to 40 CFR 1508.28 and 1502.21, this EA tiers into and incorporates by reference the information and analysis contained in the PRMP/FEIS (USDI/BLM 2003*a*), which was approved as the Final RMP for the BLM/FFO by the Record of Decision (ROD) signed September 29, 2003 (USDI/BLM 2003*b*). The PRMP/FEIS and ROD are available for review at the FFO, New Mexico, or electronically at http://www.nm.blm.gov/ffo/ffo_home.html. The assessment also tiers to and incorporates by reference the information and analysis in the *Environmental Assessment of the Criteria and Impacts of Granting Exceptions to the Seasonal Closure Periods in Designated Wildlife Areas* (USDI/BLM 2008*a*).

Implementation of the exception criteria and the policy to allow industry to request a modification to seasonal wildlife closures was identified in the Final RMP and ROD (USDI/BLM 2003*b*, page 5). Exception criteria, as allowed under the RMP and ROD, were developed by the BLM in October 2003. On May 9, 2008, WildEarth Guardians filed a lawsuit against the BLM/FFO challenging the agency's practices on granting exceptions to seasonal wildlife closures in SDAs. The issues raised in the litigation were related to compliance with the NEPA and the RMP, as the criteria for granting exceptions were developed without NEPA compliance and as the BLM's approvals of exceptions were not evaluated in site-specific EAs in compliance with NEPA.

In settlement of the suit, the BLM/FFO reviewed the exception criteria used at that time and reconsidered its exception approval practices, consistent with 43 CFR 1610.5-4. The review and modified criteria were

analyzed in the *Environmental Assessment of the Criteria and Impacts of Granting Exceptions to the Seasonal Closure Periods in Designated Wildlife Areas* (USDI/BLM 2008*a*).

The BLM 2008 exception EA and Finding of No Significant Impact (FONSI) classified the Middle Mesa Wildlife Area SDA as a moderate priority SDA allowing for exceptions to the winter closure COA for short-term activities or waivers for long-term activities such as drilling (USDI/BLM 2008*a*, page 43).

BLM national level guidance for exceptions and waivers is included in the Washington Office IM 2008-032 (USDI/BLM 2007): Exceptions, Waivers, and Modifications of Fluid Minerals Stipulations and Conditions of Approval and Associated Rights-of-way Terms and Conditions. This guidance provides instructions to field offices on procedures to evaluate requests to modify COAs and establishes guidelines for review and documentation. Attachment 1 of IM 2008-032 also provides guidelines for identifying when impacts of granting an exception, waiver, or modification may be considered acceptable.

The proposal is recognized as an appropriate use of public lands in the FFO planning area Resource Management Plan (RMP) (USDI/BLM 2003*a*). The RMP adheres to the federal mandates contained in the Energy Policy and Conservation Action (EPCA) (42 USC 6217) and Executive Order 13212, which direct federal land managing agencies to expedite the production of the federal mineral estate for the development of reliable domestic sources of energy (USDI/BLM 2003*b,* pages 1 and 11).

1.4 Decision Framework

The Reasonably Foreseeable Development Scenario (RFDS), developed for the 2003 PRMP, anticipated that spacing and/or density rules would be altered over the 20-year period of analysis to maximize extraction of oil and gas resources. For example, it was expected that the Fruitland coal spacing would be decreased to 160 acres and the Dakota Formation decreased to 80 acres (USDI/BLM 2003*a*, page 4-9). The RFDS acknowledged that uncertainty is inherent in estimating well development primarily due to infill development, commingling, or dual completions with another producing horizons and technological advancements. The RFDS predicted 300 wells drilled to the Mancos Shale and Gallup reservoirs over 20 years. The RFDS also noted that there was excellent potential for the Mancos Shale to be further evaluated as it may have significant potential as a shale gas candidate. The RFDS identified two possibilities for substantial future gas production from the Mancos Shale gas reservoir: as discreet zones of better matrix permeability or fracture density; or as a blanket, continuous-type of reservoir common to other U.S. shale gas plays like the Barnett and Ohio shales (Engler et al. 2001).

The purpose of the RFDS was to develop an estimation of the reasonable foreseeable development to support the BLM's RMP analysis. Predicted development of major producing reservoirs and minor, emerging or potential reservoirs was based on historic production data, and the geological and engineering evidence available at that time. The RFDS acknowledged that technological advances in drilling and stimulation techniques could revolutionize the development of the basin in a 20-year time frame (Engler et al. 2001). The RFDS did not identify exact locations but predicted the number of locations on a township-range basis. Based on the assumptions in the RFDS, the PRMP/FEIS estimated long-term disturbance resulting from oil and gas development to compare broad-scale impacts between alternatives. According to the PRMP/FEIS, the actual number and locations of wells to be drilled would be subject to economic and technological considerations (USDI/BLM 2003*a*). The 2003 ROD approved as the final RMP an alternative that designated 2,597,193 acres of BLM-managed land (including the area

of the proposed action alternative) as already leased and open to oil and gas development or available for future leasing (USDI/BLM 2003*a,* page 3). That alternative, as analyzed in PRMP/FEIS, addressed the cumulative development of 9,942 new oil and gas wells. The projected development was not apportioned to specific hydrocarbon reservoirs.

In the PRMP/FEIS it was estimated that the long-term surface disturbance associated with the 9,942 new oil and gas wells would be about 16,106 acres (assuming 2-acre average long-term disturbance for a new well pad, an average of 1-acre long-term disturbance for new roads/pipelines, 0.5 acre long-term disturbance for a twin/co-location, and based on 46 percent recompletions or directional drills). According to the ROD, development must be conducted in a manner that minimizes adverse impacts to other resources and other land uses, and complies with existing laws and regulations. Companies applying for permits to drill may be required to evaluate the use of new technology such as directional drilling from existing pads and other techniques in order to reduce surface disturbance with its subsequent impacts on soil, water, vegetation, and air resources (USDI/BLM 2003*a*, 2003*b*).

Currently, 3,722 wells have been spud in the FFO since implementation of the RMP and ROD. Of those wells, 1,452 have been twinned or co-located.

The Mancos Shale reservoir was analyzed in the RFD (2001) as an emerging gas play similar to the existing shale gas plays being developed at the time of the report. At the time of the RFD, onshore horizontal drilling technology was in its infancy. Since then, horizontal drilling technology has evolved considerably allowing economic gas resource recovery from low permeability reservoirs (shales) while minimizing the surface disturbance. Recent pilot exploratory horizontal wells in the Mancos Shale by both Williams and Black Hills have had encouraging results. As an emerging gas play forecasted in the RFD, Mancos Shale gas wells were combined with those of the Dakota Formation as a potential commingle candidate. The total number of Dakota-Mancos Gas wells predicted to be drilled on Federal lands was 4,108 or 41% of the total new wells forecast. The Williams' project in Middle Mesa proposes eight well pads with eight horizontal Mancos Shale wells each and up to five conventional wells per pad. The 65 horizontal Mancos wells are well within the RFD forecast of 4,108 wells.

While it's important to measure and track the total well count against the RFD, a more critical measurement is the total surface disturbance associated with the proposed action. Even though 65 wells (53 horizontal basin Mancos Shale wells and 12 directional Mesaverde wells) in the Middle Mesa POD are proposed, the total disturbance associated with the project is eight well pads and associated access roads and pipelines for a total disturbance of 52 acres-short term and 8 acres-long term. Drilled as single well actions, the total disturbance would be 45 wells and associated access roads and pipelines for a total disturbance of 162 acres-short term and 72 acres-long term. The horizontal well development approach represents a smaller acreage disturbance than the directional approach.

In compliance with the Mineral Leasing Act, the decision to be made is in what manner resource extraction should occur, not whether it can occur. The FFO must determine if the proposed action alternative on public lands is consistent with the PRMP/FEIS and associated September 29, 2003 ROD (USDI/BLM 2003*a*, 2003*b*). Under NEPA, the FFO must determine if there are any significant environmental impacts associated with the proposed action alternative, warranting further analysis in an Environmental Impact Statement (EIS). The BLM/FFO District Manager is the responsible officer who will decide either:

- To approve the proposal and modify the winter closure COA with design features as submitted by Williams;
- To approve the proposal and modify the winter closure COA with additional mitigations;
- To analyze the effects of the proposal in an EIS; or
- To deny the proposal.

1.5 Public Involvement and Scoping

The CEQ defines scoping as "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action alternative" (40 CFR 1501.7). Among other things, the scoping process is used to invite public participation, to help identify public issues, and to obtain public comment at various stages of the environmental analysis process.

Scoping is the process by which the BLM solicits internal and external input on the issues, impacts, and potential alternatives that will be addressed in an EIS or EA. As outlined in the BLM NEPA Handbook, it is optional for the BLM to conduct external scoping on actions analyzed by an environmental assessment (USDI/BLM 2008*b,* Section 6.3.2).

To date the BLM/FFO has made extensive efforts to meet early and often to focus the issues, advertised to inform the public, conducted outreach to groups including environmental organizations, and encouraged a diverse group to become involved in the process.

Between October 10, 2010, and June 14, 2011, the BLM/FFO held several meetings with the applicant and other consulting agencies such as the NMOCD, New Mexico Game and Fish Department (NMGFD), the U.S. Forest Service Carson National Forest, and other parties to discuss the proposed action throughout its development.

The BLM/FFO presented Williams Middle Mesa POD proposal for public input at their open house held on April 21, 2011. On April 26, 2011, a letter that provided information on the project and sought public scoping comment was mailed to 60 individuals and groups. The mailing included federal and state agencies, municipal offices, businesses, interest groups, and individuals. Six responses to this initial mailing were received. A legal notice was published in *The Daily Times,* the Farmington, New Mexico, paper, on April 27, 2011, to inform the public of the proposed action and the 30-day scoping comment period. On May 4, 2011, a scoping and consultation letter was mailed by the BLM/FFO to representatives of two Native American tribes: the Navajo and Southern Ute Indian Tribe.

In May 2011, a steering committee of representatives from agencies, conservation groups, and academia was formed to brainstorm and recommend study plans to evaluate big game baseline data collection and potential impacts that could occur on the east side of the Rosa Unit. The steering committee is not developing study plans for the Middle Mesa portion of the Rosa Unit. The BLM contacted representatives of San Juan Citizens Alliance, the Nature Conservancy, and others to request their participation on the steering committee. The committee has since met numerous times and engaged in extensive dialogue and communication.

1.6 Federal, State, or Local Permits, Licenses, or Other Consultation Requirements

This EA is prepared under the authority of the NEPA of 1969, (42 USC 4321-4347) and federal regulations found in CEQ Regulations (40 CFR 1500-1508).

Multiple use, as mandated by the Federal Land Policy and Management Act of 1976, requires that public lands be managed so that the use of some lands are for "a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish…" (43 USC 35).

Federal law mandates protection of some surface resources that are potentially affected by the development of the proposed action alternative. Cultural resources threatened by development are protected by the Antiquities Act of 1906 (PL 52-209), the National Historic Preservation Act of 1966 (PL 89-665and PL 52-209) and its regulations (36 CFR 800), and other legislation including NEPA (PL 91-852) and its regulations (40 CFR 1500-1508), the 1971 Executive Order No. 11593, the Archaeological and Historical Conservation Act of 1974 (PL 93-291), the Archaeological Resources Protection Act of 1979 (PL 96-95) and its regulations (36 CFR 296), the American Indian Religious Freedom Act (48 USC 1996), and the Native American Graves Protection and Repatriation Act of 1990. Compliance with Section 106 responsibilities of the National Historic Preservation Act are adhered to by following the BLM–New Mexico State Historic Preservation Office 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.

Under Section 402 of the Clean Water Act (CWA), as amended (33 USC 1251 et seq.), the U.S. Environmental Protection Agency (USEPA) regulates storm water discharges for industrial and construction activities under the National Pollutant Discharge Elimination System (NPDES) program. Additionally, Sections 404 of the Act, regulated by the U.S. Army Corps of Engineers, and Section 401 of the Act, regulated by the New Mexico Environment Department or USEPA (depending upon surface ownership), protects wetlands and waters of the United States. Operators are required to obtain all necessary permits and approvals for projects requiring CWA permits prior to any disturbance activities.

Surface water resources are protected from oil pollution sources by the Federal Water Pollution Control Act (40 CFR 112). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and other Federal regulations are designed to control the releases of hazardous materials into the environment and to direct the handling of response to accidental spills.

Threatened and endangered flora and fauna species are protected under the Endangered Species Act (ESA) of 1973, as amended (PL 94-325). Additionally, the Migratory Bird Treaty Act (16 USC 703-712) and the Eagle Protection Act (16 USC 668-668d) protect other wildlife species potentially occurring in the proposed project area.

Executive Order 11312 of 1999, "Invasive Species," establishes measures to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. The Executive Order provides guidelines to Federal Agencies

to contend with invasive species, to create an Invasive Species Council, and to implement an Invasive Species Management Plan.

The Federal Plant Protection Act of June 2000, the Federal Noxious Weed Act of 1974 (Section 2814), and the New Mexico Statutes Annotated (NMSA) 1978, "Noxious Weed Control Act," provide for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.

Air quality standards in New Mexico are under the jurisdiction of the New Mexico Environment Department/Air Quality Bureau (NMED/NMAQB). The Environmental Improvement Act, NMSA 1978, and the Air Quality Control Act, NMSA 1978, dictate state air quality standards. Also, 40 CFR § 60 "Standards of Performance for New Stationary Sources" is administered by the NMED/NMAQB. Permits for crushing operations would be required from the NMED/NMAQB.

Executive Order 12898 of 1994, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires implementing procedures to insure that proposed projects within the auspices of Federal agencies do not result in disproportionate shares of negative environmental impacts affecting any group of people due to a lack of political or economic strength. Environmental justice requires, "...the fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." As such, this document includes an assessment of the impacts of the project on minority and low-income populations.

The New Mexico Energy, Minerals, and Natural Resources Department requires oil and gas operators to follow "pit rule" guidelines contained with New Mexico Administrative Code (NMAC) 19.15.17 to reduce the potential for groundwater contamination from industry-related activities.

Additionally, Williams will comply with all applicable federal, state, and local laws and regulations; obtain the necessary permits for drilling, construction, and operation; and certify that Surface Use Agreements have been reached with the private landowners, where required.

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Alternative A—No Action (80-acre Density for Basin Mancos Using Non-Horizontal Drilling with a Seasonal Closure)

The BLM NEPA Handbook (USDI/BLM 2008*b*) states that for EAs on externally initiated proposed action alternatives, the no action alternative generally means that the proposed activity will not take place. This option is provided in 43 CFR 3162.3-2 (h) (2). The no action alternative would deny the approval of the Middle Mesa POD, which as proposed would require a modification to the seasonal timing limitation COA for the wildlife SDA. Current land and resource uses would continue to occur in the proposed project area. Williams would continue to develop the Middle Mesa portion of the Rosa Unit consistent with their existing lease rights.

2.2 Alternative B—Proposed Action (40- to 80-acre Spacing for Basin Mancos Using Horizontal Drilling with No Seasonal Closure)

Williams' proposed Rosa Unit Middle Mesa POD would utilize horizontal drilling to maximize natural gas extraction from the Basin Mancos pool in the Rosa Unit. Williams is proposing the phased development of eight proposed well pads that would be twinned or co-located with existing vertical well locations within the Middle Mesa Wildlife Area SDA. A vicinity map is provided as Figure 1 in Appendix A. Figure 2 in Appendix A shows the existing level of natural gas development on Middle Mesa within the Rosa Unit. Figure 3 in Appendix A shows the locations of the proposed well pads within the Rosa Unit Middle Mesa Wildlife Area SDA.

Under the proposed action alternative, Williams projects that 53 horizontal Basin Mancos wells would be drilled to develop the Middle Mesa portion of the Rosa Unit. Horizontal drilling from these eight well pads would result in full development of the Basin Mancos pool in the Middle Mesa portion of the Rosa Unit. Additional wells may be required if other Basin Mancos subintervals currently being tested prove to be commercially productive.

Drilling is proposed to occur during the winter closure. However, no drilling would occur during the winter closure on pads #7 and #8 to minimize potential impacts to wintering bald eagles (*Haliaeetus leucocephalus*). Only one rig would be used for drilling operations between December 1 and March 31 annually. If needed, only one rig move would be made between December 1 and March 31, and would not exceed 1.5 miles. Williams would plan drilling activities to avoid moving the rig during the winter closure to the extent practicable. A rig move would happen no more than once per winter.

Applications for Permit to Drill (APDs) would be prepared as specified by BLM for the drilling program. Each well pad and stimulation pad would be subject to additional site-specific environmental and cultural analysis at the time of the APD submittal, as determined by the BLM/FFO.

Approximately 53 horizontal wellbores would be drilled from these eight pads to the Basin Mancos pool. Additionally, 12 directional Mesaverde wells would also be drilled from the proposed eight well pad locations. Up to 13 wells could be drilled on each pad location; an average of seven horizontals in the

Basin Mancos and five or six additional directional wells are considered on each pad for development of non-Mancos reservoirs. All wells proposed for a single well pad would be drilled consecutively.

The total surface disturbance associated with the proposed action alternative would be 52 acres of short-term and 8 acres of long-term disturbance.

Drilling activities on a single well pad are projected to last 10 months on that well pad before wells would enter the production phase and reclamation would occur. The time range would vary depending on how many wells would be drilled per pad. Williams is proposing to commence drilling in the winter of 2012. All drilling activities would be completed in approximately 5 years.

Well Drilling

Each well pad would be approximately 300 by 500 feet in dimension with a 50-foot-wide construction zone around the perimeter of the pad for a total of 5.5 acres of disturbance. A representative well pad layout diagram is included in Appendix B. Each pad would be twinned or co-located with existing disturbance; therefore, no new access roads would be required for drilling. The proposed drilling well pad locations and the associated twin or co-located wells are listed in Table 2-1.

Table 2-1. Middle Mesa Plan of Development Well Drilling Pad Locations.

Site	Location	Twin or Co-Located Wells
Pad 1	1250 FNL & 2070 FWL; Sec. 33, Township 32 North, Range 6 West	242A and 151
Pad 2	1862 FSL & 717 FWL; Sec. 33, Township 32 North, Range 6 West	242
Pad 3	1820 FSL & 1129 FWL; Sec. 4, Township 31 North, Range 6 West	237 and 60
Pad 4	277 FSL & 1451 FWL; Sec. 4, Township 31 North, Range 6 West	60B
Pad 5	937 FNL & 1918 FWL; Sec. 9, Township 31 North, Range 6 West	180A
Pad 6	735 FSL & 1807 FWL; Sec. 9, Township 31 North, Range 6 West	180D
Pad 7	823 FNL & 1139 FWL; Sec. 16, Township 31 North, Range 6 West	145A
Pad 8	2252 FNL & 860 FEL; Sec. 17, Township 31 North, Range 6 West	276, 138D, and 138C

Key: FEL = from the east line; FNL = from the north line; FSL = from the south line; FWL = from the west line.

Construction activities associated with the proposed action alternative would include well pad construction, drilling, stimulation and completion of the proposed natural gas wells, and the installation of any surface equipment necessary for natural gas production. At each drilling well pad, construction crews would remove vegetation from the proposed location and the existing pad would be expanded. Well pad construction would not occur between December 1 and March 31. Cuts and fills would vary between the eight proposed pads. Excavated materials from the cuts would be used on the fill portion of the location to level the pad. Clearing and leveling is needed to provide a level surface for rig and equipment access, and drilling. Included in the pad construction would be excavation of a 150-foot by 100-foot cuttings pit. There would be no blow pit; instead a stack flare would be used to burn excess gas during drilling to relieve wellbore pressure.

A closed-loop system would be utilized. Closed-loop systems employ a suite of solids control equipment to minimize drilling fluid dilution. This results in a “dry” location where a reserve pit is not required, used fluids are recycled, and solid wastes can be land farmed, hauled off, or injected downhole. Natural gas well drilling facility assembly would occur on the well pad after site clearing and leveling. Drilling

equipment located on each drilling pad would include: the drilling rig and associated equipment (e.g., blowout preventer, gas buster, etc.), pipe storage, and four housing trailers for personnel. Pipe storage would be sufficient on the well pad location so that no deliveries would be required between December 1 and March 31.

A purpose-built rig would be used to drill multiple horizontal and directional wells from a single pad. The rig would allow mobilization from one wellbore to the next without rig disassembly and also allow much closer wellhead placements than a conventional rig, thus using a smaller area to drill multiple wells from one pad.

The purpose-built rig would have a 136-foot tall mast and sit on a substructure that is 18 feet tall, for a total of 154 feet. The rig would allow surface wellheads to be located as close as 7.5-feet apart. With multi-well drilling pads, the rigs sliding walking/moving system allows the substructure and mast (while standing with pipe in the racking board) to be moved away from the rig's centralized support system (generators, mud pumps, mud tank, fuel tanks, etc.) to the next well center. The moving system is operated with a hand-held remote controller that allows the operator total control and view of the move. When the rig needs to be moved side to side, there is a 90-degree function. The drilling rig would be powered by natural gas rather than diesel.

Drilling operations would utilize water-based mud for the surface and intermediate hole, and oil-based mud for the horizontal lateral. Water-based cuttings would be disposed of on site in a temporary pit. The cuttings are left in the pit, which is then closed according to NMOCD Rule 17, commonly referred to as the "pit rule". For closure, four feet of cover is placed on the pit and then reclaimed according to applicable rules of the respective surface management agency. A closed-loop system would be used for the oil-based mud. Oil-based cuttings would be hauled to a commercial disposal facility or land farmed on fee surface. Approximately three loads a day for 5 days (total 15 loads) of cuttings per each well drilled would be transported by truck off site. Each load would be transported in 14-cubic-yard roll-off containers. Cuttings would be transported during daylight hours.

Stimulation Activities

Stimulation (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 and chemical additives, are pumped into a geologic formation at high pressure during hydraulic fracturing. When the pressure exceeds the rock strength, the fluids open or enlarge fractures that can extend several hundred feet away from the well. After the fractures are created, a propping agent 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 (USEPA 2004).

Post drilling well stimulation would occur outside of the winter closure period. Well stimulation equipment would be located on the remote fracturing pad. For the proposed POD, two well stimulation pads would be constructed. Each pad would be approximately 350 feet by 500 feet in dimension, for a total disturbance of 4.0 acres. An approximate 2-acre produced-water holding pond would be located on each well stimulation pad. The centralized holding ponds would be built and shared by the eight drilling

locations so individual holding ponds or tanks would not be required on every pad. The well stimulation pads would be completely reclaimed following completion of well stimulation.

The holding ponds are governed by NMOCD's Rule 17. Storage in excess of 10 acre-feet is not permitted under the rules without an exception, which requires a hearing. If Williams is unsuccessful at obtaining an exception for these facilities, multiple ponds may be required so that each individual pond volume is less than 10 acre-feet. In this case, individual storage ponds would be located on each well drilling pad and would require additional surface disturbance.

A substantial amount of water would be needed to achieve maximum well stimulation potential. Williams proposes to truck produced water gathered from existing wells in the Middle Mesa portion of the Rosa Unit to the produced-water holding ponds for well stimulation. This produced water would be recycled and used for multiple stimulations. If produced water volumes are insufficient, Williams would drill a well to the Entrada Formation, which would be subject to New Mexico Office of the State Engineer regulations. The Entrada Formation is not a freshwater-bearing aquifer. If a water well is needed, drilling would occur outside the winter closure. Water from the well would be transported to the holding ponds via a temporary 10-inch poly surface line. Two different stimulation fluid designs are under consideration: slickwater and gelled water. More information on the stimulation fluid components (chemicals) in these designs can be found at the website www.hydraulicfracturingdisclosure.org.

A total of three above-ground pipelines would be temporarily installed to transport water for well stimulation. Stimulation pumping would be conducted adjacent to the holding ponds and pumped to the individual wells via two steel 4.5-inch welded pipelines. Chemicals are added "on-the-fly" at the time the stimulation is pumped. The chemicals are added to the pumped stimulation fluid at the well head just before it goes down hole. Chemicals are not added to the holding ponds.

Flowback water would be transferred by one steel 4.5-inch welded pipeline back to holding tanks on the stimulation pads. At that point, the flowback water would be filtered and returned to the storage ponds for reuse in subsequent stimulations. The aboveground stimulation and flowback lines would be installed in or adjacent to existing disturbance. The three temporary lines would be removed following well stimulation.

Following completion, the new wells would be connected to existing gathering pipelines. These pipelines are expected to be constructed within existing or proposed disturbance. Existing regional gathering systems, not owned or operated by Williams Production Company, LLC, are already in place within the Middle Mesa POD project area. The gathering system capacity and its ability to handle future produced gas volumes resulting from the proposed action alternative are unknown at this time. Additional gathering capacity may be needed in the future and would be designed (e.g., pipe and easement size, length, etc.) by the pipeline owner/operator and permitted separately from this proposed action. If additional gathering lines are needed in the future to transport gas produced by the new wells to regional transmission lines, these pipelines would likely be routed to minimize any new surface disturbance and would be expected to following existing roads and ROWs. Figure 4 in Appendix A shows the anticipated routes of potential gathering pipelines. ROWs in the Middle Mesa Wildlife Area SDA are permitted on a case-by-case basis. Pipeline construction would be subject to the winter closure COA and site-specific environmental and archaeological analysis.

Reclamation

The proposed well pads would be partially reclaimed following drilling operations, as Williams would install production facilities on the site before drilling commences. Because stimulation would be conducted from a separate pad, reclamation of the well drilling pad would not have to wait for well completion. A portion of the pad not required for production equipment and vehicular access would be re-contoured and seeded per the BLM/FFO COAs. Approximately 1 acre for production facilities on each well pad would remain in use for production and vehicle access. These areas would not be reclaimed until final abandonment of the wells. Production equipment that would remain on site would include the wellheads, production unit separators, and meter runs. Ancillary equipment could also be installed at the well pad site, such as a Christmas tree, storage tank(s), dehydrator, and separator. No well head compression is expected for the Basin Mancos wells. Equipment would be powered by gas compression engines. No overhead electric power line construction is proposed.

Work Force and Transportation

The drilling process would require activity on the well pad virtually around the clock, 7 days a week. Williams proposes a work force residential camp on private lands, approximately 0.5 linear mile west of the Rosa Unit boundary. During the winter closure period, approximately two vehicle-trips per day would be needed to transport workers to and from the drilling pad. Except for emergency situations and one shift change per day, all vehicle traffic would be restricted to daylight hours.

Approximately 15 individuals would be working on the pad during drilling operations. Four of these individuals, the company man, toolpusher, mudlogger, and measurements-while-drilling (MWD) field engineer, must live on the pad location since they are on-call 24 hours a day. The remaining individuals would work 12-hour shifts, 7 days on, 7 days off, and would be considered non-residents to the rig. These workers usually do daily commutes to/from the drilling site. The residential camp would have access to electrical power, fresh water, and an on-site septic system. The private landowner would install the septic system and an overhead 12.5 kilovolt (kV) electric power line approximately 200 feet in length for the residential camp. All residential camps facilities would be designed and constructed in compliance with local, state, and federal regulations.

At shift changes, workers would be transported to and from the residential camp by high-capacity vehicles such as a bus or large van. During the winter restriction period, Williams would require those occupying the camp during non-work hours to restrict their excursions outside of the camp boundaries. Once per week, this same high-capacity vehicle would be utilized to make crew changes, since the non-residents would be working 7 days on, 7 days off schedules.

Design Features

Design features (best management practices) are an integral part of the proposed action. The environmental effects are analyzed assuming that design features are in place and are successful. For the proposed action, standard and project-specific design features include but are not limited to:

1. Well drilling pads will be twinned or co-located to minimize surface disturbance.
2. Horizontal drilling of multiple wells from one well pad will minimize the amount of surface disturbance.

3. The purpose-built rig will minimize the amount of surface disturbance.
4. Only one rig will be used for drilling operations between December 1 and March 31.
5. If needed, only one rig move will be made between December 1 and March 31, and will not exceed 1.5 miles. Williams will plan drilling activities to avoid moving the rig during the winter closure to the extent practicable. A rig move would happen no more than once per winter.
6. The drilling rig will use natural gas powered engines.
7. A closed-loop system will be used for oil-based mud.
8. Sufficient casing inventory will be maintained on site to avoid hauling between December 1 and March 31.
9. Williams will implement adequate casing, cementing, mud weights, and blowout preventer.
10. Stimulation activities will not be conducted between December 1 and March 31.
11. Subject to NMOCD approval, centralized stimulation well pads will be constructed to minimize surface disturbance.
12. Produced water will be used for well stimulation and will be recycled.
13. Pipelines from the well stimulation pads will be located in or adjacent to existing roads or ROWs and will be temporary, above-ground steel welded lines.
14. The holding ponds will be in compliance with NMOCD Rule 17.
15. The holding ponds will be lined, netted, and fenced to restrict access.
16. Wells on drilling pads #7 and #8 will not be drilled during the winter closure to avoid impacts to wintering bald eagles.
17. A residential camp will be utilized to reduce truck traffic to the drilling rig.
18. Workers will be transported to and from the residential camp by high-capacity vehicles to minimize vehicle traffic.
19. Workers schedules will be 12-hour shifts, 7 days on and 7 days off to minimize vehicle traffic.
20. Workers occupying the residential camp during non-work hours will restrict their excursions outside of the camp boundaries.
21. Except for emergency situations and one shift change per day, all vehicle traffic will be restricted to daylight hours.
22. Engines will be equipped with mufflers. Barriers or other sound-proofing measures will be implemented, if needed, to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the Jurisdiction of the Farmington Field Office (FFO) NTL 03-1 FFO.
23. During drilling, stimulation, and completion, a trash receptacle and a chemically treated portable toilet will be on location for trash and sewer disposal.
24. All wastes will be disposed of in a proper manner as required by federal and state law and as described in the COAs.
25. Any spills will be promptly cleaned up and Williams will prepare a hazardous material response contingency plan to cover an accidental release of hazardous materials.

26. No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of 6 inches deep, the soil shall be deemed too wet to adequately support construction equipment.
27. The top 6 inches of soil will be stockpiled during well pad construction and drilling, and then respread during interim reclamation.
28. The construction zone will be recontoured and reclaimed following well drilling.
29. Disturbed areas will be seeded with a BLM seed mix as outlined in the COAs.
30. All above ground structures not subject to safety requirements shall be painted to blend with the natural color of the landscape. A reflective material may be used to reduce hazards that may occur when such structures are near roads.

One design feature was considered but not carried forward. To further reduce truck traffic, Williams considered disposing of oil-based cuttings on federal lands within the Middle Mesa portion of the Rosa Unit rather than trucking to a disposal site or disposing downhole. However, the BLM's policy is that public lands should not be used for solid waste disposal (refer to BLM Manual 1703 Section 02 and IM 93-17 Section 13). Therefore, this design feature was not carried forward.

2.3 Alternatives Considered but Eliminated from Further Analysis

An alternative responding to an issue, but not substantially accomplishing the purpose and need, is not considered a reasonable alternative to the proposed action. Several alternatives were identified and subsequently eliminated from further analysis during the development of the Middle Mesa POD. These alternatives are discussed below and will not be evaluated further in this assessment. No other alternatives were identified for the proposed Middle Mesa POD that would result in fewer environmental impacts and still meet the purpose and need of the proposed action.

40-acre spacing for Basin Mancos using non-horizontal drilling with a seasonal closure

Non-horizontal Mancos development in a stand-alone wellbore would not be economically viable in the current price environment, which is not expected to change substantially in the near future. Consequently, all Basin Mancos production would need to be commingled with Mesaverde production in non-horizontal wellbores. Since the current 40-acre density Mesaverde pool has at least four existing wells in every pro-ration (spacing) unit in Middle Mesa, the limiting factor on the number of available Mancos drill locations is the commingling requirement, not the increased density to 40-acres. Thus, even though 40-acre Basin Mancos spacing would allow up to eight wells per pro-ration unit, no more than four wells could be drilled due to the commingling requirement. Because of the commingling requirement with Mesaverde, this alternative would have been substantially the same to the no action alternative: 80-acre density for Basin Mancos using non-horizontal drilling with a seasonal closure. This alternative is eliminated from detailed analysis as would have been substantially similar in design to the no action alternative.

10-acre spacing for Basin Mancos using non-horizontal drilling with a seasonal closure

No reservoir drainage in excess of 10 acres has been observed in non-horizontal Basin Mancos wells in the Rosa Unit to date. The current approved spacing for the Basin Mancos pool is four wells per pro-ration unit (80-acre density). To optimize resource extraction using non-horizontal drilling, 10-acre well

pad spacing would be needed. At this spacing density, approximately 570 wells at 10-acre spacing would need to be drilled, resulting in a substantial increase in surface disturbance from new well pads, roads, and pipelines. Even given the number of existing well pad locations within the unit, a considerable number of these pads could not be twinned or co-located. At a drilling rate of 10 wells per year, this level of development would also result in a long-term occupancy of greater than 40 years within the Middle Mesa portion of the Rosa Unit. This alternative would result in substantially greater environmental impacts than the proposed action alternative. This alternative does not meet the action's purpose and need as it would not optimize resource extraction and would result in greater surface impacts. Therefore, it is eliminated from detailed consideration.

Horizontal drilling with a seasonal closure

Williams' federal leasehold within San Juan County, New Mexico, is wholly contained within the winter closure area; therefore drilling rig(s) remain idle during the four month (121 days) winter closure. The capital outlay for a 3-year lease for the purpose-built rig is approximately $15,000,000 to $18,000,000. At a day price of approximately $25,000, having the rig on standby for 4 months would result in a cost of over $3,000,000 per fiscal year. Coupled with the accompanying revenue loss and the cost of moving the rig in and out the unit, this alternative is not considered economically viable and therefore does not meet the purpose and need of the proposed action.

3. DESCRIPTION OF AFFECTED ENVIRONMENT

This section describes the environment that would be affected by implementation of the alternatives described in Section 2.0. Aspects of the affected environment described in this section focus on the relevant major resources or issues. Only the aspects of the affected environment that are potentially impacted are described.

For the purposes of this analysis, the proposed project area is considered the portion of William's Rosa Unit on Middle Mesa. The project area is located in the southeastern portion of the 46,052-acre Middle Mesa Wildlife Area SDA, managed to protect important seasonal wildlife habitat, specifically big game winter range. The Williams Middle Mesa portion of the Rosa Unit covers approximately 12 percent of the total SDA. The proposed eight well pads and two stimulation pads would be located on lands administered by the BLM/FFO.

Field resource investigations of the proposed project area were conducted between April and May 2011 by biologists from Ecosphere Environmental Services (Ecosphere). Preliminary cultural resource surveys were conducted by La Plata Archaeological Consultants (LAC) between March and June 2011.

Elements of the human environment that do not exist in the project area or that do not have potential to be affected are eliminated from further analysis as indicated in Table 3-1. Those elements potentially affected by the proposed action alternative or alternatives are described in the following sections.

Table 3-1. Affected Environment and Basis for Determination of No Further Analysis.

Resources	Effected by the Proposed Action	Not Effected by the Proposed Action	Further Analysis Presented in Text	Basis for Determination
Air Quality	X		X	
Cultural Resources	X		X	
Native American Religious Concerns		X	X	
Areas of Critical Environmental Concern (ACECs)		X		No ACECs are located within the project area.
Wilderness		X		No designated Wilderness Areas within a 30-mile radius.
Farmlands, Prime or Unique		X		No prime or unique farmlands located in project area or vicinity.
Water Quality, Surface/Ground	X		X	
Wetlands/Riparian Zones		X		No wetlands or riparian zones occur in the project area.
Floodplains		X		No floodplains located in project area or vicinity.
Wild and Scenic Rivers		X		There are no wild and scenic rivers in the FFO.
Topography/Surface Geology	X		X	
Mineral Resources	X		X	
Paleontology		X		No paleontological resources known to occur in the area.
Soils	X		X	
Vegetation, Forestry	X		X	
Invasive, Non-native Species	X		X	
Wildlife	X		X	
Threatened or Endangered Species		X	X	
Special Status Species	X		X	
Livestock Grazing	X		X	
Migratory Birds	X		X	
Wild Horses and Burros		X		There are no wild horse or burro populations in or near the project area.
Socioeconomics	X		X	
Environmental Justice	X		X	
Recreation	X		X	
Transportation and Traffic	X		X	
Visual Resources	X		X	
Noise	X		X	

Resources	Effected by the Proposed Action	Not Effected by the Proposed Action	Further Analysis Presented in Text	Basis for Determination
Wastes, Hazardous or Solid	X		X	Due to the handling and storage of minor volumes of fuels and lubricants during construction, and the presence of existing facilities in the project area, further analysis is warranted.
Public Health and Safety	X	X		

3.1 Air Resources

Air resources include air quality and climate. The Middle Mesa POD alternatives would occur in San Juan County, New Mexico, which is included in the project area of the Farmington PRMP/FEIS (USDI/BLM 2003*a*). In addition to the air quality information in the RMP, new information about greenhouse gases (GHGs) and their effects on national and global climate conditions has emerged since the RMP was prepared. This updated information is included in Section 3.1.2, Greenhouse Gases and Climate Change.

3.1.1 Baseline Air Quality

The USEPA has the primary responsibility for regulating atmospheric emissions. Air quality is determined by levels and chemistry of atmospheric pollutants, dispersion meteorology, and terrain. In New Mexico, regulation of atmospheric pollutants is delegated to the state and managed by the NMED.

With the federal Clean Air Act (CAA) Amendments of 1970, Congress authorized the USEPA to establish National Ambient Air Quality Standards (NAAQS) for air pollutants harmful to human health and the environment (40 CFR 50). The CAA established two types of NAAQS, primary standards to protect public health and secondary standards to protect the public welfare (USEPA 2010*a*). These standards exist in the form of quantitative, ambient air concentration thresholds for six pollutants, collectively referred to as "criteria pollutants" (USEPA 2010*a*). These standards apply to ambient air throughout the United States, including tribal lands. Table 3-2 summarizes the NAAQS for each of the six criteria pollutants:

- Ozone (O_3)
- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Sulfur dioxide (SO_2)
- Particulate matter
- Particulate matter with an aerodynamic diameter equal to or less than 10 microns (PM_{10})
- Particulate matter with an aerodynamic diameter equal to or less than 2.5 microns ($PM_{2.5}$)
- Lead (Pb)

Table 3-2. Summary of National Ambient Air Quality Standards (NAAQS).

Pollutant	Primary Standards		Secondary Standards	
	Concentration	Averaging Time	Concentration	Averaging Time
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour (1)	None	
	35 ppm (40 mg/m^3)	1-hour (1)		
Lead	0.15 µg/m^3 (2)	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	53 ppb(3)	Annual (Arithmetic Mean)	Same as Primary	
	100 ppb	1-hour(4)	None	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour (5)	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual (6) (Arithmetic Mean)	Same as Primary	
	35 µg/m^3	24-hour (7)	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour (8)	Same as Primary	
	0.12 ppm	1-hour (10) (Revoked)	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Mean)	0.5 ppm	3-hour (1)
	0.14 ppm	24-hour (1)		

mg/m^3 = milligrams per cubic meter

µg/m^3 = micrograms per cubic meter

ppm = parts per million

ppb = parts per billion

std = ozone standard

Notes: (1) Not to be exceeded more than once per year.

(2) Final rule signed October 15, 2008.

(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purposes of clearer comparison to the 1-hour standard.

(4) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).

(5) Not to be exceeded more than once per year on average over three years.

(6) To attain this standard, the three-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

(7) To attain this standard, the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

(8) To attain this standard, the three-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

(9) (a) To attain this standard, the three-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

(9) (b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.

(10) (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than 1.

(10) (b) USEPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti backsliding").

Source: USEPA National Ambient Air Quality Standards website: http://www.epa.gov/air/criteria.html. Last updated on April 16, 2009 (USEPA 2010*a*).

Existing air quality in all areas of each state is categorized by USEPA according to how the criteria pollutant levels compare to the NAAQS. For each criteria pollutant, air quality in a given geographic area (which may not coincide with political boundaries) is designated in one of three categories:

> **Attainment** – An area that meets the national primary or secondary ambient air quality standard for the pollutant and averaging time.
>
> **Non-attainment** – An area that does not meet (or that contributes to ambient air quality in an area that does not meet) the national or secondary standard for the pollutant.
>
> **Unclassified** – An area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant. With respect to major source pre-construction permitting, such areas are treated as attainment areas.

The area of the proposed action is considered Class II for air quality area. Class II areas allow moderate amounts of air quality degradation. A review of the USEPA's Green Book web page (USEPA 2010*a*) reports that the San Juan Basin is in attainment for all air pollutants regulated under the CAA NAAQS. General information on air quality in the area is contained in Chapter 3 of the PRMP/FEIS (USDI/BLM 2003*a*). Additional and updated information for criteria air pollutants that would be affected by the POD alternatives, such as ozone and particulates, are included in this section.

Ozone (O3)

Ground level ozone is not emitted directly into the air but is created by chemical reactions between NO_x (oxides of nitrogen) and volatile organic compounds (VOCs) in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NO_x and VOCs (USEPA 2010*e*). VOCs refer to organic chemical compounds that have significant vapor pressures and can affect the environment and human health. While VOCs can be a product of human activity, they are also naturally occurring and are known as biogenic volatile organic compound emissions. While ozone and nitrogen dioxide are criteria air pollutants, VOCs and the other various oxides of nitrogen are not.

The 2003 RMP discussed ozone in the Baseline Air Quality and Impact Assessment sections. The December 2003 standard attainment of the ozone was a 3-year running average of the annual fourth-highest daily maximum 8-hour ozone concentration of less than 0.084 parts per billion (ppb). During the summers of 2000 through 2002, ozone levels in San Juan County were approaching non-attainment. The New Mexico Air Quality Bureau (NMAQB) held several public meetings to discuss the issue and as a result formed an Early Action Compact, and coordinated the formation of the Four Corners Ozone Task Force. Additional modeling and monitoring was conducted by Alpine Geophysics, LLC and Environ International Corporations, Inc., in 2003 and 2004. Results of the modeling suggest the episodes recorded in 2000 through 2002 were attributable to regional transport and high natural biogenic source emissions. The model also predicted that the region will not violate the ozone NAAQS through 2007 and that the trends in the 8-hour ozone values in the region will be declining in the future.

The states of Colorado and New Mexico convened the Four Corners Air Quality Task Force (Task Force) in November 2005 to address air quality issues in the Four Corners region and consider options for

mitigation of air pollution. The Task Force is comprised of more than 100 members and 150 interested parties representing a wide range of perspectives on air quality in the Four Corners. Members include private citizens; representatives from public interest groups; universities; industry; state, tribal and local governments; and federal agencies including the BLM/FFO.

The purpose of the Task Force was to bring together a diverse group of interested parties from the area to learn about and discuss the range of air quality issues and options for improving air quality in the Four Corners area. Public involvement was vital to all stages of technical work per the Early Action Compact. NMED solicited and received input from stakeholders continually throughout the analysis through telephone and email contacts. Information about the Early Action Compact and inventory and modeling reports is available to the public on the NMED webpage (http://www.nmenv.state.nm.us/aqb/ozonetf/index.html).

Initial work of the Task Force resulted in the implementation of one interim recommendation: Compressor engines 300 horsepower or less used during well production emit NO_x at 2 grams per horsepower-hour or less.

There are three ozone monitors used to measure ozone levels in San Juan County located at: (1) Shiprock substation in western San Juan County, (2) Bloomfield in central San Juan County, and (3) Navajo Reservoir in northeastern San Juan County.

In March 2008, the USEPA revised its NAAQS for 8-hour ozone concentrations from 0.084 parts per million (ppm) to 0.075 ppm. In 2009, the NMAQB reported that the 2006 through 2009 8-hour ozone design values for the three NMAQB air monitors located in San Juan County ranged from 0.061 to 0.069 ppm (NMED 2010). Table 3-3 shows that the 2007 to 2010 design values were lower for each of the three San Juan County air monitoring stations when compared to the 2006 to 2009 design values, and the ozone trends predicted by the models appear to be accurate. Therefore, at this time San Juan County is in attainment of the federal ozone standard. However, USEPA announced in January 2010 its intention to further lower the standard to between 0.060 and 0.70 ppm. The revised standard is under review at this time.

Table 3-3. Eight-hour ozone design values for New Mexico Air Quality Bureau (NMAQB) air monitoring stations in San Juan County, New Mexico. The "design value" is the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration.

	8-hour Ozone Design Value (ppm)	
NMAQB Air Monitoring Station	2006-2009	2007-2010
Substation	0.067	0.063
Bloomfield	0.061	0.060
Navajo Reservoir	0.069	0.066

In 2009, the legislature of New Mexico passed House Bill 195, which enacted a new section of the Air Quality Control Act to provide for regulation of sources of emissions that cause the formation of ozone. If the Environmental Improvement Board determines that emissions from sources within its jurisdiction cause or contribute to ozone concentrations in excess of 95 percent of a national ambient are quality standard for ozone, it shall adopt a plan, including regulations, to control emissions of NO_x and VOCs to

provide for attainment and maintenance of the standard. At the present time, ozone concentrations in the San Juan Basin are not within 95 percent of the standard. In the future, if the ozone concentrations are within 95 percent of the standard, FFO will cooperate with the State of New Mexico to implement regulations developed by the state through COAs during the oil and gas permitting process.

Particulate Matter (PM_{10} and $PM_{2.5}$)

Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles (USEPA 2010*b*). PM is measured and regulated according to particle size. USEPA divides regulation of PM into two classes: PM_{10} and $PM_{2.5}$. PM_{10} refers to all particles with a diameter of 10 microns or less. $PM_{2.5}$ is made up of particles with diameters of 2.5 microns or less. Smaller particles are associated with more negative health effects, including respiratory and cardiovascular problems because they can become more deeply embedded in the lungs (USEPA 2010*b*).

In the FFO, most PM emissions are from road dust ($PM_{2.5}$: 19,894 tons, 69.1 percent; PM_{10}: 199,905 tons, 90.8 percent) and electricity generation ($PM_{2.5}$: 5,516 tons, 19.2 percent; PM_{10}: 8,142 tons, 3.7 percent; USEPA 2010*d*). From 1990 to 2008, PM_{10} levels measured at NMAQB air monitors in San Juan County were between approximately 25 and 65 micrograms per cubic meter ($\mu g/m^3$; USEPA 2010*c*), which is much lower than the current PM_{10} NAAQS of 150 $\mu g/m^3$ (24-hour average). $PM_{2.5}$ levels from 2000 to 2008 (data period available) measured at NMAQB air monitors were approximately 5 to 6 $\mu g/m^3$ (USEPA 2010*c*), which is also below the current $PM_{2.5}$ NAAQS of 15.0 $\mu g/m^3$ (annual average) or 35 $\mu g/m^3$ (24-hour average). Thus, San Juan County is currently in attainment of $PM_{2.5}$ and PM_{10} standards.

3.1.2 Greenhouse Gas (GHG) Emissions and Climate Change

On-going scientific research has identified the potential impacts of GHG emissions such as carbon dioxide, 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. Since GHG emissions and climate change impacts were not included in the ROD for the PRMP/FEIS, this EA incorporates an analysis of the contributions of the alternatives to GHG emissions and how climate change would affect the proposed action alternative in Chapter 5: Cumulative Impacts.

3.1.2.1 Greenhouse Gases

Energy from the sun drives the Earth's weather and climate. The Earth absorbs energy from the Sun and also radiates energy back into space. However, much of this energy going back to space is absorbed by "greenhouse" gases in the atmosphere. During the past century, humans have added to the amount of GHGs in the atmosphere by burning fossil fuels such as coal, natural gas, oil, and gasoline. The added gases—primarily carbon dioxide and methane—are enhancing the natural greenhouse effect and may be contributing to an increase in global average temperature and related climate changes.

The GHGs of primary interest in reference to the oil and gas industry are carbon dioxide and methane. Carbon dioxide is produced during the burning of fossil fuels to run internal combustion engines that may be used during natural gas drilling, transportation, pumping, and compression. Methane is the primary component of natural gas and is released to the atmosphere during both oil and gas production either intentionally during production, when it cannot be captured, or accidentally through leaks and fugitive emissions. Methane is recognized to have a greater influence in global warming than carbon dioxide, which is measured in terms of global warming potential. Methane has a global warming potential greater than carbon dioxide by a factor of 21.

The standard measure for GHGs is carbon dioxide equivalent metric tons (CO_{2eq} mtons). USEPA's Office of Transportation and Air Quality (OTAQ) uses this carbon dioxide equivalent metric for calculating the national inventory for GHG emissions. Methane emissions are converted to CO_{2eq} by multiplying weight of methane emissions expressed in mtons by the global warming potential of 21.

In 2009, total U.S. GHG emissions were 6,633.2 Tg or million metric tons $CO_{2\ eq}$. While total U.S. emissions have increased by 7.3 percent from 1990 to 2009, emissions decreased from 2008 to 2009 by 6.1 percent (427.9 Tg $CO_{2\ eq}$). This decrease was primarily due to (1) a decrease in economic output resulting in a decrease in energy consumption across all sectors; and (2) a decrease in the carbon intensity of fuels used to generate electricity due to fuel switching as the price of coal increased and the price of natural gas decreased significantly. Since 1990, U.S. emissions have increased at an average annual rate of 0.4 percent (USEPA 2011).

The levels of these GHGs are expected to continue increasing. The rate of increase is expected to slow as greater awareness of the potential environmental and economic costs associated with increased levels of GHGs result in behavioral and industrial adaptations.

In New Mexico, the Greenhouse Gas Inventory and Reference Case Projection 1990-2020 estimates that approximately 17.3 million metric tons of GHGs from the natural gas industry and 2.3 million metric tons of GHGs from the oil industry are projected in 2010 as a result of oil and natural gas production, processing, transmission, and distribution (NMED 2009).

In 2010, the New Mexico Environmental Improvement Board adopted rule 20.2.100 to "establish greenhouse gas emission reduction requirements for sources" (NMED 2010). The goal of the rule is to reduce the emissions of GHGs from high-emissions facilities in New Mexico, including certain oil and gas processing facilities and electric generating plants. Under this rule, facilities with annual GHG emissions over 25,000 CO_{2eq} metric tons per year would have to limit their emissions to no more than 2010 levels, on a per-facility basis by 2013 (Synapse 2011). Thereafter emissions levels must be reduced by 3 percent of 2010 levels every year for 10 years, or until superseded by a federal or regional GHG rule. The rule contains numerous provisions for banking and borrowing of emissions credits, as well as provisions for purchasing offsets from emissions sources that are not included in the rule. There is also a provision for a maximum compliance price of $50 per million metric tons of CO_{2eq}.

3.1.2.2 Climate

The planning area is located in a semiarid climate regime typified by dry, windy conditions and limited rainfall. Summer maximum temperatures are generally in the 80s or 90s (Fahrenheit) 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 3-4 shows the average weather conditions for Farmington, New Mexico for the 11-year period from 1998-2008. These conditions would be considered generally representative of the project area.

Table 3-4. Average weather conditions 1998-2008, Farmington Airport (WRCC 2009).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (F)													
Average Maximum	44.2	49	59.1	67.4	78.8	89.7	93.8	89.9	82	68.7	55.1	43.6	68.5
Average Minimum	20.1	23.3	29.1	35.4	43.6	52.2	61.8	59.6	50.2	38.5	27.6	19.3	38.4
Average	32.1	36.2	44.1	51.4	61.2	71	77.8	74.8	66.1	53.6	41.4	31.5	53.4
Precipitation (inches)													
Average Monthly	0.61	0.75	0.64	0.61	0.36	0.08	0.66	0.94	0.92	1.07	0.59	0.44	7.67
Maximum Daily	0.41	0.47	0.55	1.2	0.58	0.14	1.75	1.08	0.97	0.63	0.5	0.32	1.75
Snowfall [(1)]	2.9	3.9	1.2	0.1	0	0	0	0	0	0.3	0.5	2.9	11.9
Wind (Miles Per Hour)													
Daily Average	7	7.9	8.7	9.5	9	9.1	8.1	7.7	7.5	7.5	7.2	7.1	8
Daily Average Max 2-Min	16.6	19.3	22.3	24.3	23.6	23.4	24.3	22.3	20.6	19	17.5	17.6	20.9
Daily Average Peak Gust	19.9	23.6	27.7	30.6	30.2	30	30.5	27.8	25.8	23.4	21	21	26
Prevailing Direction	E	E	W	W	W	E	E	E	E	E	E	E	E

Note:
[(1)] Data obtained from Farmington Agricultural Science Center monitoring station.

In addition to the air quality information in the PRMP/FEIS, new information about GHGs and their effects on national and global climate conditions has emerged since the ROD was completed. Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies 2007). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Without additional meteorological monitoring and modeling systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs may accelerate the rate of climate change.

In 2007, the Intergovernmental Panel on Climate Change (IPCC) predicted a warming of about 0.2°C per decade for the next two decades, and then a further warming of about 0.1°C per decade. The National Academy of Sciences (2006) supports these predictions but has acknowledged that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures.

In New Mexico, a recent study indicated that the mean annual temperatures have exceeded the global averages by nearly 50 percent since the 1970s (Enquist and Gori 2008). Similar to trends in national data, increases in mean winter temperatures in the southwest have contributed to this rise. When compared to baseline information, periods between 1991 and 2005 show temperature increases in over 95 percent of the geographical area of New Mexico. Warming is predicted to be largest in the northwestern, central, and southwestern parts of the state (Enquist and Gori 2008).

3.2 Cultural Resources

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

The proposed action would be located within the Navajo Reservoir watershed. Based on the Farmington PRMP/FEIS (USDI/BLM 2003*a*), a total of 4,329 sites representing Archaic Period, Basketmaker II, Basketmaker III, Unknown Anasazi, Pueblo I, Pueblo II, Pueblo III, Pueblo IV, Unknown Navajo, Dinétah/Gobernador Phase, Cabezon Phase, Reservation Phase, Apache, Pueblo, Hispanic, and Euro-Anglo temporal/cultural components have been documented within the watershed. Of the 18 categories of sites defined based on temporal/cultural affiliation, 16 are represented. Lacking in the watershed are sites attributed to Paleo and Ute occupations. The most frequently occurring cultural affiliations recorded are Anasazi Pueblo I (41 percent) and Dinétah/Gobernador (15 percent). Features found at these sites include small pueblos, pithouses, hogans, and artifact scatters. Sites density is high with some gaps in the information or undiscovered sites due to lack of inventory.

Since site-specific locations under the no action alternative have not been identified. No cultural resource surveys have been conducted. These surveys would be conducted on a case-by-case basis when the locations are identified.

The entire area of potential affect for the proposed eight well pads and two remote stimulation pads was surveyed by LAC at a BLM Class III level (100 percent) in accordance with the *Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities* (BLM 2005). Pending final facilities design and identification of addition infrastructures needs (e.g., pipelines) additional inventory is likely and a final inventory report would be submitted at that time. The Class III inventory thus far has identified 22 cultural sites. LAC recommended 17 as eligible for nomination to the National Register of Historic Places (NRHP) and five as ineligible. Final determinations of significance by BLM and development of protection or mitigation strategies would occur upon receipt of the inventory report.

3.3 Native American Religious Concerns

Traditional Cultural Properties (TCPs) are a separate class of cultural resources that may occur in the EA analysis area, may or may not coincide with archaeological sites and artifact loci, and may fall under the

purview of one or more of the cited legislation. The National Park Service has defined TCPs as follows (Parker and King 1998):

> A traditional cultural property can be defined generally as one (a property) that is eligible for the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community (Parker and King 1998).

Native American cultural associations are the "communities" most likely to identify TCPs, although TCPs are not restricted to this group. Some TCPs are well known, while others may only be known to a small group of traditional practitioners, or otherwise only vaguely known.

There are several pieces of legislation or Executive Orders that should be considered when evaluating Native American religious concerns. These govern access and use of scared sites, possession of sacred items, protection and treatment of human remains, and the protection of archaeological resources ascribed with religious or historic importance. These include the following:

- The American Indian Religious Freedom Act of 1978 (AIRFA; 42 USC 1996, PL 95-431 Stat. 469).
  - Possession of sacred items, performance of ceremonies, access to sites.
- Executive Order 13007 (May 24, 1996).
  - Access and use of sacred sites, integrity of sacred sites.
- The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 USC 3001, PL 101-601).
  - Protection, ownership, and disposition of human remains, associated funerary objects, unassociated funerary objects, sacred objects, or objects of cultural patrimony.
- The Archaeological Resources Protection Act of 1979 (ARPA; 16 USC 470, Public Law 96-95).
  - Protection or archaeological resources on federal and Indian lands.

For the proposed action alternative, efforts to identify Native American religious concerns included reviewing existing published and unpublished literature (e.g., Valkenburgh 1941, 1974; Brugge 1993; Kelly et al. 2006), personal communication with BLM staff, and coordination with the Navajo Nation and Southern Ute Indian Tribe (SUIT). According to the BLM/FFO, no known TCPs occur within the project area (Copeland, pers. comm., 2011). The BLM/FFO contacted the Navajo Nation and SUIT concerning the proposed action alternative in May 2011.

3.4 Water Quality—Surface and Groundwater

The proposed project area is located in the Upper Colorado River Hydrologic Region and is part of the San Juan River sub-region. The proposed project area is located within the Navajo Reservoir sub-watershed approximately 0.4 to 1 mile east of Navajo Reservoir. Navajo Reservoir consists of 19 river miles of permanent surface water impounded by Navajo Dam. The western side of Middle Mesa drains into the Los Piños River via Bonita and Wool canyons. The eastern side of Middle Mesa drains into the San Juan arm of the reservoir via Cotttonwood, Dick Earl, Negro Andy, and Spruce canyons. Cottonwood Canyon bisects the Middle Mesa portion of the Rosa Unit from north to south and is located

approximately 0.5 to 1 mile west of the eight proposed pad locations. There are no well-defined ephemeral drainages within the pad locations under the proposed action. There are no perennial water resources, springs, seeps, or wetlands within the proposed pad locations. One man-made stock pond is located at well pad #8. The stock pond is approximately 10 feet wide by 10 feet long. The pond discharge is armored by river rocks, and the diversion ditch created above the slope of the recontoured hill north of the existing well pads feeds the stock pond. The stock pond did contain water during the April 14, 2011, field survey.

The primary aquifers in the BLM/FFO area are the sandstone based Uinta-Animas and the Mesaverde. Groundwater is readily available in most of the BLM/FFO area and is of fair to poor quality. A search of the New Mexico State Engineer's Office Water Administration and Technical Engineering Resource System (WATERS) database for the proposed project area and vicinity (1-mile radius) was performed. The database has no records of water wells located with the proposed project area or a 1-mile radius.

3.5 General Topography/Surface Geology

Middle Mesa is a peninsular feature isolated by the Los Piños River on the west and the Navajo Reservoir San Juan arm to the east. The proposed pads would be located on the southeast portion of Middle Mesa an average of about 4,000 feet west of Navajo Reservoir San Juan arm and east of Cottonwood Canyon. The terrain within the area is characterized by eroded mesa tops and buttes with rocky terraced side slopes intertwined with narrow, deep canyons. Steep, sheer sandstone cliffs line the edge of Navajo Reservoir. Elevation within the project area ranges between 6,400 to 6,600 feet.

The principle geological formation underlying Middle Mesa portion of the Rosa Unit is the San Jose Formation (Manley et al. 1987).

3.6 Mineral Resources

Natural gas production in the San Juan Basin is the highest in the State of New Mexico, with approximately 844,000,000 thousand cubic feet (Mcf) produced in 2010 (NMOCD 2010). In the Four Corners region, the San Juan Basin covers an area of about 7,500 square miles across the Colorado/New Mexico border (USEPA 2004). The top of the Mancos Shale, the target formation evaluated in this document, is gradational with the Point Lookout Sandstone member of the Mesaverde Group, while the base contacts the Dakota Sandstone. Within the project area, Mancos Shale is located below the ground surface at a depth of 5,938 to 6,646 feet; the average of this maximum and minimum is 6,292 feet. A number of rock types including shale, sandstone, and limestone comprise Mancos Shale. These rock types tend to have low matrix porosity and permeability and therefore, better regarded as a source rock than a reservoir. An approximately 50 township area in northeast San Juan County and northwest Rio Arriba County, New Mexico demonstrates a gas-window level of maturity capable of producing economic quantities (Engler et al. 2001). In 1995, the U.S. Geological Survey assessed U.S. reserves and assigned an estimated 34 billion standard cubic feet to the "fractured Mancos" play. However, the FFO planning area RFDS noted that a possible multi-trillion cubic feet reserve might be realized over the 20-year planning period (Engler et al. 2001).

There are no coal mines or salable mineral extraction projects operating in the vicinity of the proposed project.

3.7 Soils

Soils in the San Juan Basin were formed primarily in two kinds of parent material: alluvial sediment and sedimentary rock. Alluvial sediment is material that was deposited in river valleys and on mesas, plateaus, and ancient river terraces. The material has been mixed and sorted in transport and is widely ranging in mineralogy and particle size. Sedimentary parent material consists mainly of sandstone and shale bedrock. These shale and resistant sandstone beds form prominent structural benches, buttes, and mesas bounded by cliffs.

Three major soil mapping units occur within the Middle Mesa portion of the Rosa Unit; Penistaja loam, gently sloping, Penistaja-Buckle association, and Travessilla-Weska-Rock outcrop complex, extremely steep (Keetch 1980).

Penistaja loam association, gently sloping occurs on mesas and plateaus with slopes ranging from 0 to 5 percent. The unit is comprised of alluvium and eolian material derived from sandstone and shale. Included in this unit are small areas of Travessilla and Weska soils on hills, breaks, and mesas; Twick soils on hills; and Buckle soils on fans. Permeability is moderate with high available water capacity. Effective rooting depth is 60 inches or more. Runoff is medium with the potential for water erosion moderate. The hazard of soil blowing is severe. The unit is used for livestock grazing, recreation, and wildlife habitat. Risk of corrosion for uncoated steel pipe is rated high. The potential as habitat for open land wildlife and rangeland wildlife is fair. The road rating for Penistaja soils is moderate due to the shrink/swell potential and low strength.

The Penistaja-Buckle soil unit is found on mesas, plateaus, fans, and in valleys with slopes from 0 to 5 percent. This unit is about 50 percent Penistaja loam, 35 percent Buckle silt loam, and 15 percent other soil inclusions. The Penistaja soil is deep and well drained, and was formed in alluvial and eolian material derived predominantly from sandstone and shale. The surface layer is typically brown loam about 3 inches thick. This soil has moderate permeability, high available water capacity, medium runoff, and a moderate potential for water erosion. The Buckle soil is deep and well drained, and was formed in alluvium derived predominantly from sandstone and shale. The surface layer is typically brown silt loam about 8 inches thick. This soil has moderately slow permeability, very high available water capacity, medium runoff potential, and a moderate potential for water erosion.

The Rock Outcrop-Travessilla-Weska soil unit is found on hills, breaks, and mesas with slopes of 30 to 70 percent. This unit is about 40 percent Rock outcrop, 30 percent Travessilla sandy loam, 20 percent Weska silty clay loam, and 10 percent other soil inclusions. Rock outcrop is exposed areas of barren sandstone. The Travessilla soil is very shallow and well drained, and is formed in residuum derived predominantly from sandstone. The surface layer is typically pale brown sandy loam about 1 inch thick. This soil has moderately rapid permeability, very low available water capacity, rapid runoff, and severe water erosion potential. The Weska soil is very shallow and well drained, and is formed in residuum derived predominantly from shale. This soil has moderately slow permeability, very low available water capacity, rapid runoff, and very severe water erosion potential.

3.8 Vegetation, Forestry

Extensive areas of Middle Mesa have undergone vegetation treatments. Beginning in the late 1960s, anchor chaining was conducted in piñon-juniper woodlands, and more recently prescribed fire and herbicide treatments have been employed to facilitate the growth of grasses and browse. Three major vegetation communities occur within the Middle Mesa portion of the Rosa Unit: reclaimed shrub grassland habitat associated with the existing disturbance, piñon-juniper woodland, and Great Basin desert scrub sagebrush series. The eight well pads under the proposed action would utilize previous disturbance associated with existing well pads, access roads, and pipeline corridors.

Dominant species in the reclaimed shrub grassland habitat include western wheat (*Pascopyrum smithii*), crested wheat (*Agropyron cristatum*), and smooth brome (*Bromus inermis*), with scattered four-winged saltbush (*Atriplex canescens*), rubber rabbitbrush (*Ericameria nauseosa*), and big sagebrush (*Artemisia tridentata*). Typically vegetative cover ranges widely from 2 to 70 percent in this vegetation type.

The piñon-juniper woodland is dominated by piñon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) with and understory dominated by broom snakeweed (*Gutierrezia sarothrae*), big sagebrush, Indian ricegrass (*Achnatherum hymenoides*), and James' galleta grass (*Pleuraphis jamesii*). Trees in the woodland vary widely in size and stature, and are a mix of juvenile and mature. Tree canopy varies within woodland areas and ranges from 25 to 40 percent with understory cover widely ranging from approximately 15 to 30 percent.

The Great Basin desert scrub sagebrush series is dominated by big sagebrush, broom snakeweed, Indian ricegrass, and James' galleta grass. Vegetative cover varies from an estimated 25 to 40 percent.

3.9 Invasive, Non-native Species

The BLM/FFO maintains a list of invasive, non-native plant species of concern. One BLM/FFO listed invasive and non-native plant species, musk thistle (*Carduus nutans*), was observed at proposed well pads #5, #6, and #8 during the field survey. On proposed well pad #5, the musk thistle was observed along the existing road. Musk thistle was observed on the edge of the proposed well pad #6. Proposed well pad #8 contained an approximate 10-foot by 20-foot patch of musk thistle on the southern side of the well pad within a reclaimed area. No other species listed as invasive, non-native species by the BLM were identified in the proposed project area.

3.10 Wildlife

The BLM is responsible for the stewardship and habitat for wildlife in the project area. The project area is part of the larger NMGFD Game Management Unit (GMU) 2B that includes all of Middle Mesa.

The vegetation in the project area generally consists of piñon-juniper woodlands on mesa tops and ridges with sagebrush grasslands at lower elevations. The natural vegetation has been highly disturbed since the late 1960s by mechanical and chemical treatments. Additionally, oil and gas activities have been underway for more than 50 years within the Middle Mesa Wildlife Area SDA.

A portion of Middle Mesa Wildlife Area is designated as critical deer winter range, and management objectives include measures to preserve and protect these ungulate species (USDI/BLM 2003*a*). However, little empirical data documenting Middle Mesa use by mule deer or elk exists. Annual aerial surveys are conducted by NMGFD in adjacent GMU 2A and 2C to the west and south of GMU 2B, respectively, but the most recent aerial survey of GMU 2B was in 1998. During the 1998 aerial survey, 63 mule deer and 57 elk were counted including 6 bucks, 34 doe, and 23 juveniles, and 7 bulls, 36 cows, and 14 juveniles, respectively (USDI/BLM 2008*a*).

In 2008, the BLM conducted several analyses to evaluate and describe the key aspects of wildlife SDAs in the FFO planning area as they pertain to big game. The key aspects that could be described at that point in time were animal density, condition of surrounding habitat, and the amount of existing disturbance. The analyses included the Middle Mesa SDA. The analyses used the following criteria: (1) a Thiessen polygon analysis of the oil and gas development within each SDA, (2) road density, and (3) browse studies (USDI/BLM 2008*a*). Within each SDA, the Thiessen polygon analysis used Geographic Information System (GIS) software to draw a polygon around each natural gas well pad that was equidistant from the nearest well pads resulting in a mean polygon size; the smaller the polygon, the greater the development. The mean polygon size for Middle Mesa was 59.9 acres. In comparison, Carracas Wildlife Area SDA had the lowest average polygon size of 58.6, while Thomas Canyon SDA had the largest polygon size at 526.9 acres. The BLM also calculated a road density of 2.29 miles of road per square mile in the Middle Mesa SDA. Seven browse studies were completed in Middle Mesa SDA following a modified Cole browse method resulting in an average score of 34.3. These descriptive statistics provided the bases for ranking wildlife SDAs and categorizing Middle Mesa as a moderate priority. A moderate priority SDA was considered to demonstrate suitable ecological conditions that would allow for exceptions to the winter closure COA (USDI/BLM 2008*a*). Additionally, in 2006 the BLM estimated 100 to 150 mule deer and less than 50 elk use all of Middle Mesa (USDI/BLM 2008*a*).

It is unclear whether deer and elk in the SDA are mostly year-round residents or migratory. The BLM speculates that most of the deer and elk in the project area are year-round residents (Hansen, pers. comm. 2011). Data collected by the SUIT on radio-collared mule deer since 2004 indicate that only about 10 percent of that nearby population is resident (Johnson pers. comm. 2011*a*). The Colorado Division of Wildlife (CDOW) Natural Diversity Information Source (NDIS) designates most of the area adjacent to Middle Mesa just north of the New Mexico-Colorado state line as winter range of some varying degree. During a field visit to the project area by an Ecosphere biologist on May 12, 2011, four cow elk were observed near proposed well pad #3, but no other ungulates were observed. Individual cattle, tracks, and scat were observed at all proposed well pad locations. Cattle were present in the project area during surveys conducted in April 2011, and the area is part of a BLM grazing allotment.

Ramakka (2011*a*) recently conducted browse and pellet surveys near the eight proposed well pads to assess use of the proposed project area by wintering mule deer. The surveys were observational only and included non-random transects of varying lengths and proximity to the eight well locations. He observed that pellet group numbers counted in sample plots were very low (Ramakka 2011*a*). Ramakka (2011*a*) indicated that vegetation within transects appeared to have undergone only very light browsing during the past winter and that shrub growth form was indicative of similar light use during the past several winters. Ramakka (2011*a*) surmised that because of very light browse during the past, assuming there was a period of relief from browsing pressure, no browsing had occurred that winter and a number of years had

likely passed since the plants were browsed. Further, he speculated most of the browsing he recorded was due to domestic cattle he observed in the field. He did not encounter any mule deer or elk during the 3 days of field surveys that were completed in late February and early March 2011.

Since 2004, a multi-year collaborative effort between the SUIT and the CDOW has been studying seasonal ranges and migration routes of mule deer in the HD Mountains east of Durango, Colorado, about 25 miles north of the project area. None of the radio collared deer captured to date in the HD Mountains use Middle Mesa as wintering habitat, but several deer do travel south and follow the San Juan River into New Mexico about 10 miles east of the project area, on the east side of Navajo Reservoir. Further, the mule deer sample studied do not use the proposed project area as wintering habitat (Johnson, pers. comm. 2011*a*).

Typically the amount of snow dictates how far south mule deer will travel in winter in search of food. The habitat adjacent to Middle Mesa just north of the New Mexico-Colorado state line is primarily irrigated pastureland. While deer are often observed all over pasturelands in this area (Johnson pers. comm. 2011*b*), it is likely less suitable habitat because it provides virtually no browse and little cover. The HD Mountains Mule Deer Monitoring Project is on-going and may provide helpful information in assessing the impacts to mule deer from oil and gas development, as well as determining meaningful mitigation measures to minimize impacts to mule deer, especially in winter.

Piñon-juniper and sagebrush grassland vegetation communities provide habitat not only for mule deer and elk, but a variety of other terrestrial wildlife species. Field visits to the project area were made by biologists from Ecosphere in April and May 2011. Common wildlife species, including herptiles and raptors that have been documented or have the potential to occur in the project area, include small mammals such as desert shrew (*Notiosorex crawfordi*), black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audobonii*), Gunnison's prairie dog (*Cynomys gunnisoni*), spotted ground squirrel (*Spermophilus spilosoma*), rock squirrel (*Spermophilus variegates*), pocket gopher (*Thomomys bottae*), white-tailed antelope squirrel (*Ammopermophilus leucurus*), deer mouse (*Peromyscus maniculatus*), northern grasshopper mouse (*Onychomys leucogaster*), and woodrat (*Neotoma* sp.). Bat species that may be found in the project area include Yuma myotis (*Myotis yumanensis*), California myotis (*Myotis californicus*), small-footed myotis (*Myotis leibii*), western pipistrelle (*Pipistrellus hesperus*), brown bat (*Eptisecus fuscus*), big hoary bat (*Lasiurus cinereus*), Townsend's big-eared bat (*Plecotus townsendi*), pallid bat (*Antrozous pallidus*), and Brazilian free-tailed bat (*Tadarida braziliensis*). Porcupine (*Erethizon dorsatum*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), long-tailed weasel (*Mustela frenata*), red fox (*Vulpes vulpes*), badger (*Taxidea taxus*), black bear (*Ursus americanus*), mountain lion (*Felis concolor*), and bobcat (*Felis rufus*) are larger mammals that may use the project area.

Reptiles that may commonly be found in the area are prairie rattlesnake (*Crotalus viridis*), collared lizard (*Crotaphytus collaris*), western whiptail (*Cnemidophorus tigris*), and bull snake (*Pituophis melanoeucus*).

Terrestrial invertebrates, namely moths, butterflies, wasps, ants, bees, beetles, and flies common to northwestern New Mexico, have potential to occur throughout the project area.

The project lies between the Los Piños River and Navajo Reservoir; however, no perennial lakes, rivers, or streams occur in the area to provide habitat for fish.

3.11 Federally Listed Threatened and Endangered Species

Under Section 7 of the ESA of 1973 (as amended), federal agencies are required to consult with the U.S. Fish and Wildlife Service (USFWS) on any proposed action alternative that may affect federally listed threatened or endangered species or species proposed for listing. In May 2011, a Biological Survey Report (BSR) for the proposed Middle Mesa POD was prepared by Ecosphere (Appendix C). The BSR addresses the potential for federally listed and other special status species to occur in the project area. Table 3-5 lists the federal species and summarizes the finding of the BSR.

Table 3-5. Habitat Descriptions and Presence of Federally Listed Threatened (T), Endangered (E), or Candidate (C) Species with Potential to Occur in San Juan County, New Mexico.

Species	Status	Habitat Associations	Presence [1]
Black-footed ferret (*Mustela nigripes*)	E	Open grasslands with year-round prairie dog colonies.	NP
Canada lynx (*Lynx canadensis*)	C	Generally occurs in boreal and montane forests dominated by coniferous or mixed forest with thick undergrowth.	NP
Southwestern willow flycatcher (*Empidonax traillii extimus*)	E	Breeds in dense, shrubby riparian habitats, usually in close proximity to surface water or saturated soil.	NP
Mexican spotted owl (*Strix occidentalis lucida*)	T	Nests in caves, cliffs, or trees in steep-walled canyons of mixed conifer forests.	NP
Yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	C	Breeds in riparian woodlands with dense, understory vegetation.	NP
Colorado pikeminnow *(Ptychocheilus lucius)*	E	Large rivers with strong currents, deep pools, and quiet backwaters.	NP
Razorback sucker *(Xyrauchen texanus)*	E	Medium to large rivers with silty to rocky substrates. Prefers strong currents and deep pools.	NP
Roundtail chub *(Gila robusta)*	C	Large rivers. Present in low numbers in the San Juan, Mancos, La Plata, and Animas rivers in Colorado and New Mexico.	NP
Knowlton's cactus *(Pediocactus knowltonii)*	E	Alluvial deposits that form rolling, gravelly hills in piñon-juniper and sagebrush communities (6,200-6,400 ft). A type locality of the Los Piños River area.	NP
Mancos milkvetch *(Astragalus humillimus)*	E	Cracks of Point Lookout Sandstone of the Mesa Verde series (5,000-6,000 ft).	NP
Mesa Verde cactus *(Sclerocactus mesae-verdae)*	T	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland Formations (4,000-5,550 ft).	NP

Note:
[1] K - Known, documented observation within project area; S - Suitable habitat and species suspected to occur within the project area; NS - Habitat suitable but species is not suspected to occur within the project area; NP - Habitat not present and species unlikely to occur within the project area.

No federally listed species with the potential to occur in San Juan County, or potential habitats for federally listed species, were observed within the proposed project area.

3.12 Special Status Species

In accordance with BLM Manual 6840, the BLM manages certain sensitive species not federally listed as threatened or endangered in order to prevent or reduce the need to list them as threatened or endangered in the future. Included in this category are federal candidates or proposed species that receive no special

protections under the ESA. Special status species and their potential to occur in the proposed project area are listed in Table 3-6. The BSR in Appendix C provides the basis for the findings listed in the table.

Table 3-6. BLM/ Special Status Species, Habitat Associations, and Potential to Occur in the Project Area.

Species	Habitat Associations	Presence [(1)]
Golden eagle *(Aquila chrysaetos)*	In the west, mostly open habitats in mountainous, canyon terrain. Nests primarily on cliffs and trees.	S
Burrowing owl *(Athene cunicularia)*	Rarely dig their own burrows and are typically associated with prairie dog colonies.	NP
Mountain plover *(Charadrius montanus)*	Breeds in flat, open grasslands; often associated with prairie dog towns and intensive grazing.	NP
Yellow-billed cuckoo *(Coccyzus americanus occidentalis)*	Breeds in riparian woodlands with dense, understory vegetation.	NP
Prairie falcon *(Falco mexicanus)*	Found in arid, open grasslands and shrub-steppe habitats. Prairie falcons require cliffs for nesting.	NP
American peregrine falcon *(Falco peregrinus anatum)*	Rugged terrain with rocky cliffs and canyons (30-1,000+ ft high), adjacent to rivers, lakes, or streams. Urban areas with towers and buildings are also inhabited.	S
Bald eagle *(Haliaeetus leucocephalus)*	Nests in forested areas adjacent to large bodies of water.	S
Aztec gilia *(Aliciella formosa)*	Salt desert scrub communities in soils of the Nacimiento Formation (5,000-6,000 ft).	NP
Brack's hardwall cactus *(Sclerocactus cloveriae ssp. brackii)*	Sandy clay of the Nacimiento Formation in sparse shadscale scrub (5,000-6,000 ft).	NP

Note:
[(1)] K - Known, documented observation within project area; S - Habitat suitable and species suspected to occur within the project area; NS - Habitat suitable but species is not suspected to occur within the project area; NP - Habitat not present and species unlikely to occur within the project area.

The proposed project area contains potential habitat for three BLM/FFO special management species: golden eagle (*Aquila chrysaetos*), American peregrine falcon (*Falco peregrinus anatum*), and bald eagle.

Navajo Reservoir, located east and southeast of the proposed project area, provides perching, roosting, and foraging opportunities for bald eagle; however, this species is not known to nest in San Juan County (USDI/BLM 2003*a*). Bald eagles are common winter residents in the area. Three BLM-designated Bald Eagle Area of Critical Environmental Concern (ACEC) units are located within the Middle Mesa portion of the Rosa Unit; San Juan #5, #6, and #7 units. These three ACEC units are located within 2,250 feet of the proposed well pads #7 and #8, and the proposed southern remote stimulation pad. The proposed well pad #7 is located adjacent to the boundary of the San Juan #7 Unit (Appendix A, Figure 3). Because of the project area's proximity to Navajo Reservoir, and designated ACEC units, bald eagles are likely to occur in the area between November and March.

According to the BLM/FFO, there are three recorded historic or currently active golden eagle nests and three American peregrine falcon nests within 15 miles of the project area (USDI/BLM 2010*a*,

unpublished data). Estimated home range during nesting of American peregrine falcons in Enderson and Craig, Colorado, was found to be between 138 to 582 square miles (White et al. 2002).

The open scrubland throughout the proposed project area is excellent foraging habitat for golden eagles. The proposed area of disturbance associated with the proposed action was not found to contain suitable nesting substrate for any of these raptor species. Average hunting territory size for golden eagles was found to be 19 to 59 square miles in California and 25 to 35 square miles in Utah (Weidensaul 1996).

Given the distance of known territories and suitable nesting habitat from the proposed location and the possibility of yet undocumented territories, these raptor species may forage in the proximity or fly through the proposed action alternative area.

The proposed project area does not contain potential habitat for any other BLM, special status species. No special status species, or signs of, were observed during the field investigations conducted in April and May 2011.

3.13 Migratory Birds

Under the Migratory Bird Treaty Act (MBTA) and Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," federal agencies are required to consider management impacts to migratory nongame birds. While all migratory songbirds are protected by law, certain species have been determined to be at greater risk than others. There are slightly over 350 avian species in San Juan County and the surrounding area administered by the BLM/FFO. A total of 136 species have been confirmed as breeding in San Juan County with likely additional species if one considers the adjacent counties within the FFO area. Data collected through breeding bird surveys coordinated by the USFWS as well as other private sector efforts have provided the basis for the New Mexico Partners in Flight (NMPIF) organization to develop bird "Watch Lists" and the USFWS's "Birds of Conservation Concern List." The proposed project area contains two community types addressed in these documents: Great Basin desert scrub and piñon-juniper woodland. Some of the birds listed as "Highest Priority" by the NMPIF group as well as USFWS "Birds of Conservation Concern" includes the ferruginous hawk (*Buteo regalis*), gray vireo (*Vireo vicinior*), piñon jay (*Gymnorhinus cyanocephalus*), and juniper titmouse (*Baeolophus ridgwayi*).

The NMPIF Group has identified priority species of birds for the State of New Mexico by habitat type. The FFO area lies within the Colorado Plateau physiographic region as identified by the NMPIF. The Bird Conservation Plan developed for the State of New Mexico by NMPIF lists the sage thrasher (*Oreoscoptes montanus*) and sage sparrow (*Amphispiza belli*) within the Great Basin Desert Shrub habitat type as "highest priority" species for conservation (NMPIF 2007).

Priority species in piñon-juniper woodland include gray vireo, piñon jay, and juniper titmouse. Most of the priority bird species identified by the NMPIF also occur on the USFWS Division of Migratory Bird Management "Birds of Conservation Concern 2008" within Bird Conservation Region 16–Southern Rockies/Colorado Plateau. Birds included on this list are those "species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973" (USFWS 2008).

The piñon-juniper woodland in and surrounding the proposed project area provides foraging and roosting habitat for large raptors, including golden eagles, bald eagles, peregrine falcons, prairie falcons, and red-tailed hawks (*Buteo jamaicensis*). A variety of bird species may be found in the proposed project area such as Bendire's thrasher (*Toxostoma bendirei*), loggerhead shrike (*Lanius ludovicianus*), and vesper sparrow (*Pooecetes gramineus*). Certain birds, including the juniper titmouse, western scrub jay (*Apelocoma californica*), and bushtit (*Psaltriparus minimus*), nest almost exclusively in piñon-juniper habitats. Mountain chickadees (*Parus gambeli*), black-throated gray warblers (*Dendroica nigrescens*), and blue-gray gnatcatchers (*Polioptila caerulea*) also occur in this community (NMPIF 2007).

Important Bird Areas are sites that provide essential habitat for one or more species of bird. Important Bird Areas include sites for breeding, wintering, and/or migrating birds. A site may be important at the global, continental, or state level. Important Bird Areas help support species of conservation concern (e.g., threatened and endangered species), restricted-ranges species, species that are vulnerable because their populations are concentrated in one general habitat type or biome and species, or groups of similar species (that are vulnerable because they occur at high densities due to their congregatory behavior (http://www.audubon.org/bird/iba/ prog_status.html). There are no Important Bird Areas identified within the project area or vicinity.

No raptors or sign of consistent raptor use, including nests or whitewash, were observed within an approximate 0.3-mile radius of the proposed project area.

3.14 Livestock Grazing

The BLM/FFO manages 167 grazing allotments with 351 grazing authorizations that permit cattle, sheep, and horse grazing within the resource area. Of the 351 grazing authorizations, 317 are permitted under Section 3 of the Taylor Grazing Act. Of the 167 grazing allotments, there are four authorizations issued under Section 15 of the Taylor Grazing Act to the Navajo Tribe that authorizes grazing on 35 allotments. Additional Section 15 authorizations permit grazing on 30 allotments in the Lindrith, New Mexico, area.

The proposed project is located within BLM grazing allotment #5056 (Middle Mesa AMP). Allotment #5056 is permitted annually from March 1 through February 28 for 268 cattle for a total of 2,798 animal unit months (AUMs).

3.15 Socioeconomics

The socioeconomic impacts of the Middle Mesa POD alternatives are related to the jobs, wages, spending, and tax revenues generated by POD. This analysis focuses on the government revenues from natural gas production because the detailed data necessary to estimate the other impacts is not available with the POD. By focusing on government revenues generated by natural gas production, this analysis underestimates the total socioeconomic impacts by not including direct government revenues from other taxes such as gross receipts tax on industry spending, indirect government revenues from personal and corporate income taxes, as well as the economic impacts of employment and household spending.

The natural gas produced in Middle Mesa is located in San Juan County, New Mexico. Therefore, impacts to government revenues from severance taxes and royalties would affect San Juan County, the State of New Mexico, and the U.S. Federal government. Total natural gas production in San Juan County

was 550 billion cubic feet (bcf) in 2009. Using an average price of $4.60 per thousand cubic feet (Mcf) for 2009, the estimated value of this natural gas production was $2.5 billion dollars (IPANM 2011). In San Juan County, the average tax rates for the four natural gas production taxes total 8.84 percent of production value (Lillywhite and Starbuck 2008). In 2009, these production taxes from both oil and gas production in San Juan County amounted to over one-third of San Juan County's General Fund Revenue.

The State of New Mexico collects oil and gas production taxes and distributes the revenue as follows: about one-third goes to the State General Fund, about one-quarter goes to local schools, about one-fifth goes to the State Severance Tax Bond Fund and the Land Grant Permanent Fund, and the remainder to local governments and state institutions (Headwaters Economics 2011). In Fiscal Year 2009, more than 18 percent of the State General Fund (almost $1 billion) was funded by taxes on oil and gas production (Starbuck 2009).

In addition to State taxes, Federal Royalty of 12.5 percent is levied on the natural gas produced on BLM lands (Headwaters Economics 2011). About half of this royalty payment is returned to New Mexico and the other half is retained by the U.S. Treasury. In 2009, the Federal Royalty revenue from natural gas production in San Juan County is estimated to be more than $300 million.

3.16 Environmental Justice

President Clinton's Executive Order 12898 on February 11, 1994, requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States…" (Executive Order 12898). The CEQ guidance on incorporating environmental justice into NEPA analysis notes that "In order to determine whether a proposed action alternative is likely to have disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Indian tribes, agencies should identify a geographic scale for which they will obtain demographic information on the potential impact area. Minority populations should be identified where… b) the minority population percentage of the affected area is meaningfully greater than the minority population in the general population or other appropriate unit of geographic analysis." The same guidance is given for measuring low-income populations. Usually, this is measured by comparing the individual poverty rate for the affected area to a comparison area.

To determine whether a risk or rate of hazards exposure by a vulnerable population such as minority or low-income population is significant according to NEPA, CEQ guidance requires that the risk or rate "much appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards." Therefore, the Environmental Justice impact analysis compares the risk and rate of adverse impacts associated with the proposed action alternative (primarily human health impacts) for the affected area to a comparison group to determine whether there are significant Environmental Justice impacts.

The minority population and poverty rate for the San Juan County, New Mexico, is included in Table 3-7. While the individual poverty rate is comparable but lower than the state average, San Juan County has a

significantly higher portion of minority population than the remainder of New Mexico because more than half of the County's land area is located on the Navajo Reservation. Therefore, potential disproportionate impacts on minority populations must be considered for the alternatives.

Table 3-7. Potential Affected Populations for Environmental Justice Impacts

County	Population (2010)	Percent Minority Population (2009)	Individual Poverty Rate (2008)
San Juan County	133,170	42%	14%
New Mexico	2,010,000	16%	17%

Source: U.S. Census 2010.

3.17 Recreation

The proposed project area vicinity provides dispersed recreation opportunities such as hiking, mountain biking, horseback riding, and hunting. Navajo Reservoir was formed after the construction of Navajo Dam across the San Juan River. The waters of Navajo Reservoir have backed up some 30 miles upstream of the dam along the river and lesser distances along various tributaries. Although all branches are quite narrow, the lake has a considerable area and offers numerous recreational activities. Nearby Navajo Reservoir provides for concentrated water sports such as boating and jet skiing, as well as camping. Navajo Reservoir also offers fishing opportunities for native and non-native sport fishes. Navajo State Park is less than 1,300 feet southwest from the proposed well pad #8.

3.18 Transportation and Traffic

In the PRMP/FEIS, the transportation infrastructure serving the planning area is described as a regional network of federal and state highways with U.S. Highway 550 serving as the major highway link between Aztec, Farmington, and Bloomfield, and the oil and gas fields. (USDI/BLM 2003*a*, page 3-57). For the Middle Mesa POD, the point of origin for the majority of traffic is assumed to be Aztec, New Mexico. The proposed travel route from Aztec to Middle Mesa will use these roads: U.S. Highway 550, La Plata County Road 310, Colorado Highway 172, Colorado Highway 151, La Plata County Road 328, San Juan County Road 4010, and San Juan County Road 4018. All of these roads are paved except for San Juan County Roads 4010 and 4018, which have a gravel surface.

Recent analysis by the New Mexico and Colorado Departments of Transportation found that capacity of U.S. Highway 550 would be inadequate to meet forecasted traffic growth (CDOT 2005). Before improvements completed in 2007, U.S. Highway 550 could accommodate 7,800 to 9,800 vehicles per day and maintain an acceptable level of service. The forecasted daily vehicle count for U.S. Highway 550 in 2025 is approximately 15,000 vehicles per day (CDOT 2005). Therefore, improvements to U.S. Highway 550 were recommended and implemented to accommodate the anticipated level of traffic.

3.18.1 Baseline Traffic Conditions

Traffic conditions for the road segments with available data along the travel route from Aztec to Middle Mesa are summarized in Table 3-8 with Average Annual Daily Traffic (AADT) estimates for 2010 and 2030 (CDOT 2011, NMDOT 2009).

Table 3-8. Traffic Conditions along Travel Route from Aztec to Middle Mesa

Road Segment	AADT 2010	Estimated AADT 2030
U.S. Highway 550 North of Aztec (2009 data)	8,400	12,600
U.S. Highway 550 at Stateline	4,900	7,000
Colorado Highway 172 south of Colorado Hwy 151	6,000	9,500
Colorado Hwy 151 east of Colorado Hwy 172	3,400	4,800

Generally, these road segments are forecasted to have substantial increases in traffic levels during the next 20 years. Regional transportation planning authorities, such as in San Juan County, New Mexico, and La Plata County, Colorado, have developed plans to modify the transportation infrastructure to accommodate this growth.

3.19 Visual Resources

The project area is within the San Juan Basin, an area visually characterized by steep colorful escarpments, mesas, plains, dunes, and sheer-walled canyons. The project area is located on Middle Mesa east of Navajo Reservoir. Portions of the project area are visible from Navajo Reservoir. Proposed well pads #1, #7, and #8 are visible from the reservoir.

The BLM has stewardship responsibility to identify and protect visual values on public lands. Visual Resource Management (VRM) objectives are developed by determining the extent and quality of visual resources by utilizing the Visual Resource Inventory (VRI) process. After the VRI is completed, visual resources are weighed along with all other resource allocations identified during the RMP development process. A VRI was conducted between 1978 and 1980 within the planning area, and VRM management classes were assigned in the 1988 RMP. The 2003 RMP carried forward the VRM class designations from the 1988 RMP pending completion of a new VRI and RMP amendment, if necessary.

The VRM classification system is designed to maintain or enhance visual qualities and describe the different degrees of modification to the landscape (BLM 2003*a*). Modifications to the visual resource must follow the guidelines for the types of change suitable for each class. The proposed action would be located in a Class II VRM area (BLM/USDI 2003*a*). Management objectives for the Class II VRM are to retain the existing character of the landscape and the level of change should be low.

In 2009, an updated VRI was completed for the FFO planning area. The VRI identified the proposed project area as displaying Class IV VRM values based on landscape changes over the last 30 years.

In June 2011, the BLM/FFO filed a Notice of Intent (NOI) to amend the RMP (BLM/USDI 2003*a*) and prepare an associated EA to address the VRM in the planning area. The 2009 VRI will form the basis of

the analysis in the RMP amendment. The FFO will analyze issues during the amendment process and will continue to honor all valid existing rights and other planning criteria listed in the NOI.

3.20 Noise

In the PRMP/FEIS, noise is defined as unwanted or annoying sound that is associated with human activity and interferes with or disrupts normal activities (USDI/BLM 2003*a*, page 3-93). Noise from oil and gas compressors has been identified by the public as an issue of primary concern in the FFO planning area. Generally noise is perceived as an annoyance to residents and visitors near the noise source. The response of individuals to similar noise events is diverse and influenced by the type of noise, perceived importance of the noise and its appropriateness in the setting, time of day and type of activity during which the noise occurs, and sensitivity of the individual (USDI/BLM 2003*a*, page 3-93).

Noise is measured in decibels (dBA). Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort. Noise levels at a distance of 50 feet from the source for typical oil and gas activities are approximately 83 dBA for well drilling, 71 dBA for produced water injection facilities, and 89 dBA for gas compressor facilities (USDI/BLM 2003*a*, page 3-93). In the planning area, noise from compressor station operations represents the largest and longest term noise source associated with natural gas production. Sound levels measured at existing oil and gas facilities range from 44 to 69 dBA at a distance of 500 feet from a compressor station (USDI/BLM 2003*a*). Therefore, based on the distance from facilities such as compressor stations or other infrastructure, the baseline noise levels in this area are likely to range from 44 to 69 dBA.

The proposed project is located within close proximity to Navajo Lake State Park. The U.S. Bureau of Reclamation (USBR) managed lands around Navajo Reservoir are classified as Noise Sensitive Areas (NSA). Bald eagle ACEC units are also designated as NSAs. For these boundary-focused NSAs, the Notice to Lessee (NTL) 03-1 (FFO) applies. For noise sources located outside boundary-focused NSAs, the standard is 48.6 dBA Equivalent Continuous Noise Level at 400 feet in all directions from the noise source.

3.21 Wastes—Hazardous or Solid

The Resource Conservation and Recovery Act (RCRA) passed in 1976, establishes a comprehensive program for managing hazardous wastes from the time they are produced until their disposal. The USEPA regulations define solid wastes as any "discarded materials" subject to a number of exclusions. A "hazardous waste" is a solid waste that (1) is listed by the USEPA as a hazardous waste, (2) exhibits any of the characteristics of hazardous wastes (ignitability, corrosivity, reactivity, or toxicity), or (3) is a mixture of solid and hazardous waste. A 1980 amendment to RCRA conditionally exempted from regulation as hazardous wastes, "drilling fluids, production waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas." On July 6, 1988, USEPA determined that oil and gas exploration, development, and production (EDP) wastes would not be regulated as hazardous wastes under RCRA. A simple rule of thumb was developed for determining if an EDP waste is likely to be considered exempt or non-exempt from RCRA regulations: If (1) the waste came from down-hole, or (2) the waste was generated by contact with the oil and gas production stream during removal of produced water or other contaminants, the waste is most likely to be considered exempt by

USEPA. The CERCLA, passed in 1980, deals with the release (spillage, leaking, dumping, accumulation, etc.) or threat of a release of hazardous substances into the environment. Despite many oil and gas constituent wastes being exempt from hazardous waste regulations, certain RCRA exempt contaminants could be subject to regulations as hazardous substances under CERCLA. The NMOCD administers hazardous waste regulations for oil and gas activities in New Mexico.

3.22 Public Health and Safety

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

4. ENVIRONMENTAL CONSEQUENCES

Environmental resources can be affected in many ways during implementation of the proposed action alternative. The effect, or impact, is defined as any change or alteration in the pre-existing condition of the environment produced by the proposed action alternative, either directly or indirectly. This chapter analyzes the environmental consequences of the no action and proposed action alternative.

Impacts can be either long-term (permanent, residual) or short-term (incidental, temporary). Short-term impacts affect the environment for only a limited time period and the environment usually reverts rapidly to the pre-construction condition. Short-term impacts are often disruptive and obvious. Long-term impacts are substantial and permanent alterations to the pre-project environment. The BLM defines long-term impacts as those impacts whose results endure more than 5 years. Impacts may be irreversible or residual and affected resources irretrievable.

For the purpose of this EA, potential impacts have been divided into three categories:

High – as defined in CEQ guidelines (40 CFR 1500-1508), impacts that are substantial in severity and therefore should receive the greatest attention in decision making.

Moderate – impacts that cause a degree of change that is easy to detect but do not meet the criteria for significant impacts.

Low – impacts that cannot be easily detected and cause little change in the existing environment.

4.1 Methodology Assumptions for Impact Analysis

The BLM issued the oil and natural gas leases covering the Rosa Unit portion of Middle Mesa in 1948 to Williams and the leases were unitized that same year. Under the no action alternative, Williams could continue to develop the Rosa Unit Middle Mesa area consistent with the existing lease rights and current NMOCD spacing requirements.

Therefore, Williams would continue to develop the Basin Mancos pool at 80-acre spacing in the project area using vertical/directional (non-horizontal) drilling with the seasonal closure in place. In order to provide a comparative analysis between the alternatives, an RFDS was developed that could occur under the no action. Based on reservoir characteristics, current spacing regulations, and economics, the future development that could occur under the no action was projected for this analysis.

For the purposes of this analysis, the RFDS projects that 45 non-horizontal Basin Mancos/Mesaverde wells could be drilled to develop the reserves in the Middle Mesa portion of the Rosa Unit. Williams would attempt to twin (co-locate) the majority of these wells. Drilling would be expected to continue at its present pace, utilizing rigs from the current San Juan fleet. To twin or co-locate a well using existing rigs from the fleet, wellheads are offset by 50 feet given the rig's configuration. This offset requires a larger amount of surface disturbance as more wells are placed on one well pad. Thus, it may not be feasible to physically expand some individual well pads to support multiple well heads due to topography, cultural resources, and other natural resource concerns. Therefore, for this analysis, it is estimated that approximately 80 percent of these wells could be twinned with existing locations, while the remaining 20

percent (9 of 45) could require construction of a new well pad, access road, and pipeline in order to access the pool target zone.

Under the no action alternative, commingling of Basin Mancos wells with Mesaverde wells would be necessary to produce economical gas quantities. Stand-alone Basin Mancos wells would not produce sufficient gas volumes to offset the cost of drilling and maintenance. Commingling wells allows for two zones of production from one well bore.

Although Williams has identified 40-acre parcels available for drilling, the exact surface locations of the Basin Mancos/Mesaverde well pads cannot be determined at this time, as that would require extensive on-the-ground surveying and analysis. The actual number of wells to be drilled is subject to economic and technological considerations, but these numbers are presented to allow for analysis and comparison and are based on the best available information.

For this analysis, the surface disturbance for Basin Mancos/Mesaverde wells is estimated using the following assumptions: (1) 5.5 acres of short-term disturbance for new well pad locations with 3 acres reclaimed after completion, resulting in 2.5 acres of long-term disturbance; (2) the size of an existing pad would be expanded by 2.75 acres of short-term disturbance with approximately 1 acre of long-term disturbance following reclamation; and (3) estimated road and pipeline disturbance would follow the analysis in the PRMP (USDI/BLM 2003*a*) that is an average of 1.5 acres of short-term disturbance decreasing to 1 acre of long-term disturbance, based on an average length of 800 feet by 50 feet wide (USDI/BLM 2003*a*).

Total estimated surface disturbance associated with the no action alternative is shown in Table 4-1. Total short-term disturbance is estimated to be 162 acres with long-term disturbance totaling 72 acres. Based on the current drilling rate of 10 wells per year with the seasonal closure in effect, it would take approximately 5 years for Williams to develop all of the acreage in the Middle Mesa portion of the Rosa Unit.

Table 4-1. Estimated Surface Disturbance Associated with the No Action Alternative.

Type	Number of Wells and Pads	Short-term Disturbance (Acres)	Long-term Disturbance (Acres)
Twinned well pads	36	99	36
New well pads	9	49.5	27
New roads/pipelines	0	13.5	9
Total	45	162	72

Well Drilling

Each well drilling pad would be approximately 300 by 500 feet in dimension with a 50-foot-wide construction zone around the perimeter of the pad for a total of 5.5 acres of disturbance. A representative well pad layout diagram is included in Appendix B. For twinned well locations, no new access roads would be required. New access roads and pipeline right-of-ways (ROWs) would be needed for new well pad development.

Construction activities associated with the no action would include well pad construction, drilling, stimulation, and completion of the proposed natural gas wells, and the installation of any surface equipment necessary for natural gas production. At each drilling well pad, construction crews would remove vegetation from the proposed location, and the existing pad would be expanded or a new pad would be created. Cuts and fills would vary based on the topography at each well location. Clearing and leveling is needed to provide a level surface for rig and equipment access. Excavated materials from the cuts would be used on the fill portion of the location to level the pad. Included in the pad construction would be excavation of a 150-foot by 100-foot cuttings pit, and a reserve pit to contain drilling fluids. A blow pit would be used to burn excess gas during drilling to relieve wellbore pressure. Natural gas well drilling facilities assembly would occur on the well pad after site clearing and leveling. Drilling equipment located on each drilling pad would include: the drilling rig and associated equipment (e.g., blow out preventer, gas buster, etc.), pipe storage, and housing trailers for personnel.

Drilling operations would utilize water-based mud. Water-based cuttings would be disposed of on site in a temporary pit.

Stimulation Activities

Well stimulation equipment would be located on site. Water would be needed to achieve maximum well stimulation potential. Williams proposes to truck produced water gathered from existing wells in the Rosa Unit to tanks located on site to store water used for stimulation. Other equipment would include pumps, engines, and flow lines. Large water volumes would be needed to stimulate each Basin Mancos well. Two different stimulation fluid designs are under consideration: slickwater and gelled water. More information on the stimulation fluid components (chemicals) in these designs can be found at the website www.hydraulicfracturingdisclosure.org.

Reclamation

The well pads would be partially reclaimed following drilling operations. A portion of the pad not required for production equipment and vehicular access would be re-contoured and seeded per the site-specific COAs determined by the BLM/FFO. Approximately 1-acre for production facilities on each well pad would remain in use for production and vehicle access. These areas would be reclaimed after final abandonment of the wells. Production equipment that would remain on site would include the wellheads, production unit separators, and meter runs. Ancillary equipment such as a Christmas tree, compressor, storage tank(s), dehydrator, and separator could also be installed at the well pad site. Equipment would be powered by gas compression engines.

Design Features

The environmental effects are analyzed assuming that design features are in place and are successful. For the no action, standard design features include but are not limited to:

1. To the extent practicable, well drilling pads will be twinned or co-located to minimize surface disturbance.
2. Implementation of adequate casing, cementing, mud weights, and blowout preventer.
3. Produced water will be used for well stimulation and will be recycled.

4. Engines will be equipped with mufflers. Barriers or other sound-proofing measures will be implemented, if needed, to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the Jurisdiction of the Farmington Field Office NTL 03-1 FFO.
5. During drilling, stimulation, and completion, a trash receptacle and a chemically treated portable toilet will be on location for trash and sewer disposal.
6. All wastes will be disposed of in a proper manner as required by federal and state law and as described in the COAs.
7. Any spills will be promptly cleaned up and Williams will prepare a hazardous material response contingency plan to cover an accidental release of hazardous materials.
8. No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of 6 inches deep, the soil shall be deemed too wet to adequately support construction equipment.
9. The top 6 inches of soil will be stockpiled during well pad construction and drilling, and then respread during interim reclamation.
10. The construction zone will be recontoured and reclaimed following well drilling.
11. Disturbed areas will be seeded with a BLM seed mix as outlined in the COAs.
12. All above ground structures not subject to safety requirements shall be painted to blend with the natural color of the landscape. A reflective material may be used to reduce hazards that may occur when such structures are near roads.

4.1.1 Summary Comparison of Alternatives

Under both alternatives, before development, each well pad and/or stimulation pad would be subject to site-specific environmental analysis at the time of APD submittal.

Table 4-2 provides a summary comparison between the alternatives that includes the estimated number of wells, the number of wells drilled during the winter closures, surface disturbance, and duration of drilling.

Table 4-2. Summary Comparison of Alternatives

	Number of Wells	Number of Wells Drilled During the Winter Closure	Short-term Disturbance (Acres)	Long-term Disturbance (Acres)	Duration of Drilling (Years)
No Action	45	0	162	72	5
Proposed Action[(1)]	65	20	52	8	5

Note:
(1) Total of 53 Basin Mancos wells plus 12 Mesaverde wells.

4.2 Air Resources

Impacts to air resources are determined by estimated changes to ambient air concentrations for criteria air pollutants associated with the alternatives. On June 23, 2011, a Memorandum of Understanding (MOU)

between the U.S. Department of Agriculture (USDA), USDI, and USEPA was signed. The purpose of this MOU is to set forth expectations and agreements for addressing air quality analyses and mitigation measures through the NEPA process related to federal oil and gas planning, leasing, or field development decisions (USDA 2011). When preparing an EA for a federal oil and gas decision where air quality or air quality related values are issues warranting NEPA analysis, the Lead Agency will consider following the procedures established in the MOU. Section X, B (Implementation) of the MOU states that within 90 days of the effective date, BLM, USEPA, and U.S. Forest Service will coordinate to: develop agency and joint plans for implementing and disseminating the MOU, develop appropriate joint training efforts and materials, and designate national senior level managers to oversee implementation of the MOU (USDA 2011).

The reasonable and foreseeable development scenario developed for the FFO planning area RMP forecasted that 9,942 wells would be completed on existing and new leases for Federal minerals within the planning area. (USDI/BLM 2003*a*, page 4-105). This development level would average 497 wells being completed annually Since 2000, an average of 459 wells have been drilled annually. Because the level of activity and oil and gas development for the alternatives are consistent with those levels predicted in the RFDS, the potential air quality impacts of the alternatives are included in the FEIS and were considered in the ROD (USDI/BLM 2003*b*, page 13. Further NEPA analysis will be conducted during the implementation of POD, if approved. At that time, the detailed data required for emissions analysis will be available.

4.2.1 Direct and Indirect Impacts

4.2.1.1 No Action Alternative

The air emissions and associated air quality impacts for the no action alternative are consistent with the air emissions for the RFD considered in the ROD for the PRMP/FEIS. The ROD found that "With the additional mitigation, BLM expects that significant impacts to air quality will be avoided and that oil and gas operations will meet all applicable air quality standards" (USDI/BLM 2003*b*, page 13). Therefore, there would be no significant air resource impacts under the no action alternative.

4.2.1.2 Proposed Action

Impacts under the proposed action would be similar to those of the no action. However, with the implementation of design features air emissions are expected to be less than the no action. The design features included in the Middle Mesa POD for the proposed action alternative that could decrease air emissions include implementing natural gas-fired generators for the drill rig and minimizing vehicle-trips.

4.3 Cultural Resources

4.3.1 Direct and Indirect Impacts

4.3.1.1 Impacts Common to All Alternatives

Direct effects normally include alterations to the physical integrity of a cultural resource. If a cultural resource is significant for other than its scientific information, direct effects may also include the

introduction of audible, atmospheric, or visual elements that are out of character for the cultural site. A potential indirect effect could be the increase in human activity or access to the area with the increased potential of unauthorized removal or other alteration to cultural resources in the area.

Effects to significant cultural sites would be avoided by adherence to BLM/FFO cultural resources requirements, based on the archaeological survey report recommendations and the results of the BLM field check. These requirements would be detailed in the Cultural Resource Record of Review, attached to the COAs in each APD. No construction would be permitted until the Cultural Resource Record of Review is completed. Mitigations may include, but are not limited to, temporary or permanent fencing or other physical barriers, monitoring of earth-disturbing construction, project area reduction and/or specific construction avoidance zones, and employee education. All employees, contractors, and sub-contractors of the project would be informed by the project proponent that cultural sites are to be avoided by all personnel, personal vehicles, and company equipment, and that it is illegal to collect, damage, or disturb cultural resources, and that such activities are punishable by criminal and/or administrative penalties under the provisions of the ARPA (16 USC 470aa-mm).

In the event of a discovery during construction, the project proponent 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., National Register, NAGPRA, ARPA), it would be protected in place until mitigating measures can be developed and implemented according to guidelines set by the BLM.

Detailed cultural resource inventory data would be complied for specific drilling locations pursued in the future and would be in accordance with the *Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities* (USDI/BLM 2005). Prior to the submittal of APDs for development of the individual well locations, site-specific cultural resource inventory reports would be submitted to the BLM/FFO. Typically, previous Section 106 consultations for natural gas wells in the FFO have resulted in determinations no effect.

4.3.1.2 No Action

Although 40-acre spacing units have been identified for future drilling, site-specific drilling locations under the no action alternative have not been identified. The no action alternative would disturb approximately 162 acres compared to 52 acres under the proposed action alternative. This would increase the potential to impact cultural resources.

4.3.1.3 Proposed Action

The eight proposed well pads were staked to avoid cultural resources; those that could not be avoided were tested to a point where ineligibility for National Register nomination recommendations would be made. The proposed action would disturb 68 percent less acreage than the no action, decreasing the potential to impact cultural resources.

4.4 Native American Religious Concerns

4.4.1 Direct and Indirect Impacts

4.4.1.1 No Action

Site-specific drilling locations under the no action alternative have not been identified. Identification efforts and consultations for Native American religious concerns would be conducted following identification of specific locations and the site-specific environmental analysis.

4.4.1.2 Proposed Action

The proposed action alternative is not known to physically threaten any TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere or otherwise hinder the performance of traditional ceremonies and rituals pursuant to the AIRFA or Executive Order 13007. Currently, no known remains fall within the purview of the NAGPRA or the ARPA. In the event of any discoveries during project implementation, the BLM/FFO will be notified.

4.5 Water Quality–Surface and Groundwater

Key factors that influence the surface water quality in the San Juan drainage basin include some or all of the following: sparse vegetative cover, highly erosive and saline soils, rapid runoff, livestock grazing, and mineral resource development.

4.5.1 Direct and Indirect Impacts

4.5.1.1 Impacts Common to All Alternatives

Under both alternatives, vegetation removal and soils disturbance would result in an undetermined increase in sediment transfer. These increases would be expected to be minimal, localized, and proportional to the amount of disturbance. Sediment transfer reaching waterways would result in short-term impacts to surface water quality. These impacts would be greater during and following storm events when soils are more prone to mobilization. Impacts to water quality from sedimentation would continue until the disturbed areas are stabilized, and therefore would be short-term in duration. As of June 12, 2006, Stormwater Pollution Prevention Plans (SWPPPs) are not required for oil and gas related projects under USEPA jurisdiction.

All field activities would be suspended in the event of muddy conditions to prevent vehicle travel from creating ruts. Those areas not needed for access and production would be reseeded with the BLM/FFO seed mix upon completion of all wells on each pad. The remote stimulations pads would be reclaimed following completion of stimulation.

Each pad would be evaluated on a case-by-case basis prior to the submittal of APDs to the BLM/FFO. At that time, it would be determined if CWA Section 404 permitting with the U.S. Army Corps of Engineers would be needed. Site-specific design features would be developed during the APD approval process to minimize the impacts to surface and groundwater.

Minimal amounts of hazardous materials (i.e., gas, diesel, etc.) would be used and stored on location. There would be the potential for accidental spills or releases of these materials, which could impact local water quality. Williams maintains a hazardous material response contingency plan to cover eventualities that could arise from an accidental release of hazardous materials.

Contamination of groundwater could occur without adequate cementing and casing of the proposed well bore. Surface casing setting depth is determined by regulation. A 9-5/8-inch surface casing would be set. Intermediate 7-inch casing would be set at the base of the Mesaverde formation to control loss circulation. Production casing of 4.5-inch would be run from total depth to surface. Each string would be cemented in place. Cement bond logs are run on the production casing and approved by regulating agencies to prevent any subsurface fluids migrating and to protect fresh water zones. Adherence to APD COAs and other mitigation measures, such as adequate casing, cementing, and other drilling and completion methods, would minimize potential effects to groundwater quality.

Stimulation (fracking) fluid is roughly 99 percent water but also contains numerous chemical additives as well as propping agents, such as sands. Chemicals added to stimulation fluids include friction reducers, surfactants, gelling agents, scale inhibitors, acids, corrosion inhibitors, antibacterial agents, and clay stabilizers. Two different stimulation fluid designs are under consideration: slickwater and gelled water. More information on the stimulation fluid components in these designs can be found at the following website www.hydraulicfracturingdisclosure.org.

No micro-seismic data are available for the Middle Mesa portion of the Rosa Unit. In 2010, Williams collected micro-seismic data from two test horizontal well bores in the Basin Mancos gas pool on the east side of Navajo Reservoir. It is assumed that the formation is similar and continuous within the Rosa Unit; therefore, these data can be applied to the west side of Navajo Reservoir. Along the well bore, the greatest vertical fractures extended approximately 1,000 vertical feet, with the majority at less than 700 vertical feet. More specifically, 5,700 feet was the shallowest micro-seismic event observed in the 24 stages pumped for the two horizontal wells. Based on these data, fracturing in the Mancos Shale formation is not expected to occur above depths above 5,700 feet below the ground surface. Fracturing could extend into the Mesaverde formation overlying the Basin Mancos; however, this is not a freshwater-bearing formation within the San Juan Basin.

4.5.1.2 No Action

Site-specific locations have not been identified under the no action alternative. However, a total of 45 Basin Mancos/Mesaverde wells are projected to be drilled, nine of which could be new locations. This would result in disturbance to 162 acres on 45 well pads. Impacts to surface water quality from sediment transfer would be low and short term. Before development, each well pad would be subject to site-specific environmental analysis at the time of APD submittal.

Drilling operations would utilize water-based mud which would be disposed of on site in a temporary pit. The cuttings would be left in the pit, covered, and then reclaimed in accordance with NMOCD Rule 17.

Potential for surface water quality impacts from accidental spills or releases of hazardous materials would be low and long-term. The impact of the proposed action alternative on area water quality would be low in both the short and long term.

With implementation of FFO standard drilling and completion requirements (e.g., adequate casing and cementing), potential short and long term impacts to groundwater resources would be low.

For stimulation, produced water gathered from existing wells in the Middle Mesa portion of the Rosa Unit would be transported to tanks located on site. Approximately two stages (every 500 feet) would be needed for each vertical well to stimulate the Basin Mancos formation, with each stage requiring approximately 5,000 barrels (bbls) of fluid, for a total of approximately 10,000 bbls (1.92 acre-feet) per well. On average total depth of each well bore would be 6,700 feet below the ground surface. Based on the hydraulic fracturing micro-seismic data discussed above, no impacts to freshwater-bearing groundwater aquifers are expected to occur under the proposed action alternative.

4.5.1.3 Proposed Action

The proposed action alternative would not impact any perennial drainages, wetlands, or floodplains. All residential camps facilities would be designed and constructed in compliance with local, state, and federal regulations.

The proposed action alternative would temporarily expose a maximum of 52 acres of soil as a sediment source entering area drainage ways. Impacts to surface water quality from sediment transfer would be low and short term. Site-specific mitigation measures such as silt ponds or other best management practices (BMPs) would minimize the potential for sediment transfer reaching Navajo Reservoir. With the implementation of design features, no measurable impacts to Navajo Reservoir water quality are anticipated. Direct impacts from the proposed action alternative would be about 89 percent less than those under the no action as the amount of disturbance would be reduced and would be consolidated at eight locations.

Drilling operations would utilize water-based mud for the surface and intermediate hole and oil-based mud for the horizontal lateral. Water-based cuttings would be disposed of on site in a temporary pit. A closed-loop system would be used for the oil-based mud to minimize potential impacts to surface and groundwater quality.

Stimulation would not be conducted between December 1 and March 31. No fresh water sources would be used for stimulation. Rather than transporting produced water from existing wells to a disposal well or facility, it would be transported to one of the remote stimulation pads and stored prior to use. Approximately 12 stimulation stages (every 500 feet) would be needed for each horizontal well bore to stimulate the formation, with each stage requiring approximately 10,000 bbls (1.29 acre-feet) of fluid. Stimulation fluid would be recycled for reuse with approximately one-third of the total volume expected to be reused. Approximately 40,000 bbls (5.2 acre-feet) of produced water would be needed per well.

If produced water volumes are insufficient, Williams would drill a well to the Entrada Formation, subject to New Mexico Office of the State Engineer regulations. The Entrada Formation is not a freshwater-bearing aquifer. If a water well is needed, drilling would occur outside the winter closure. Water from the well would be transported to the holding ponds via a temporary 10-inch poly surface line located adjacent to existing access roads and would not result in any additional surface disturbance.

For each Basin Mancos well, stimulation (fracturing) would occur along an average 5,200-foot horizontal well bore at stages spaced approximately 500 feet apart. On average total depth of each well bore would

be 6,700 feet below the ground surface. Based on the hydraulic fracturing micro-seismic data discussed above, no impacts to freshwater-bearing groundwater aquifers are expected to occur under the proposed action alternative.

With implementation of FFO standard drilling and completion requirements (e.g., adequate casing and cementing) and design features, potential short and long term impacts to groundwater resources would be low.

4.6 Topography

4.6.1 Direct and Indirect Impacts

4.6.1.1 No Action

Under the no action alternative, approximately 80 percent (36) of the 45 Basin Mancos/Mesaverde wells would be twinned with existing locations. Expanding an existing location typically results in low, residual, long-term impacts to topography. Approximately nine new well pad locations could be constructed, which could include the construction of new access roads and pipeline ROWs. These site-specific locations have not been identified. Before development, each well pad would be subject to site-specific environmental analysis at the time of APD submittal. Given the BLM/FFO's siting criteria, new well pad locations would likely be situated in areas that would not result in high impacts to topography.

During interim reclamation, Williams would recontour those disturbed areas not needed for access and operation and obliterate all earthwork by removing embankments, backfilling excavations, and grading to reestablish the approximate original contours of the land on the well pads. The construction zones would be reseeded with the BLM/FFO seed mix. Upon final abandonment, the entire well pad would be recontoured and reseeded per the COAs.

Therefore, impacts to topography under the no action would be expected to be low to moderate and long term.

4.6.1.2 Proposed Action

The proposed action alternative would result in the expansion of eight existing well pads, resulting in fewer impacts to topographical resources than the no action. During interim reclamation, Williams would recontour those disturbed areas not needed for access and operation and obliterate all earthwork by removing embankments, backfilling excavations, and grading to reestablish the approximate original contours of the land on the well pads. The construction zones would be reseeded with the BLM/FFO seed mix. Upon final abandonment, the entire well pad would be recontoured and reseeded per the COAs.

Impacts to topography would be low, residual, and long term.

4.7 Mineral Resources

4.7.1 Direct and Indirect Impacts

4.7.1.1 No Action

The natural gas production that would occur under the no action alternative is estimated to be 20.25 bcf.

4.7.1.2 Proposed Action

The natural gas production for the proposed action alternative is estimated to be 275 bcf. The use of horizontal drilling would optimize natural gas production, resulting in more than 10 times the amount of production over no action.

4.8 Soils

4.8.1 Direct and Indirect Impacts

4.8.1.1 Impacts Common to All Alternatives

Under both alternatives, construction would result in temporary displacement, compaction, and mixing of soils. Each well pad (approximately 1 acre) would remain as bare, compacted soil for the life of the project, approximately 30 years, and would be subject to an undetermined amount of wind and water erosion until the well is completely reclaimed. On twinned locations, this long-term impact would overlap existing disturbance. Compaction of the soils during construction and operation, coupled with the implementation of mitigation measures, would limit soil impacts from erosion. The most susceptible period for soil erosion impacts is during construction when strong winds or precipitation events during soil disturbing activities could mobilize soils.

Standard COAs would be implemented to minimize impacts. These include but are not limited to the following. Vehicle and pedestrian traffic would be restricted to the permitted disturbance areas and existing roads. Implementation of proper soil salvage, storage, and reclamation would retain adequate infiltration and permeability rates that would allow for maintenance of soil moisture, which is necessary for plant growth and vigor, and minimizes surface runoff. Following construction activities, disturbed areas would be reseeded with a BLM/FFO-approved seed mix to stabilize soils and prevent erosion. Reseeding would be repeated by Williams at the request of the BLM until it is successful. Following construction, vehicle traffic would be restricted to existing bladed roads to prevent erosion, soil mixing, and compaction in adjacent areas.

4.8.1.2 No Action

Under the no action alternative, approximately 162 acres of soils within the Middle Mesa portion of the Rosa Unit would be disturbed, resulting in low to moderate short-term impacts. This disturbance would occur over the span of approximately 5 years. Low and long-term impacts would affect approximately 72 acres of soils.

4.8.1.3 Proposed Action

The proposed action alternative would result in fewer impacts to soils than the no action alternative. Approximately 68 percent less acreage would be affected in the short term with approximately 89 percent less affected in the long term. Low to moderate and short-term impacts would affect 52 acres of soils disturbed under the proposed action alternative. This disturbance would occur over the span of approximately 5 years. Low and long-term impacts would affect 8 acres of soils.

4.9 Vegetation, Forestry

Three major vegetation communities occur within the Middle Mesa portion of the Rosa Unit: reclaimed shrub grassland habitat associated with the existing disturbance, piñon-juniper woodland, and Great Basin desert scrub sagebrush series.

4.9.1 Direct and Indirect Impacts

4.9.1.1 Impacts Common to All Alternatives

Impacts common to both alternatives are related to the removal and modification of vegetation. Direct impacts to vegetation would result from construction of well pads, roads, and pipeline ROWs. Those areas not needed for access and well operation would be reclaimed following completion. However, there would be long-term vegetation loss as final reclamation would not occur until the wells are abandoned. Indirect impacts would include a change in species composition and density in vegetation communities. Woodland areas would take generations to return to current conditions. Therefore, impacts on vegetation would be low and short-term in previously disturbed areas or areas vegetated by Great Basin desert scrub, and low to moderate and long-term in woodland areas. The potential for the introduction and spread of invasive species would increase in disturbed areas.

During construction, Williams and their contractors' vehicles would only operate on areas identified as work areas and on existing roadways. Implementation of proper soil salvage, storage, and reclamation would retain adequate infiltration and permeability rates that would allow for maintenance of soil moisture, which is necessary for plant growth and vigor, and minimize surface runoff. Revegetation would be initiated by Williams immediately following construction or at the direction of the BLM. Table 4-3 lists the BLM seed mix (pure-live-seed) to be applied to restored areas. Following seedbed preparation, seed would be applied to restored areas using a seed drill and at rates as specified in Table 4-3. Broadcast or hydroseeding may be used in lieu of drill seeding and applied at double the recommended drill seeding rates. Drill seeding is preferred and should be the method used on all areas suitable for drilling. Where not suitable, hydroseeding or broadcast seeding may be used.

Table 4-3. Farmington Field Office Seed Mixture.

Common Name	Variety	Percent for Mix	Pure Live Seed (Pounds/Acre)
Western Wheatgrass	Arriba	23%	3.0
Indian Ricegrass	Paloma or Rimrock	23%	3.0

Slender Wheatgrass	San Luis	15%	2.0
Crested Wheatgrass	Hy-Crest	22%	3.0
Bottlebrush Squirreltail		15%	2.0
Four-wing Saltbush		2%	0.25

Source: USDI/BLM 2006

4.9.1.2 No Action

Site-specific locations have not been identified, but approximately 162 acres of previously disturbed and undisturbed vegetation would be directly impacted through vegetation removal in the short term. Long-term impacts would affect about 72 acres of vegetation during well operation.

4.9.1.3 Proposed Action

Short-term impacts would be realized from the removal and modification of approximately 52 acres of vegetation. Long-term impacts would affect approximately 8 acres of vegetation. The two stimulation pads would be fully reclaimed following the conclusion of well completion activities. Approximately 68 percent less vegetation would be impacted in the short term with approximately 89 percent less impacted in the long term as compared to the no action alternative.

4.10 Invasive, Non-Native Species

4.10.1 Direct and Indirect Impacts

4.10.1.1 Impacts Common to All Alternatives

Surface disturbance creates the potential for the establishment and spread of noxious weeds and invasive, non-native species. Non-native species may also outcompete native species resulting in changes in vegetation composition that may indirectly result in altered wildlife use or a loss in livestock forage. Vehicles entering the project area have the potential to distribute and spread invasive, non-native plant species picked up from other areas.

Proper seeding and monitoring of the disturbed areas would reduce the potential for invasive species to establish. Williams would adhere to BLM reclamation measures to minimize impacts from invasive, non-native species. Williams would implement appropriate control/eradication measures prior to construction and would monitor during operation for non-native, invasive species in accordance with standard COAs.

4.10.2 No Action

The no action alternative would have low and long-term impacts from the potential spread and/or introduction of invasive, non-native species over a total of approximately 162 acres. Additionally, the development of new well pads, roads, and pipeline ROWs would increase the potential for invasive, non-native species to establish in new areas.

4.10.3 Proposed Action

Musk thistle, a BLM-listed invasive, non-native species, was identified in the area of potential effect. The proposed action alternative would have low and long-term impacts from the potential spread and/or introduction of invasive, non-native species over a total of approximately 52 acres. Overall, impacts under the proposed action alternative pertaining to the introduction and establishment of invasive, non-native species would be less compared to the no action alternative.

4.11 Wildlife

Impacts to mule deer and elk from energy development are not well understood–especially in the long term. Effects of energy development may take years to manifest on long-lived ungulates, and no study has been conducted of sufficient duration to make firm conclusions (Hebblewhite 2011). In 2006, the BLM estimated 100 to150 mule deer and fewer than 50 elk use all of Middle Mesa (USDI/BLM 2008*a*). The NMGFD characterizes the project area as low wintering big game density with good browse availability (Wunder, pers. comm. 2011).

All of the project area is contained within the Middle Mesa Wildlife Area SDA. Winter closures were established in 2003 by the BLM in the PRMP/FEIS and associated ROD (USDI/BLM 2003*a*, 2003*b*). This change in management policy was made in the RMP to address human impacts on wildlife populations, primarily big game. Timing restrictions were implemented as a means to reduce the amount of vehicle travel and associated human activity (USDI/BLM 2008*a*). This designation imposes seasonal restrictions on construction and drilling activities during a 4-month period (December 1 through March 31) to protect the integrity of the habitat for wintering deer and elk. Lower elevation winter habitat is important as it provides forage that is otherwise buried under deep snow at higher elevations and allows animals to move unhampered by deep snow. Winter is a critical time of year because typically mule deer and elk require suitable browse to sustain or slow the drain of fat reserves. Winter survival is usually determined by the amount of fat reserves the individual is carrying going into winter as well as the severity and duration of the winter (Peek 2003).

The project area is currently well-developed and has been undergoing natural gas development for over 60 years (USDI/BLM 2008*a*). According to the BLM, there are 825 wells and 193 miles of road within the Middle Mesa Wildlife Area SDA as of May 1, 2011.

4.11.1 Direct and Indirect Impacts

4.11.1.1 Impacts Common to All Alternatives

Impacts to big game are dependent on timing, duration (years), and intensity. Vegetation removal would result in loss of elk and deer habitat. Reclamation using the BLM/FFO seed mix focuses on establishing a plant community dominated by herbaceous species with a lesser shrub component. Twinned well pads would require minimal new surface disturbance, thereby reducing the amount of forage and browse lost. Sawyer et al. (2006) showed that mule deer shift their habitat use away from high-quality habitat to less suitable habitats in response to development. Similarly, studies have shown elk typically move away from disturbance areas, altering their habitat selection, movement rates, and use of seasonal home ranges in response to disturbance. However, elk do not change their home ranges as a result of disturbance; rather,

they shift usage within home ranges (Hebblewhite 2011). Easterly et al. (1991) suggested that stress from human activities associated with oil and gas development may be additive to environmental stress and increase winter mortality. Severe, prolonged winters that reduce forage availability and quality also reduce growth and survival of elk (Peek 2003); disturbance during winter may serve as a similar mechanism reducing access to quality browse.

Mule deer and elk have been shown to avoid natural gas wells, roads, and areas immediately surrounding them. Easterly et al. (1991), Lyon (1983), and Rost and Bailey (1979) found that deer and elk tend to avoid areas within 0.25 mile (402 meters) to 0.5 mile (805 meters) adjacent to roads. The nature and extent of this avoidance is dependent upon the amount of cover present, the volume of traffic, and whether or not the vehicles stop or continue moving. More recently, Powell (2003) found elk avoided roads and wells by as much as 1.24 miles (2,000 meters), and Sawyer et al. (2005) showed mule deer avoided roads by approximately 1.67 miles (2,700 meters). Additionally, wildlife tend to avoid areas where humans are present and associated disturbances occur. This displacement could push individual animals from preferred habitat into less suitable habitat with lower quality forage or cover. Use of less suitable habitats could result in stress or impacts to reproductive success and reduced fitness. Additionally, some responses to human presence, traffic, and noise could induce a flush response in wildlife, including elk and deer, resulting in physiological stress and behaviors (such as fast movements) that could increase incidence of predation and vehicular collisions. Sawyer et al. (2006) showed mule deer responded quickly (less than 1 year) to development and avoided disturbances in a developed energy field; moreover, avoidance increased over the course of the 3-year study. Studies conducted by Sawyer et al. (2007) and Powell (2003) also demonstrated that elk continued to avoid energy development long after exploration was completed, and this suggests population-level impacts.

Results from Sawyer et al. (2010 suggested reducing well pad traffic from seven to eight vehicle-trips per day to three trips was sufficient for mule deer to perceive less risk; well pads with less vehicle-trips were avoided less often. This effectively reduced indirect habitat loss associated with producing wells.

Noise and human presence associated with the well pad construction and drilling would also cause impacts to wildlife. Impacts to wildlife from noise are compounded by multiple variables such as the magnitude and duration of the noise generated, proximity of the noise source to an individual, individual behaviors/ responses, time of year (namely, summer vs. winter for mule deer and elk), time of day, and influence of other environmental stressors such as heat or snow depth. Ungulates, like most wildlife, typically flee or escape noise disturbances displayed as either mild annoyance or panic behavior (Fletcher 1980). Such displacement would likely be localized around the well pad or road at the source of the disturbance (i.e., equipment noise, human presence, etc.), but these effects could have multiple impacts such as displacement from suitable habitat, increased potential for vehicle collision, predisposition to predation, and physical and emotional stress as described previously for roads.

Engines would be equipped with mufflers. Barriers or other sound proofing measures would be implemented, if needed, to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the Jurisdiction of the FFO NTL 03-1 FFO. These measures would serve to minimize effects to wildlife from increased noise levels.

Direct impacts from vehicle traffic on roads could include incidental mortality to wildlife. Animal vehicle collisions are variable depending on time of day, speed and volume of traffic, local topography, structural

features of the road, and the size and behavior of the individual impacted (Dodd et al. 2004). During the winter closure, the roads in the area are traveled infrequently, primarily during daylight hours and at low speeds due to topography and road conditions, so mortality of big game due to vehicle collisions is considered unlikely. Roads are expected to be used more frequently during construction and drilling of wells than during maintenance and production stages.

Table 4-4 provides a summary of estimated total vehicle-trips and average daily vehicle-trips for the alternatives. It is assumed that since wells would be twinned with existing locations, vehicle-trips for operation and maintenance would not measurably increase as workers would access one pad to maintain several wells.

Table 4-4. Summary Estimated Total Vehicle-Trips and Average Daily Vehicle-Trips Per Alternative.

Years One Through Five		
	No Action	**Proposed Action**
Total Vehicle-Trips During Winter Closure	1,440	2,380
Total Vehicle-Trips Remainder of the Year	6,620	7,603
Total Annual Vehicle-Trips	8,060	9,983
Average Daily Vehicle-Trips Per Well Pad During Winter Closure	12	20
Average Daily Vehicle-Trips Per Well Pad Remainder of the Year	30	30
Year Six		
Total Annual Vehicle-Trips	8,640	8,640
Average Daily Vehicle-Trips Per Well Pad During Winter Closure	25	25
Average Daily Vehicle-Trips Per Well Pad Remainder of the Year	25	25

4.11.1.2 No Action

Up to about 162 acres of vegetation would be removed for the development of 45 Basin Mancos/Mesaverde wells over the next 5 years. Interim reclamation of each new well pad would reduce the long-term loss of habitat for mule deer and elk to about 72 acres. The PRMP/FEIS evaluated impacts to wildlife within the nine designated Wildlife Area SDAs. Of the 397,000 acres in these SDAs, the analysis estimated a long-term habitat loss of 8,600 acres due to new disturbance. When added to the amount lost to existing development, the total long-term habitat loss was projected to be at least 27,000 acres in Wildlife Area SDAs (USDI/BLM 2003, page 4-112).

Under the no action alternative, drilling would continue to be restricted during the winter closure period, and current operations and maintenance vehicular traffic would also continue. Under the no action alternative, the current average number of well site visits is estimated to range between 10 to 12 vehicle-trips per day during the winter closure period for operation and maintenance on completed wells and about 30 vehicle-trips per day for the remainder of the year when drilling is occurring. In year six, after the 45 projected wells are completed, there would be an average of about 25 vehicle-trips per day per pad for operations and maintenance of the wells year-round.

As the well development activity for the no action alternative is included in the RFDS for the PRMP/FEIS, these vehicle-trips and new roads are assumed to be included in the 20,500 vehicle-trips per day considered in the ROD (USDI/BLM 2003*a*, page 4-34).

The scale and pace of the no action alternative is consistent with planning area RFDS. Therefore, the impacts of this scenario are included in the ROD for the RMP (USDI/BLM 2003*a*, 2003*b*).

4.11.1.3 Proposed Action

Short-term habitat loss from the proposed action alternative is expected to be 52 acres, and long-term loss is expected to be about 8 acres after the areas are reclaimed. This represents about 68 percent less habitat loss in the short term and about 90 percent less in the long term as compared to the no action alternative. The scale and pace of this development is consistent with planning area RFDS. Therefore, the impacts of this scenario are included in the ROD for the RMP (USDI/BLM 2003*a*, page 4-112, 2003*b*).

No new roads would be constructed to access the existing well pads, but annual vehicle traffic would be greater than the no action alternative. Under the proposed action alternative, approximately 2,300 to 2,400 annual vehicle-trips would occur during the winter closure period for five consecutive winters. Annual vehicle-trips are estimated to be 7,600 to 7,700 during the rest of the year, about 15 percent more than the no action alternative. Average daily vehicle-trips under the proposed action alternative are estimated to be about 20 during the winter closure period while drilling would be occurring (Table 4-4). This estimate represents 8 to 10 more trips during the winter closure period than under the no action. The duration of this impact would be for approximately 5 years.

Stimulation activities would occur outside the winter closure. Stimulation activities are not expected to increase the number of vehicle-trips, but there would be spatial changes in traffic patterns within the project area as produced water would be trucked from existing well pads to the remote stimulation ponds rather than the normal disposal site, which is located within the Middle Mesa portion of the unit.

Because wells would be twinned with existing locations, vehicle-trips for operation and maintenance would not be expected to increase in the long term as workers would access one pad to maintain several wells. Therefore, vehicle-trips in the long term (beyond 5 years) would be similar during the winter closure for both the no action and proposed action alternatives for operations and maintenance only. Thus, the no action and proposed action alternative would have similar long-term impacts that have been previously evaluated in the RMP.

During the proposed 5-year drilling program, increased vehicle traffic, noise, and night-time lighting, as well as increased human-wildlife encounters and general human presence, would impact wintering mule deer and elk. These impacts would be expected to affect individuals rather than populations. The severity of impacts associated with development and disturbance during the winter is dependent on the severity of each winter when disturbance would occur. In severe winters, individual mule deer and elk that would have otherwise utilized the area would likely avoid areas where development and disturbance are occurring. During winters with deep snow when movement is more difficult and browse more difficult to locate, impacts of habitat loss would be expected to more severely impact individuals. If mule deer and elk habituate to new disturbances, avoidance of developed areas would be expected to decrease incrementally each winter. Therefore, in the short term, during the first 5 years when activity would occur

during the winter closure, impacts are expected to be low, but could be moderate depending on the severity of the winter. These impacts would also be localized, that is centralized around an approximate 1,000 meter radius of the one active well pad and the access roads leading to it. Given the minor amount of habitat modification and amount of area that would be subject to avoidance during drilling as compared to the amount of suitable habitat within the wildlife area, these impacts would be expected to affect individuals but are not expected to have population-level impacts. The short-term adverse impacts would be mitigated to minimize impacts through design features proposed by Williams.

Design features that would minimize surface disturbance, human presence, noise, and browse/habitat loss include:

- Twinned or co-located well pads
- Horizontal drilling of multiple wells from one well pad
- Use of a purpose-built rig

Design features that would minimize disturbance to wildlife, especially during the winter closure period, include:

- Only one rig will be used for drilling operations between December 1 and March 31.
- If needed, only one rig move will be made between December 1 and March 31, and will not exceed 1.5 miles.
- Stimulation activities will not be conducted between December 1 and March 31.
- A residential camp will be utilized to reduce truck traffic to the drilling rig.
- Workers will be transported to and from the residential camp by high-capacity vehicles to minimize vehicle traffic.
- Workers schedules will be 12-hour shifts 7 days on and 7 days off to minimize vehicle traffic.
- Workers occupying the residential camp during non-work hours will restrict their excursions outside of the camp boundaries.
- Except for emergency situations and one shift change per day, all vehicle traffic will be restricted to daylight hours.

4.12 Federally Listed Threatened and Endangered Species

4.12.1 Direct and Indirect Impacts

4.12.1.1 No Action

Site-specific locations have not yet been identified. These locations would be evaluated for potential effects to federally listed species on a case-by-case basis following the determination of specific locations. Before development, each well pad would be subject to site-specific environmental analysis at the time of APD submittal.

4.12.1.2 Proposed Action

No USFWS listed species, or potential habitats, were found in the proposed area of effect. The FFO reviewed and determined that the proposed action alternative is in compliance with listed species management guidelines outlined in the September 2002 Biological Assessment (Cons. #2-22-01-I-389). No further consultation with the USFWS is required (USDI/BLM 2002).

4.13 Special Status Species

The proposed project area contains potential habitat for three special status species: bald eagle, golden eagle, and American peregrine falcon. None of these special status species were observed during the field surveys conducted between April and May 2011. Their potential to occur within the project area is based on evaluation of the habitat, the known habitat associations of the species, and the proximity to documented occupied habitat.

4.13.1 Direct and Indirect Impacts

4.13.1.1 No Action

Under the no action, 45 well locations would be developed which could include an estimated nine new locations. Site-specific locations have not yet been identified. However, the Middle Mesa portion of the Rosa Unit contains habitat for the three species listed above. The no action alternative would result in short-term disturbance of approximately 162 acres and long-term disturbance to 72 acres. This disturbance would likely result in direct low to moderate impacts to special management species based on the amount of disturbance in relation to the amount of suitable habitat surrounding the project area.

Direct impacts to nesting raptors or nesting habitat would be avoided or minimized by the BLM/FFO's pre-development siting criteria. Other direct impacts would include temporary avoidance during construction and drilling of the proposed well pads. Before development, each well pad would be subject to site-specific environmental analysis at the time of APD submittal. Site-specific evaluations conducted by the BLM/FFO would evaluate the potential for impacts to these species and develop design features to minimize or avoid impacts.

Construction activities would be confined to the permitted areas to avoid further disruption to all raptors. Adherence to COAs provided by the BLM would minimize effects to all raptors that may utilize the project area. Noxious weed control measures would minimize the spread of weeds in the project area. Any spills would be promptly cleaned up, and Williams would prepare a hazardous material response contingency plan to cover eventualities that could arise from an accidental release of hazardous materials. Any open cavities will be covered. Should any nesting raptors be identified before or during construction activities, the BLM/FFO biologist will be immediately contacted in order to evaluate whether additional resource protection measures are warranted.

4.13.1.2 Proposed Action

Impacts to potential raptor habitat under the proposed action would be less than those under the no action. The proposed action alternative would directly impact 52 acres of potential foraging habitat for these

raptor species. Direct impacts would include the removal and modification of vegetation, including the loss of piñon and juniper trees that could serve as perch sites. There would be no direct impacts to potential nesting habitat. There would be a long-term loss of approximately 8 acres of marginal foraging habitat which overlaps existing disturbance. The proposed well pads would be twinned with existing disturbance to minimize effects to raptors and potential habitat. Direct impacts from habitat loss and modification to golden eagles, bald eagles, and American peregrine falcons are expected to be low in the short term due to the utilization of existing disturbance.

During construction, increased human and vehicular activity may cause these raptors to avoid the area of potential effect. Only one rig would be used for drilling operations during the winter closure. Since drilling from only one well pad would occur during the winter closure period each winter, these impacts would be localized. Given the amount of suitable habitat on Middle Mesa as compared to the amount of habitat that would be impacted at any one time, these impacts are not expected to be significant. Additionally, drilling from well pad #7 and #8 would not occur during the winter closure period due to their close proximity to BLM-designated bald eagle ACEC units. The remote stimulation water storage ponds would be lined, fenced, and netted to restrict wildlife access

Impacts from avoidance would be low to moderate and short term. Indirect impacts could include a change in prey species composition for raptors from the disturbance and modification of vegetation. These impacts would be low and short to long term.

4.14 Migratory Birds

Executive Order 13186, dated January 17, 2001, calls for increased efforts to more fully implement the MBTA. In keeping with this mandate, the BLM/FFO has consulted the NMPIF Bird Conservation Plan for the State of New Mexico and the USFWS "Birds of Conservation Concern List." A review of these documents, specifically as they pertain to the Colorado Plateau physiographic area, indicates there are three "priority" avian species (with a known range of distribution in the FFO area) that utilize the piñon-juniper woodland habitat types, and eight "priority" species that utilize the sagebrush-grass within the Great Basin desert shrub habitat type that occur on the NMPIF "Highest Priority" and USFWS "Birds of Conservation Concern 2008" lists. Nine of these species occur on both lists. Various types of perturbations and anthropogenic activity may affect these species.

4.14.1 Direct and Indirect Impacts

4.14.1.1 Impacts Common to All Alternatives

Determining effects on birds is ambiguous, since activities that result in the loss of habitat for one species may improve conditions for another. Habitat provides a source of food, security and escape cover, and nesting habitat for migratory bird species. Potential effects to migratory birds can include disturbance from increased human presence, increased noise levels, temporary and permanent removal of nesting or foraging habitat and resulting habitat fragmentation, increased edge creation, or destroying individual nests or eggs during habitat removal if the project occurs during the breeding season.

Construction activities would be confined to the proposed project area to avoid further disruption to migratory birds. During construction, a trash receptacle and a chemically treated portable toilet will be on

location for trash and sewer disposal. Following construction activities, disturbed areas would be reseeded with the appropriate BLM seed mix. Noxious weed control measures would minimize the spread of weeds in the project area. Any spills would be promptly cleaned up, and Williams will prepare a hazardous material response contingency plan to cover eventualities that could arise from an accidental release of hazardous materials. Any open cavities would be covered. Any active bird nests found within the proposed project area would be reported to a BLM/FFO biologist for appropriate mitigation prior to construction activities.

4.14.1.2 No Action

Under the no action alternative, 45 well locations would be developed that could include an estimated nine new locations. Site-specific locations have not yet been identified. However, the Middle Mesa portion of the Rosa Unit contains habitat for migratory birds.

The no action alternative would result in short-term disturbance of approximately 162 acres and long-term disturbance to 72 acres. This alternative would be expected to result in increased habitat fragmentation from the creation of new well pads, roads, and pipelines. Impacts would be greater should vegetation removal occur during the breeding season. This level of disturbance would likely result in low to moderate impacts to migratory birds. These impacts would be greater than those of the no action as more surface disturbance and an undetermined amount of habitat fragmentation would occur. Site-specific evaluations conducted by the BLM/FFO would evaluate the potential for impacts and develop design features to minimize those impacts.

4.14.1.3 Proposed Action

High priority migratory bird species and a brief assessment of the effects of the proposed action alternative on their habitat are provided in Table 4-5.

Table 4-5. Migratory Bird Species of Concern Occurring within the Project Area and Potential Impacts.

Species	Habitat Type	Effects	Impact Rating None/Low/Moderate/High
Grasshopper sparrow (*Ammodramus savannarum*)	Sage-grass	May be positively affected due to conversion to grassland.	Low
Sage sparrow [(1)] (*Amphispiza belli*)	Sage-grass	Minor loss of nesting and brood rearing habitat	Low
Burrowing owl (*Athene cunicularia*)	Sage-grass	Little effect, nests in abandoned prairie dog burrows.	Low
Ferruginous hawk (*Buteo regalis*)	Sage-grass/ piñon-juniper interface	Loss of nesting and foraging habitat; decrease in prey (small mammals) abundance likely.	None
Mountain plover (*Charadrius montanus*)	Sage-grass	May be positively affected due to conversion to grassland; may produce more prey (i.e., arthropods).	None

Species	Habitat Type	Effects	Impact Rating None/Low/Moderate/High
Long-billed curlew (*Numenius americanus*)	Sage-grass	May be positively affected due to conversion to grassland.	Low
Sage thrasher [(1)] (*Oreoscoptes montanus)*	Sage-grass	May be some loss of sage/ nesting habitat.	Low
Bendire's thrasher (*Toxostoma bendirei)*	Sage-grass	Little effect anticipated; some loss of nesting habitat; increase in prey (i.e., arthropods) likely.	Low
Juniper titmouse (*Baeolophus ridgwayi*)	Piñon-juniper	Secondary cavity nester; some loss of nesting habitat.	Low
Piñon jay (*Gymnorhinus cyanocephalus*)	Piñon-juniper	Colony nester in piñon; loss of piñon may negatively impact.	Low
Gray vireo (*Vireo vicinior*)	Piñon-juniper	Nests in juniper; reduction of juniper may be detrimental.	Low

Note:
[(1)] "High Priority" bird species that are listed on the NMPIF "Highest Priority" birds of conservation concern list but not on the USFWS "Birds of Conservation Concern 2008" list.

Winter drilling that would occur under the proposed action alternative would have no affect to breeding or nesting migratory birds. Overall, impacts to migratory birds would be low given the level of disturbance required for the proposed project and the proximity to existing infrastructure. Approximately 52 acres of short-term disturbance would affect a variety of tree, shrub, and ground-nesting birds. There would be some piñon and juniper trees removed during construction activities, resulting in a long-term loss of potential nesting and perching habitat for breeding birds.

There would be no increase in habitat fragmentation or edge effects since the proposed action would utilize and expand existing disturbance. Impacts to migratory birds would be greater from construction and drilling during the breeding season of April 15 through August 30. Direct and indirect impacts to migratory birds would be low and short to long term. There could be positive long term impacts to species such as long-billed curlew (*Numenius americanus*) and grasshopper sparrow (*Ammodramus savannarum*) from the conversion of woodlands to grasslands following interim and final reclamation.

4.15 Livestock Grazing

4.15.1 Direct and Indirect Impacts

4.15.1.1 Impacts Common to All Alternatives

Forage species would be absent during well pad and remote stimulation pad construction and in limited quantities 1 to 2 years after revegetation. The BLM-approved seed mix containing grasses and shrubs would be used. Forage species biomass within the reseeded portions of the project area should be similar to or possibly greater than preconstruction quantities. There would be a long-term loss of forage associated with the access and operational well pads. For twinned well pads, this long-term loss would be offset by using existing disturbance.

During construction, a trash receptacle and a chemically treated portable toilet would be on location for trash and sewer disposal. At interim reclamation, each well pad construction zone would be reseeded with the BLM approved seed mix. The entire well pad would be recontoured and reseeded upon final abandonment. Non-native, invasive weed species would be treated prior to construction and monitored for the life of the wells. Any open pits would be fenced to restrict livestock access.

4.15.1.2 No Action

Up to approximately 162 acres of undisturbed and previously disturbed vegetation could be removed and modified by the no action alternative, resulting in a short-term reduction in forage and a change in the composition of herbaceous species in the project area. Short-term forage loss would be approximately 6.5 AUMs based on 25 acres per AUM. Based on 36 acres of disturbance, there would be approximately 1.5 AUMs impacted for the long term from the development of an estimated nine new well pads, roads, and pipelines.

4.15.1.3 Proposed Action

Approximately 52 acres of undisturbed and previously disturbed vegetation could be removed and modified by the proposed action alternative, resulting in a short-term reduction in forage and a change in the composition of herbaceous species in the project area. The proposed eight well pads would be twinned with existing well pads, minimizing surface disturbance and forage removal. Short-term forage loss would be approximately 2.0 AUMs based on 25 acres per AUM. No long-term loss in forage above what has already occurred from previous development is anticipated.

4.16 Socioeconomics

The socioeconomic impacts of the alternatives focuses on the government revenues from natural gas production because the detailed data necessary to estimate the other impacts is not available. This focus would result in underestimating the socioeconomic impacts of the alternatives as impacts associated with other tax revenues such as gross receipts and property taxes are not considered. Also, the employment and income impacts are not included.

4.16.1 Direct and Indirect Impacts

4.16.1.1 No Action

The natural gas production that would occur under the no action alternative is estimated to be 20.25 bcf. Using an average natural gas price from U.S. Department of Energy (USDOE) energy market forecasts of $4.14 per Mcf, the estimated production value is $84 million (USDOE 2010). This production value would generate a total of about $7.5 million to the State of New Mexico and San Juan County through severance taxes, assuming a tax rate of 8.84 percent. In addition, there would be approximately $10.5 million in Federal Royalty taxes, assuming a tax rate of 12.5 percent, paid to the U.S. Federal government with about half being returned to the State of New Mexico. These tax revenues are consistent with the pace and scale of the development included in the RFDS for the FFO RMP; and therefore, these impacts are included in the ROD for the FFO PRMP/FEIS (USDI/BLM 2003*a*, page 4-34). Thus, there would be no significant direct or indirect impacts for the no action alternative.

4.16.1.2 Proposed Action

The natural gas production for the proposed action alternative is estimated to be 275 bcf. Using an average natural gas price from USDOE energy market forecasts of $4.14 per Mcf, the estimated production value is $1,100 million (USDOE 2010). This production value would generate a total of about $100 million to the State of New Mexico and San Juan County through severance taxes, assuming a tax rate of 8.84 percent. In addition, there would be approximately $143 million in Federal Royalty taxes, assuming a tax rate of 12.5 percent, paid to the U.S. Federal government with about half being returned to the State of New Mexico. The natural gas production and associated government revenues for the proposed action alternative are more than 10 times larger than the no action alternative. Since these tax revenues are used to fund government programs and services that can benefit the local communities, they would represent a substantial direct and indirect socioeconomic benefit.

4.17 Environmental Justice

Federal agencies must consider the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations or environmental justice impacts of a proposed action alternative. In this case, because the minority population in San Juan County, New Mexico, is higher than New Mexico as a whole, disproportionate impacts to minority populations are evaluated.

4.17.1 Direct and Indirect Impacts

4.17.1.1 No Action Alternative

There would be no measurable or disproportionate impacts to minority populations under the no action alternative. The PRMP/FEIS analyzed impacts to minority populations and determined that energy resources within the planning area are located with Rio Arriba and San Juan counties, both of which have disproportionately minority populations. Resource development would provide jobs and therefore benefit these groups (USDI/BLM 2003*a*, page 4-129).These impacts were also considered in the ROD for the FFO PRMP/FEIS because development of natural gas resources on Middle Mesa is consistent with the RFDS for the RMP (USDI/BLM 2003*a,* page 4-5).

4.17.1.2 Proposed Action

Impacts under the proposed action would be the same as those described under the no action.

4.18 Recreation

There are no designated recreation areas within the project area. Navajo Reservoir is located within the exterior boundaries of the Rosa Unit. During winter, recreation in the area is limited to mainly hunters. Existing roads would be used to the greatest extent practicable. Watering of roads during construction would be implemented to reduce fugitive dust levels, if needed.

4.18.1 Direct and Indirect Impacts

4.18.1.1 No Action

During construction and drilling, recreationists may experience an increase in traffic, fugitive dust, and sound levels, as well as night time lighting. These impacts would be low to moderate and short-term. During operation, impacts to recreationists would be low and mainly resulting from periodic increases in localized fugitive dust and noise.

4.18.1.2 Proposed Action

The type of impacts to recreationists would be similar to those described above under the no action. However, these impacts would be of less intensity than the no action as only eight existing well locations and two remote stimulation pads would be utilized.

To reduce vehicle traffic in the area, existing roads would be used access the well pads; a residential camp would be utilized to reduce truck traffic to the drilling rig; workers would be transported to and from the residential camp by high-capacity vehicles; worker schedules would be 12-hour shifts 7 days on and 7 days off; and workers occupying the residential camp during non-work hours would restrict their excursions outside of the camp boundaries. Except for emergency situations and one shift change per day, all vehicle traffic would be restricted to daylight hours.

4.19 Transportation and Traffic

The impacts to transportation infrastructure and traffic conditions for the Middle Mesa POD alternatives are measured in terms of site visits associated with development and maintenance of natural gas wells. The average daily oil and gas well site visits estimated in the PRMP/FEIS associated with 9,942 new federal wells is about 20,500 vehicle-trips per day (USDI/BLM 2003*a*, page 4-34). The ROD for the PRMP/FEIS notes that there could be "considerable" impacts to transportation infrastructure and traffic conditions associated with these vehicle-trips on U.S. Highway 550, U.S. Highway 64, and U.S. Highway 173, depending on the timing and pattern of oil and gas development within the FFO planning area (USDI/BLM 2003*a,* page 4-127).

4.19.1 Direct and Indirect Impacts

4.19.1.1 No Action

The no action alternative includes nine new access roads to be added to the existing road network inside the Rosa Unit on Middle Mesa. The current average number of well site visits for the no action alternative is estimated to be about 10 to 12 vehicle-trips per day during the winter closure period for operations and maintenance on completed wells and about 30 vehicle-trips per day for the remainder of the year when drilling is occurring (Table 4-4). In year six, after the 45 projected wells are completed, there would be an average of about 25 vehicle-trips per day for operations and maintenance of the wells year-round (Table 4-4). As the well development activity for the no action alternative is included in the RFDS for the PRMP/FEIS, these vehicle-trips and new roads are assumed to be included in the 20,500 vehicle-trips per

day considered in the ROD. Therefore, there would be no high impacts to the transportation infrastructure or traffic conditions under this alternative.

4.19.1.2 Proposed Action

No new access roads would be constructed under the proposed action. For the first 5 years of the POD when wells are being drilled, the average number of vehicle-trips for the proposed action alternative is estimated to require about 20 vehicle-trips per day during the winter closure period for operations and maintenance on completed wells and about 30 vehicle-trips per day for the remainder of the year (Table 4-4). In year six, after all 65 wells are completed, there would be an average of about 25 vehicle-trips per day for operations and maintenance of the wells year-round (Table 4-4).

The difference in vehicle-trips for the proposed action alternative compared to the no action alternative would occur during the first 5 years of the implementation of the POD. The total difference is estimated to be between 4,500 and 5,000 additional vehicle-trips during the winter closure period and about 5,000 additional vehicle-trips during the rest of the year.

To reduce vehicle traffic in the area, existing roads would be used access the well pads; a residential camp would be utilized to reduce truck traffic to the drilling rig; workers would be transported to and from the residential camp by high-capacity vehicles; worker schedules would be 12-hour shifts 7 days on and 7 days off; and workers occupying the residential camp during non-work hours would restrict their excursions outside of the camp boundaries. Except for emergency situations and one shift change per day, all vehicle traffic would be restricted to daylight hours.

Stimulation activities would occur outside the winter closure. Stimulation activities are not expected to increase the number of vehicle-trips, but there would be spatial changes in traffic patterns within the project area as produced water would be trucked from existing well pads to the stimulation pads rather than the normal disposal site, which is located within the Middle Mesa portion of the unit.

Because wells would be twinned with existing locations, vehicle-trips for operation and maintenance would not be expected to increase in the long term as workers would access one pad to maintain several wells. Therefore, after well drilling is complete, the estimated number of vehicle-trips for well operation and maintenance is similar under both alternatives.

In summary, the total difference between the no action and the proposed action alternatives would be a 24 percent increase in the total number of vehicle-trips during the first 5 years of the POD. This amounts to an average of five additional vehicle-trips per day during the first 5 years of the POD. The transportation infrastructure is presently adequate to handle these additional vehicle-trips, and they would not have a measurable impact on baseline traffic conditions on U.S. Highway 550 or the other roads along the access route. Therefore, there would a short-term, low impact to transportation infrastructure and traffic conditions under the proposed action alternative.

4.20 Visual Resources

The Middle Mesa portion of the Rosa Unit is located within a Class II VRM area. The 2009 VRI classified the area as displaying Class IV VRM values based on landscape changes over the last 30 years.

4.20.1 Direct and Indirect Impacts

4.20.1.1 No Action

Under the no action alternative, 45 well pads, including nine new locations, would be expanded or drilled throughout the Middle Mesa portion of the Rosa Unit. During construction and drilling operations, the effects of disturbed ground, machinery emissions, above ground storage tanks, and the presence of the drill rig and construction equipment would result in low to moderate short-term visual impacts. These impacts would not occur during the winter closure period. After construction and during operation of the proposed action alternative, there would be low long-term visual impacts. Mitigation measures that minimize visual impacts include revegetation and recontouring, above-ground facility paint color, and low profile equipment requirements that are established by the BLM.

Impacts to visual resources under the no action would be more widespread as compared to the proposed action alternative. However, these impacts are not expected to further degrade the viewshed and therefore would not be significant.

4.20.1.2 Proposed Action

The types of visual resource impacts would be similar to those described above under the no action alternative. Drilling multiple wells from one location would minimize impacts to visual resources. Therefore, impacts would be of less intensity than the no action as only eight existing well locations and two remote stimulation pads would be utilized. These impacts are not expected to further degrade the viewshed and therefore would not be significant.

4.21 Noise

Noise impacts are estimated in terms of measurable changes to baseline noise conditions in the affected area. In analyzing the noise impacts, the noise levels from natural gas development and production activities are compared to baseline noise levels. Baseline noise levels are estimated to range from 44 to 69 dBA because of the extent of existing natural gas production and compressor facilities.

4.21.1 Direct and Indirect Impacts

4.21.1.1 Impacts Common to All Alternatives

The ROD includes a noise policy (BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the Jurisdiction of the FFO NTL 03-1 FFO) as a stipulation for operations in 62 specially designated areas or in cases where noise could be a nuisance to residents or recreationists (USDI/BLM 2003*a*, Appendix E). The policy establishes a noise standard of 48.6 dBA for oil and gas lease operations that operate more than 8-hours per day for more than 1 week in duration. This noise standard must not be exceeded within 500 feet of an NSA boundary. The noise standard does not apply to transient operations such as construction, drilling, completion or workover activities, or short-term events such as well venting or compressor start-up. These activities are addressed on a case-by-case basis should a conflict be identified during the permitting process.

Engines would be equipped with mufflers and barriers or other sound-proofing measures would be implemented, if needed, to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the Jurisdiction of the FFO NTL 03-1 FFO.

4.21.1.2 No Action Alternative

The no action alternative is consistent with the scale and timing of activities included in the RFDS for the PRMP/FEIS. Therefore, the potential noise impacts for the no action were considered in the ROD. Noise impacts are addressed as follows in the PRMP/FEIS, "Temporary impacts could occur throughout the FFO from construction and development activities, such as noise, dust, and emissions from construction equipment and vehicles, but these would be localized and temporary in nature and have no long-term effect on any particular land use." (USDI/BLM 2003*a*, page 4-118).

Given the noise levels generated by existing natural gas production on Middle Mesa and that the activities included for this alternative were considered in the RFDS for the PRMP/FEIS, there would be no significant noise impacts under the no action alternative.

4.21.1.3 Proposed Action

Long-term noise levels for the proposed action alternative are estimated to be comparable to the no action alternative. Specifically, there is no wellhead compression included under either alternative, and both alternatives would have a similar amount of operations and maintenance activity, and vehicle-trips associated with well site visits after the wells are completed. The major difference between the alternatives is short-term noise from well drilling. The natural gas-fired generators that would be used to power the drill rig under the proposed action alternative are estimated to have similar noise levels as the diesel generators that would be used under the no action alternative. However, the natural gas generators would be operating during the winter closure, and there would be additional vehicle traffic and equipment operation associated with well drilling activities. Therefore, the proposed action alternative would have low short-term noise impacts.

Stimulation activities would not be conducted between December 1 and March 31, which would reduce noise levels during the winter closure. Wells on pads #7 and #8 would not be drilled during the winter closure to avoid noise impacts to wintering bald eagles. Measures implemented to minimize vehicle-trips during the winter closure (worker van trips and vehicle-trips being limited to daylight hours) would also reduce noise levels.

4.22 Wastes–Hazardous or Solid

Typical wastes associated with the proposed action alternative include trash, sewage, produced water, and produced hydrocarbons. No chemicals subject to the Superfund Amendments and Reauthorization Act (SARA) Title III in amounts greater than 10,000 pounds will be used during project activities. No extremely hazardous substances as defined in 40 CFR 355 in threshold planning quantities will be used.

During construction, a trash receptacle and a chemically treated portable toilet would be on location for trash and sewer disposal. All wastes would be disposed of in a proper manner as required by federal and state law and as described in the COAs.

4.22.1 Direct and Indirect Impacts

4.22.1.1 No Action

The potential for littering and hazardous leaks exists during construction, drilling, and operation of the POD. The impacts from hazardous or solid waste would be minimal to non-existent in both the short and long term with adherence to the design features.

4.22.1.2 Proposed Action

Impacts under the proposed action alternative would be the same as those described above under the no action.

4.23 Public Health and Safety

4.23.1 Direct and Indirect Impacts

4.23.1.1 Impacts Common to All Alternatives

The proposed project may impact public health and safety in a number of ways. The primary activities associated with public health and safety are traffic and transportation to/from the sites, including the handling, storage, and operation of equipment associated with construction activities. Health and safety issues for construction workers include operation of heavy equipment, drilling, welding activities, and working in the vicinity of other utilities (primarily other oil and gas gathering pipelines and overhead power lines).

Adherence to company safety policies and BLM COAs would mitigate public health and safety hazards. In addition, hauling equipment and materials for the project on public roads would comply with all Department of Transportation regulations. All equipment operation would be performed in compliance with appropriate Occupational Safety and Health Administration (OSHA) regulations.

4.23.1.2 No Action

Direct and indirect impacts to public health and safety would be low to moderate and short term during construction and drilling. Impacts during operation would be low and long term.

4.23.1.3 Proposed Action

Impacts under the proposed action alternative would be the same as those described above under the no action.

5. CUMULATIVE EFFECTS

NEPA regulations require that cumulative impacts of a proposed project be addressed when the cumulative impacts are expected to be significant (14 CFR 15130 [a], 40 CFR 1508.25[a][2]). Cumulative impacts are impacts on the environment that result from the incremental impact of the proposed action alternative when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). These impacts can result from individually minor but collectively significant actions taking place over time. Cumulative impacts are presented in terms of how project-specific impacts from the proposed construction of the proposed action alternative would add to baseline data derived from development activity in this specific area.

This analysis tiers to the Farmington PRMP/EIS (BLM 2003*a*, page 4-121 to 4-129). For a detailed analysis of cumulative impacts from the proposed action refer to Chapter 4 in the Farmington PRMP/EIS (BLM 2003*a*). The ROD approving the final plan acknowledged these, and future projected impacts, and considered them acceptable when balanced against the nation's need for domestic energy sources (USDI/BLM 2003*a*, 2003*b*, page 12).

The proposed project area has been industrialized with oil and gas well development. The surface disturbance for each project that has been permitted has resulted in dispersed development and fragmentation. The cumulative impacts fluctuate with the gradual reclamation of plugged and abandoned wells and the creation of new additional surface disturbances in the construction of new access roads and well pads.

5.1 Reasonably Foreseeable Development

This analysis of cumulative impacts considers past, present and reasonably foreseeable Federal and non-Federal activities that are expected to occur in the region. The proposed action would be one of a number of projects that have taken place or may reasonably be expected to take place in the region and are summarized in Table 5-1.

Table 5-1. Reasonable Foreseeable Development for the Region Surrounding the Proposed Action.

Project	Status	Description
Oil and Gas Related Projects		
Oil and Gas Development	On-going	The PRMP/FEIS for the lands managed by the BLM/FFO indicates development of 9,942 new oil and gas wells from 2003 and 2023 in the San Juan Basin, allowing for about 16,100 acres of long-term disturbance.
Oil and Gas Development – Navajo Reservation.	Proposed	These activities would require well pads, construction areas, access roads, pipelines, or distribution power lines as needed. Western Oil and Gas has proposed approximately 600 natural gas wells in eastern Burnham Chapter extending north into Upper Fruitland and Nenahnezad/San Juan Chapters.

Project	Status	Description
Oil and Gas Development	Proposed	Williams is considering a pilot project on the east side of Navajo Reservoir to drill horizontal wells to the Basin Mancos gas pool. Specific details have not yet been developed.
Power Plants and Transmission Lines		
Four Corners Generating Station	Existing/Change in Operations in 2014	Sale of Southern California Edison's share of the power plant. Closure of units 1, 2, and 3 and installation of air pollution control on Units 4 and 5 for regional haze. Extent and timing are uncertain, and require approvals. Post-2016 Lease for FCGS with the Navajo Nation has been extended until 2041, but needs approval.
San Juan Generating Station (SJGS)	Existing/Change in Operations in 2014	Best Available Retrofit Technology requirements for regional haze may require expensive retrofit on all 4 units. Could result in closure of some units to avoid costly retrofit.
Electric Transmission System Expansion	Proposed	Variety of projects including Navajo Transmission Project and San Juan Basin Interconnect Project proposed to expand the capacity of electric transmission across New Mexico to move renewable power, shift gas-fired compressors to electricity, and meet increased electric demand in the San Juan Basin.
Electric Power Expansion	Proposed or under consideration	Coal-fired generation for other coal-based development on Navajo or Ute reservations power, renewable generation such as solar and pumped storage hydro.
Coal Mining Projects		
Navajo Mine Areas I - III	On-going	Supplies coal to Four Corners Generating Station. Mining activities in Areas I and II have concluded. Reclamation is ongoing in Area II. Area III is actively mined in two pits with contemporaneous reclamation.
San Juan Coal Company San Juan Mine	On-going	An underground mine which is the exclusive supplier of coal to the San Juan Generating Station. Surface mining at San Juan reached a depth in the early 2000s that represented an economic limit, but underground mining is feasible and the coal supply contract with SJGS extends through 2017. Approximately 5400 acres disturbed as of 2010.
San Juan Coal Company La Plata Mine	Past, present	From 1986 through 2002 the La Plata mine also supplied coal to the San Juan Generating Station. The mine ceased operation in 2002 and reclamation continued through 2005. Approximately 2000 acres disturbed as of 2010.
Black Mesa Mine Peabody Western Coal	Past, present, ongoing?	Black Mesa Mine supplies coal to Navajo Generating Station in Page, Arizona which has been shut down since 2008. An EIS for future mine operations at Black Mesa was completed in 2008. Peabody submitted a mine plan

Project	Status	Description
Company		renewal application and EA to OSM in 2010.
Other Development		
Navajo Agricultural Products Industry Agricultural Development	On-going	Total irrigated agricultural land 110,000 acres. Project was about 60% complete in 2006.
Urban Development	On-going	Population of San Juan County, New Mexico 1990 – 92,000 2010 – 124,000 2030 – 156,000 (projected)
Animas-La Plata Project	Under construction	Development will include Ridges Basin Dam and Reservoir, Durango Pumping Plant, Ridges Basin Inlet conduit, with an average annual depletion of 57,100 acre-feet, and for the construction of a pipeline to deliver water for domestic use on the Navajo Nation at Shiprock, New Mexico
Navajo Gallup Water Supply Project	Under construction	The project would divert water from the San Juan River downstream of Fruitland, New Mexico, e, treat the water, and then deliver it along Highway N36 and south to Navajo chapters along U.S. Highway 491. Water delivery would continue to Window Rock, Arizona, and to the city of Gallup, New Mexico.
Indian Gaming on Navajo Reservation	Since 2009 and on-going	First Indian gaming operation on Navajo Reservation (Fire Rock Casino) opened near Gallup, New Mexico in 2009. A second casino near Shiprock, NM opened in October 2010. Two more casinos are planned near Farmington, New Mexico and Flagstaff, Arizona.

The temporal scope considered for cumulative impacts is as follows:

- Past actions are those that occurred between 1990-2010
- Present actions are those that occurred in 2010 and are continuing, and are considered in determining baseline conditions in the Affected Environment (Chapter 3)
- Future actions are those that are reasonably expected to occur after 2011 through 2023

5.2 No Action

The scale and timing of natural gas development in the Middle Mesa POD for the no action alternative is consistent with the RFDS used in evaluating the cumulative impacts of the PRMP. Therefore, it is assumed that the cumulative impacts of the no action alternative have been considered in the ROD for the PRMP/FEIS, and there are no adverse cumulative impacts for this alternative that would be significant after mitigation in the PRMP/FEIS and associated mitigations in future APDs were implemented.

5.3 Proposed Action

The proposed action alternative would result in low cumulative effects to air quality, water quality, vegetation, soils, topography, wildlife, BLM sensitive raptor species, range resources, and socioeconomic resources. The cumulative impacts for each of these resources for the proposed action alternative are presented below.

5.3.1 Air Quality

The air quality cumulative impacts analysis area is the San Juan Basin airshed. The POD for the proposed action alternative does not include specifications for natural gas compression for the 275 bcf that would be produced under the POD. Natural gas compression is one of the largest contributors to ozone precursor emissions (NO_x and VOCs) in San Juan County (Environ 2010). In the PRMP/FEIS, "the impact of RMP emissions with reasonably foreseeable future emissions would produce potentially significant cumulative impacts to ambient ozone levels in the project area (USDI/BLM 2003*a*, page 4-124). Since the ROD was completed for the PRMP/FEIS, the Four Corners Air Quality Task Force (Task Force) was convened, and BLM/FFO has been an active participant. Ambient air quality modeling and emissions research conducted for the Task Force has helped to identify and prioritize emissions reductions strategies that would be most effective in reducing ozone levels in San Juan County. Using these results as a guide, the NMED formally requested FFO to initiate a COA to limit NO_x emissions for compressor engines less than 300 horsepower to 2 grams per horsepower-hour. This COA was implemented by FFO on August 1, 2005. The FFO has received no other requests for COAs concerning emissions from the NMED.

5.3.2 Water Quality and Soils

The cumulative impact assessment area for water quality and soils is the Navajo Reservoir watershed. Navajo Reservoir watershed contains approximately 378,389 acres with approximately 1,334 existing oil and gas wells, approximately 7,951 acres of existing disturbance, and a road density of approximately 1.8 miles per square mile (BLM 2003*a,* page 3-3). Cumulative, long-term disturbance is associated with wells and facilities related to the development of oil and gas resources, including injection wells, roads, corridors for gathering lines and utilities, compressor stations, and ancillary facilities. At some future date, these wells and facilities would be reclaimed when gas production drops below an economic level.

Reasonably foreseeable development within the Navajo Reservoir watershed may include an estimated additional 1,256 oil and gas wells and related facilities. Surface-disturbing activities that would be associated with these actions may affect an estimated 4,707 acres for the long term; including wells, pipeline, roads and all associated facilities BLM 2003*a*, page 4-7). Other reasonably foreseeable actions expected within the watershed are livestock grazing, recreation including off road vehicle travel, fire management activities such as prescribed burns, and non-native invasive species control.

The PRMP/FEIS determined that the primary cumulative impacts on water quality would result from surface disturbance which would generate increased sediment yields (PRMP/FEIS 2003*a*, page 4-123 and 124). The PRMP/FEIS also noted that "cumulative impacts on soils in the San Juan Basin would comprise the total amount of short-term and long-term surface disturbance due to all new oil and gas development and other activities" (USDI/BLM 2003*a*, page 4-123).

Surface disturbance from oil and gas development activities would include removing vegetation and stockpiling topsoil, road construction, and shallow excavations for well pads and facilities. All of these surface disturbances have and continue to increase the potential for erosion and sedimentation. Additional sedimentation would exacerbate these existing impairments. The implementation of BMPs during construction, operation, and reclamation to control erosion would minimize effects on soil resources, and reduce additional sediment contribution to downstream surface waters. The proposed, existing and reasonably foreseeable developments would result in a minor increase in erosion and sediment load. The volume of water used during reasonably foreseeable development, including drilling, would not affect water resources of the planning area (BLM 2003*a*).

Surface-disturbing activities other than oil and gas development that may cause accelerated erosion include, but are not limited to, construction of buildings, roads, other facilities, and installation of trenches for utilities; road maintenance such as grading or ditch-cleaning; public recreational activities; vegetation manipulation and management activities; prescribed and natural fires; and agricultural activities such as wild horse and livestock grazing.

Cumulative effects to soil and water resources would be maximized shortly after construction begins and would decrease over time as reclamation efforts proceed. The pipeline ROW would be regularly inspected and maintained to minimize erosion, sedimentation, and impairment of water quality..

Given that the cumulative impacts to water quality and soils for the no action alternative were considered in the ROD for the PRMP/FEIS, the cumulative impacts to these resources for the proposed action would be insignificant after mitigation measures specified by the FFO are implemented. These could include submission of a site reclamation plan and minimizing soil disturbance during construction.

5.3.3 Vegetation and Range Resources

The cumulative impacts analysis area for vegetation is the BLM/FFO planning area. Within the FFO planning area there are approximately 633,400 acres of piñon-juniper and approximately 435,500 acres of Great Basin Desert Shrub habitat types (USDI/BLM 2003*a*, page 3-31). These vegetation types typically require 20 to 30 years to regenerate to a mature community stage. It may be reasonable to assume that the majority of the foreseeable oil and gas development may occur within the shrubland/big sagebrush community as well as the level areas of the piñon-juniper community. The reasonably foreseeable future actions for oil and gas development that may be expected within the steep slope piñon-juniper community would probably be limited to connecting access roads and pipeline ties. It could be estimated that 60 percent of the reasonable foreseeable future disturbed acreage (including existing and future long-term disturbances) may occur in the desert grassland and Great Basin desert scrub communities and approximately 40 percent may occur within the piñon-juniper and juniper savannah communities. Based on the acres of plant community types within the planning area and the estimated total disturbance of future activities, and given the above assumptions, approximately 2.7 percent of the desert grassland and Great Basin desert scrub communities and less than 1 percent of the piñon-juniper and juniper savannah communities would be disturbed within the planning area, within 20 years under the reasonably foreseeable future actions (USDI/BLM 2003*a*, page 3-31 and 4-7).

The cumulative effects of reasonable foreseeable future actions in the planning area, such as prescribed burns that are planned, projected grazing of livestock, grazing by wildlife and wild horses, recreation uses

such as hunting, and oil and gas development, would have a low cumulative effect of long-term duration on vegetation resources, provided best management practices are implemented.

Ground-disturbing activities and vehicle traffic aid in the distribution of noxious weeds. Noxious weeds are often adapted to take advantage of disturbed ground, establishing first growth and often out-compete native vegetation. Current noxious weed populations could contribute to growth on adjacent lands where roads and disturbed ground occur in close proximity. Best management practices would minimize the potential increase in distribution of existing weed communities in the planning area.

Similar to evaluating cumulative impacts to soils, cumulative impacts to vegetation and range resources are dependent on the total surface disturbance for the POD alternative. The proposed action results in long-term surface disturbance of almost one-tenth the area of the no action alternative. The other consideration for cumulative vegetation impacts is the type of vegetation community that would be disturbed and if it is unique or rare in the region. The POD for the proposed action would use existing well pads and areas of previous disturbance. No new roads would be built. By minimizing surface disturbance with these development strategies, the cumulative impacts to vegetation and range resources for the proposed action would be insignificant.

5.3.4 Wildlife

The cumulative impacts analysis area for wildlife is the Middle Mesa SDA given its topographical isolation created by Navajo Reservoir. The existing and future surface disturbance in the Middle Mesa Wildlife Area SDA is summarized in Table 5-2. The Williams Middle Mesa portion of the Rosa Unit comprises 12 percent of the SDA. Existing surface disturbance in the SDA totals about 1,700 acres.

Table 5-2. Summary Existing and Future Surface Disturbance in Project Area

Location	Estimated Area
Middle Mesa Wildlife Area SDA	46,052 acres
Middle Mesa Portion of Williams Rosa Unit	5,700 acres
Estimated Existing Surface Disturbance in the SDA (825 wells; 194 miles road)	1,700 acres
Estimated Existing Surface Disturbance on Middle Mesa Portion of Williams Rosa Unit (53 well pads; 18 miles road)	140 acres
Estimated Long-term Habitat Loss in the SDA	3,300 acres
Estimated Additional Long-term Surface Disturbance in Williams Rosa Unit portion of the SDA– No Action Alternative	72 acres
Estimated Additional Long-term Surface Disturbance in Williams Rosa Unit portion of the SDA– Proposed Action	8 acres

Cumulative impacts to wildlife for the proposed action were assessed based on known occurrences of mule deer and elk in the project area as described in Section 3.10 compared with peer-reviewed literature documenting impacts to deer and elk from oil and gas or similar disturbances, as well as past, present, and foreseeable activities that would impact ungulates in Middle Mesa. Middle Mesa is used as the area of analysis in this section in order to address impacts beyond the individual, which are impacts that may have detrimental or beneficial impacts to the local herd or the larger population, whether it is mule deer or elk. The natural boundaries that define most of Middle Mesa, the Pine River to the west, Navajo

Reservoir to the east, and the San Juan River to the south, likely influence animal movement in the area. Also, although wildlife do not recognize political boundaries, Middle Mesa is defined to the north by the state line between Colorado and New Mexico.

The parameters used in other recent wildlife impact assessments to measure cumulative impacts to wildlife include female survival and density of oil and gas development.

Female mule deer survival is an important parameter to measure in assessing energy impacts (Hebblewhite 2011, Johnson 2009). Watkins et al. (2001) reported adult female survival on the Uncompahgre Plateau in Colorado between 80 to 91 percent from 1997 to 2001; in the Piceance Basin in northwest Colorado, White et al. (1987) reported 83 percent for the same parameter; and Unsworth et al. (1999) found an average of 83 percent survival for adult female mule deer from studies in Colorado, Idaho, and Montana combined. Johnson (2009) found a low adult female survival rate at about 72 percent between 2004 and 2009 for individuals trapped in the HD Mountains less than 20 linear miles north of the Project Area. If these statistics are extrapolated to the project area, impacts may affect mule deer populations if they contribute to decreased adult female survival as suggested by Easterly et al. (1991).

Hebblewhite (2011) may provide the only published threshold of development density. In the studies he reviewed, impacts started to appear on ungulates at 0.1 to 0.4 wells per square kilometer. Using the data provided by the BLM, 825 well pads were confirmed using aerial imagery in GIS to occur in the analysis area, the density of well pads in the Middle Mesa SDA would be about 4.4 well pads per square kilometer. Studies conducted by Sawyer (2007) and Powell (2003) demonstrated that elk continued to avoid energy development long after exploration was completed and suggest population-level impacts.

To better understand the impacts of oil and gas development on the deer populations in the FFO planning area, a study of deer migration routes on the east side of Navajo Reservoir is in the preliminary design phase. The purpose of the study would be to determine the migration routes and high density winter use areas of mule deer on Rosa Mesa to provide data for use in pre-project siting. Pre-project siting outside of migration corridors or heavy use areas would serve to minimize impacts to wintering big game. The study is proposed to be funded by private industry and be conducted by a qualified research biologist. The preliminary study design involves tracking mule deer movements via collars with global positioning system (GPS) units. This study would be conducted for a horizontal drilling pilot project consisting less than five well pads. Eventually, full field development could occur on the east side of Navajo Reservoir, but at this time is speculative. Additionally, this pilot project is not located within the cumulative impacts analysis area.

Given the lack of scientific data on the deer and elk populations in the SDA, as well as the limited literature on the impact of oil and gas development on these populations, it is difficult to draw conclusions regarding the long-term or cumulative impacts of the proposed action on wildlife. The effectiveness of the winter closure in the SDA is also uncertain. Without empirical data, it is not possible to determine the significance of cumulative wildlife impacts on Middle Mesa. The POD for the proposed action alternative includes many design features to minimize impacts to deer and elk during the winter closure, including:

- Only one rig will be used for drilling operations between December 1 and March 31.

- If needed, only one rig move will be made between December 1 and March 31, and will not exceed 1.5 miles.
- Stimulation activities will not be conducted between December 1 and March 31.
- A residential camp will be utilized to reduce truck traffic to the drilling rig.
- Workers will be transported to and from the residential camp by high-capacity vehicles to minimize vehicle traffic.
- Workers schedules will be 12-hour shifts 7 days on and 7 days off to minimize vehicle traffic.
- Workers occupying the residential camp during non-work hours will restrict their excursions outside of the camp boundaries.
- Except for emergency situations and one shift change per day, all vehicle traffic will be restricted to daylight hours.

Therefore, the cumulative impacts to big game for the proposed action are estimated to be low to moderate. It cannot be determined whether these cumulative impacts would be significant. Therefore, monitoring of deer and elk populations in the Middle Mesa area is recommended.

5.3.5 BLM Sensitive Raptor Species

The cumulative impacts analysis area for special status species is the BLM/FFO planning area. The proposed project area contains potential habitat for three special status species: bald eagle, golden eagle, and American peregrine falcon. The cumulative impacts to these sensitive species are related to availability of undisturbed habitat in the area and the amount of disturbance that would occur with proposed action. Therefore, the long-term disturbance and cumulative impacts to sensitive raptor species for the proposed action would be small and insignificant, especially after site-specific mitigation measures are implemented. The BLM 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 their being listed under the Federal ESA (USDI/BLM 2003*a*, 4-111).

5.3.6 Socioeconomics

The cumulative impacts analysis area for socioeconomics is the BLM/FFO planning area. The PRMP/FEIS notes that "Overall, the effect of oil and gas development on land with non-federal minerals over 20 years would benefit economic activity in the planning area" (BLM/USDI 2003*a*, page 4-129). The POD for the proposed action alternative would result in full field development of the Basin Mancos pool within the Middle Mesa portion of the Rosa Unit, as well as additional development in the Mesaverde formation. This results in more than 10 times the natural gas production than the no action alternative. The cumulative socioeconomic benefit of the proposed action would include the long-term employment, income, and industry output generated by this natural gas production.

A recent economic base analysis for San Juan County, New Mexico, examined some of the potential consequences of a worst-case scenario in which one-half of the energy and extractive industry jobs are lost over a 15 year period (EPS 2011). Given the trends in oil and gas resource depletion in the San Juan Basin and changes to air quality standards, a decline in energy and extractive industry jobs in San Juan County is reasonably foreseeable. This study found that a reduction in mining employment from coal, oil,

and natural gas of 3,400 jobs between 2010 and 2025 would result in a total job loss in San Juan County of 7,500 jobs. These job losses would increase the county unemployment rate to between 15 and 18 percent.

Given the possible trend of a long-term decline in oil and gas employment and revenues, the socioeconomic benefits of the proposed action are even more significant because they would incorporate full field development of the Basin Mancos pool in the Middle Mesa portion of the Rosa Unit and increase employment and government revenues compared to the no action or the business-as-usual alternative.

5.3.7 Climate Change

The lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts of the alternatives. However, potential impacts to natural resources and plant and animal species due to climate change are likely to be varied, including those in the southwestern United States. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased windblown dust from drier and less stable soils. Cool season plant species' spatial ranges are predicted to move north and to higher elevations, and extinction of endemic threatened/endangered plants may be accelerated.

In 2007, the U.S. Government Accountability Office (GAO) Report on Climate Change found that, "federal land and water resources are vulnerable to a wide range of effects from climate change, some of which are already occurring. These effects include, among others: 1) physical effects such as droughts, floods, glacial melting, and sea level rise; 2) biological effects, such as increases in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events; and 3) economic and social effects, such as adverse impacts on tourism, infrastructure, fishing, and other resource uses." It is not, however, possible to predict with any certainty regional or site-specific effects on climate relative to the proposed action alternative and subsequent actions.

To estimate the impacts of climate change on the Middle Mesa POD alternatives requires a forecast of future climate conditions for the region. Climate prediction simulation models are generally not very accurate at the fine scale required to estimate climate change impacts on northern New Mexico. In April 2009, land managers in New Mexico, including those from federal agencies, met to discuss how climate change would affect conservation and land management strategies (Enquist 2009). This discussion focused on the Jemez Mountains about 100 miles southeast of Middle Mesa. Two climate change scenarios were considered for the discussion:

- Scenario 1: Increases in mean annual temperature between 2 and 4°C with increased drying, on average, and periodic extreme events in the first half of the 21st century; precipitation reduced but skewed toward fewer larger events.
- Scenario 2: Increases in mean annual temperature between 2 and 6°C with increased drying, on average, and increased frequency of extreme events (e.g., episodic "mega" drought) by mid-century; note that drought has been a natural part of the southwest for thousands of years. (The Scenario 2 general temperature range would be the same as Scenario 1 but with only 67 percent of its precipitation).

Generally, the climate change models predict that regionally, northern New Mexico will experience an increase in mean annual temperature and a decrease in mean annual precipitation (Enquist and Gori 2008). Based on the land manager discussions, the potential impact of these changes to weather conditions at Middle Mesa would include:

- Increased dust and particulate emissions.
- Increased risk to workers from heat stroke and other heat and dust-related illnesses.
- Increased risk of catastrophic fire events, smoke plumes, or dust storms at the Middle Mesa area.

All of these impacts would affect natural gas operations and require additional mitigation to protect workers and equipment. These effects would be the same for both Middle Mesa POD alternatives.

6. CONSULTATION COORDINATION

The environmental document was prepared by Ecosphere Environmental Services in conformance with the standards of and under the direction of the BLM/FFO. This section includes individuals or organizations from the public, public land users, and the interdisciplinary team that were contacted during the development of this document.

The following public and private entities contributed to this document:

Maureen Joe, Project Lead, Bureau of Land Management Farmington Field Office
Gary Torres, Field Manager, Bureau of Land Management Farmington Field Office
Barney Wegener, Interdisciplinary Team Lead, Bureau of Land Management Farmington Field Office
Jim Copeland, Archaeologist, Bureau of Land Management Farmington Field Office
John Hansen, Wildlife Biologist, Bureau of Land Management Farmington Field Office
Dale Wirth, Branch Chief Range and Multiple Resources, Bureau of Land Management Farmington Field Office
Megan Stouffer, Bureau of Land Management State National Environmental Policy Act Coordinator
Rebecca Hunt, Bureau of Land Management, State Natural Resource Specialist

Heather Riley, Senior Regulatory Specialist, Williams Four Corners, LLC.
Larry Higgins, Supervisor Permits, Williams Four Corners, LLC.
Ben Mitchell, Regulatory Specialist, Williams Four Corners, LLC.
Ken McQueen, Director, San Juan Region Exploration and Production, Williams Four Corners, LLC.

Jim Ramakka, Tierra Natural Resource Consulting, LLC.

Aran Johnson, Wildlife Biologist, Southern Ute Indian Tribe

The following agencies and individuals were contacted during preparation of this document.

- Kathy McKim
- Theresa Pasqual, Acoma Historical Preservation Office
- U.S. Army Corps of Engineers, Albuquerque District Office
- Barry Longwell, Bureau of Reclamation
- Jay Lininger, Center for Biological Diversity
- Taylor McKinnon, Center for Biological Diversity
- Commissioner of Public Lands
- Pete Valencia, Assistant to Congressman Ben Ray Lujan
- Armando Espinosa, Espinosa Ranch
- John Faverino, Grazing Permittee
- Sean and Dannette Washburn, Grazing Permittee
- Santiago Valasquez, Grazing Permittee
- Richard Hodgson, Grazing Permittee
- Leigh J. Kuwanwisiwma, Director Hopi Tribe

- Terry Morgart, Hopi Tribe
- Cordell TeCube, Jicarilla Apache Nation
- Gifford Valarde, Director Jicarilla Apache Nation
- Alexander Hays, National Trust for Historical Preservation Office
- Andrea Hazelton, Botanist Navajo Nation Department of Fish and Wildlife
- Chad Smith, Zoologist Navajo Nation Department of Fish and Wildlife
- Dr. Alan Downer Director, Attn: Tony JoeNavajo Nation Historic Preservation Department
- Caren Cowan, New Mexico Cattle Grower's Association
- Tim Cimbal, New Mexico Department of Game and Fish
- Brian Gleadle, Chief, New Mexico Department of Game and Fish
- Matt Wunder, Chief. New Mexico Department of Game and Fish
- New Mexico Energy, Minerals & Natural Resources
- Mary Uhl, New Mexico Environment Department
- Gedi Cibas, Environmental Review, New Mexico Environment Department
- Marcy Leavitt, Bureau Chief, New Mexico Environment Department
- New Mexico Highway and Transportation Department
- New Mexico Land Use Alliance
- New Mexico Oil Conservation Division
- Jan Biella, New Mexico State
- New Mexico Wildlife Federation
- Office of the Governor, Santa Fe, New Mexico
- Mike Eisenfeld, San Juan Citizens Alliance
- San Juan County Commissioners
- Jim Dumont Assistant to Senator Jeff Bingaman
- Sara Cobb, Field Representative for Senator Tom Udall
- Sierra Club, Santa Fe, New Mexico
- Lena M Atencio, Director, Southern Ute Tribe
- Susan Mac Mullin, Director, U.S. Fish and Wildlife Service
- Erik Ryberg, U.S. Fish and Wildlife Service
- Cindy MacDonald, U.S. Fish and Wildlife Service
- Johnny Ahlm, U.S. Fish and Wildlife Service
- Nicole Rosmarino, Wild Earth Guardians

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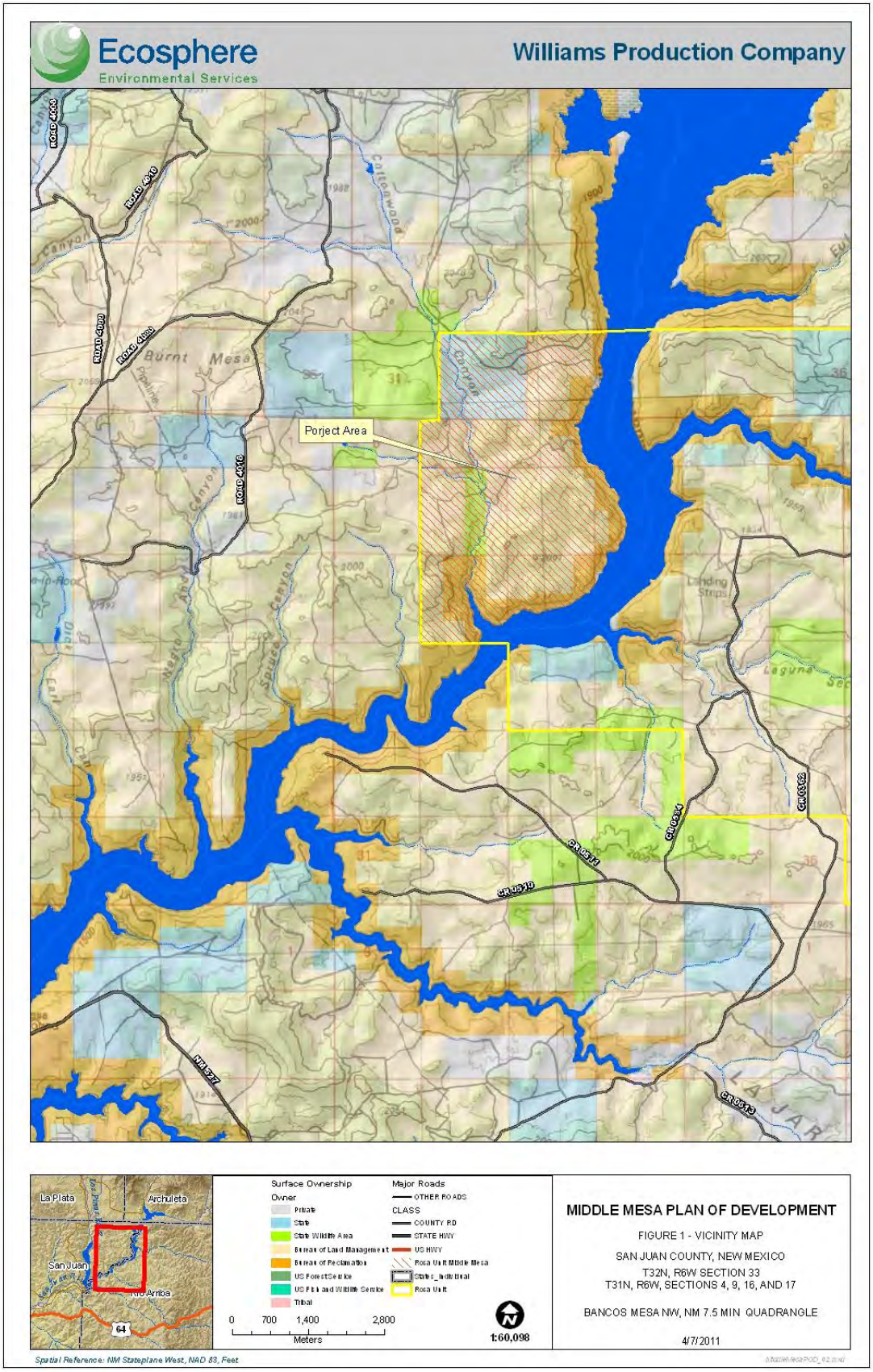
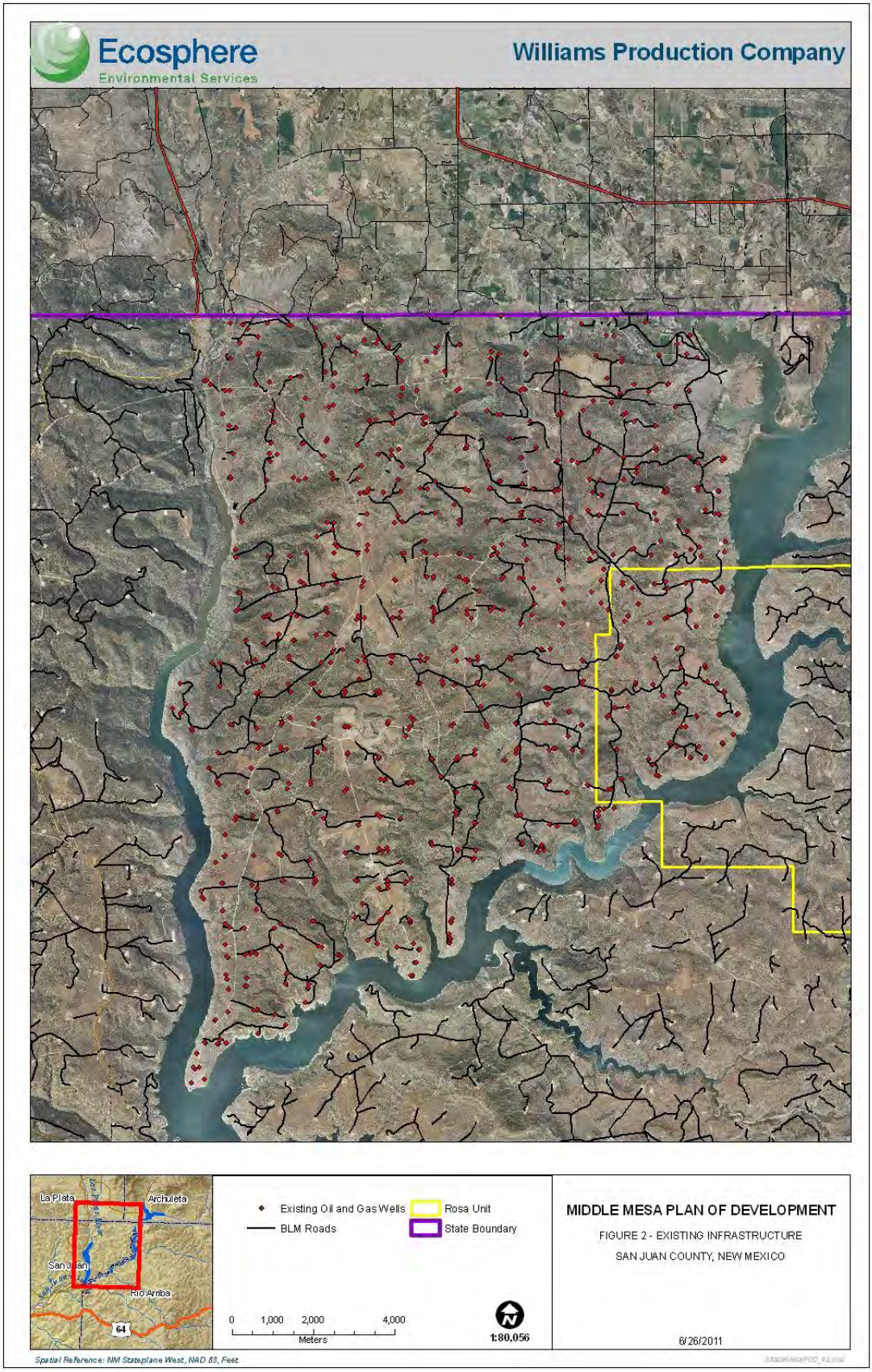
APPENDIX A
FIGURES

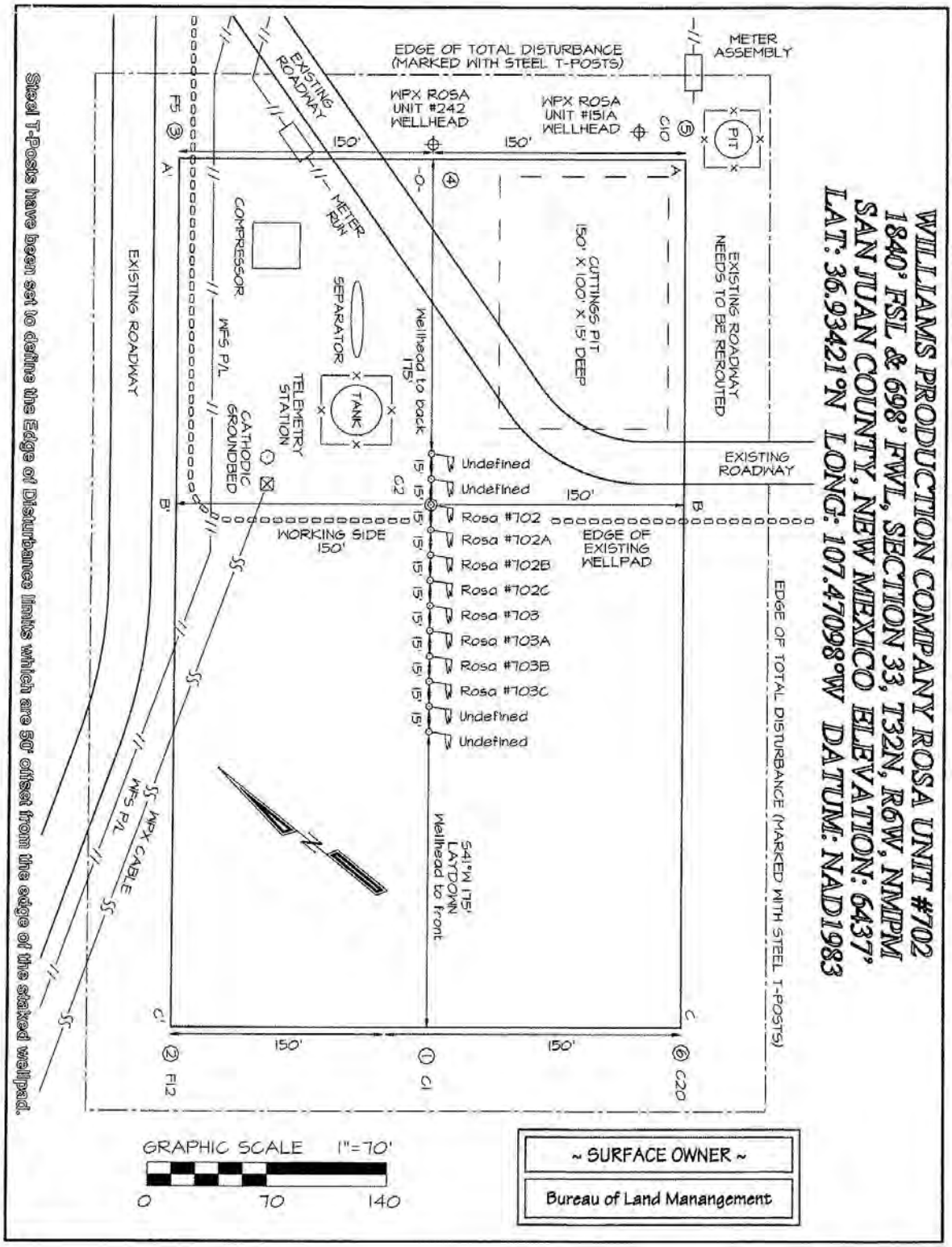

Ecosphere
Environmental Services
Williams Production Company
Porject Area
ROAD 4008
ROAD 4009
ROAD 4010
CR 0519
CR 0520
NM 527
La Plata
Archuleta
San Juan
Rio Arriba
64
Surface Ownership
Owner
Private
State
State Wildlife Area
Bureau of Land Management
Bureau of Reclamation
US Forest Service
US Fish and Wildlife Service
Tribal
Major Roads
OTHER ROADS
CLASS
COUNTY RD
STATE HWY
US HWY
Rosa Unit Middle Mesa
State_Individual
Rosa Unit
0 700 1,400 2,800
Meters
1:60,098
MIDDLE MESA PLAN OF DEVELOPMENT
FIGURE 1 - VICINITY MAP
SAN JUAN COUNTY, NEW MEXICO
T32N, R6W SECTION 33
T31N, R6W, SECTIONS 4, 9, 16, AND 17
BANCOS MESA NW, NM 7.5 MIN QUADRANGLE
4/7/2011
Spatial Reference: NM Stateplane West, NAD 83, Feet

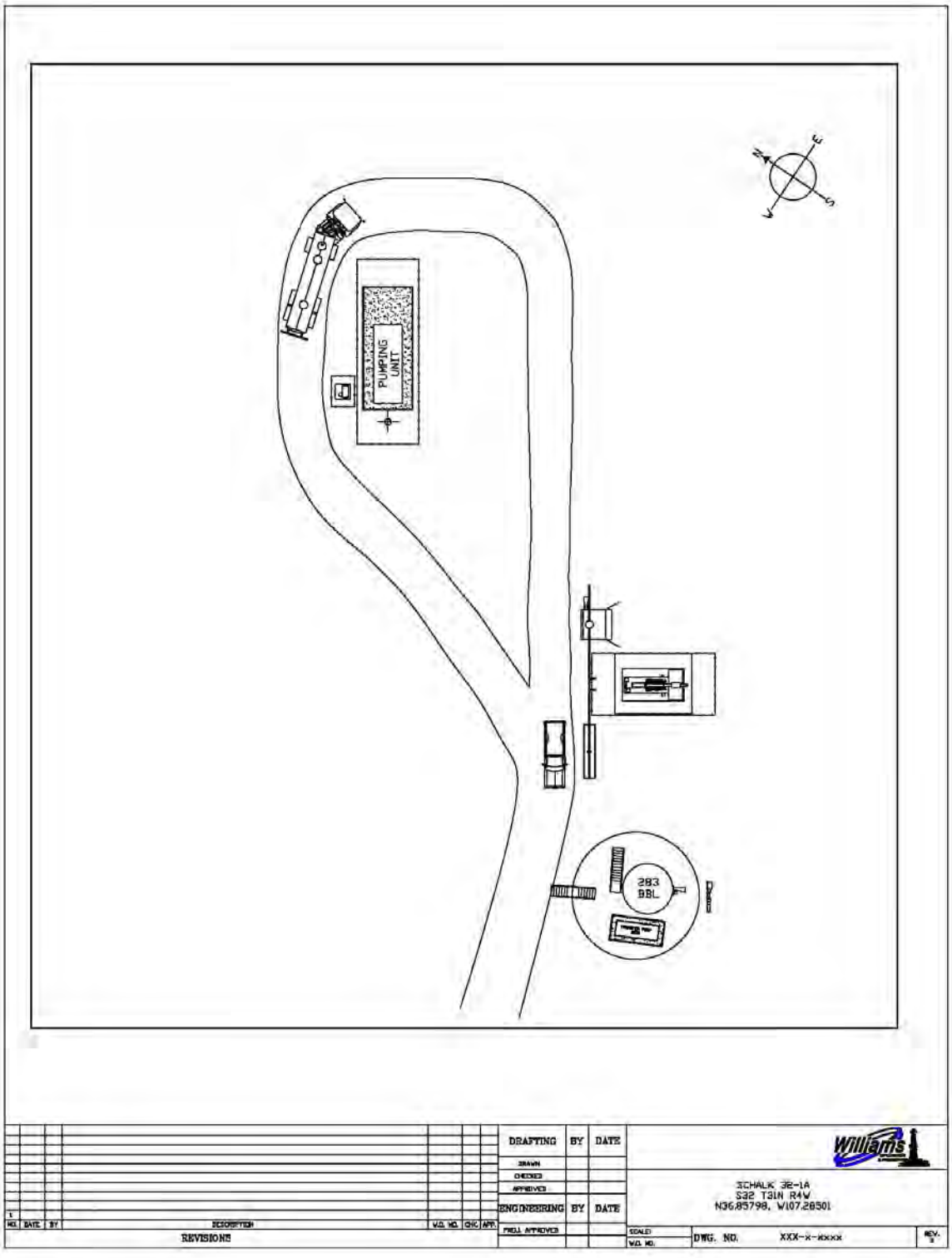

Ecosphere
Environmental Services
Williams Production Company
La Plata
Archuleta
San Juan
Rio Arriba
64
Existing Oil and Gas Wells
BLM Roads
Rosa Unit
State Boundary
0 1,000 2,000 4,000
Meters
1:80,056
MIDDLE MESA PLAN OF DEVELOPMENT
FIGURE 2 - EXISTING INFRASTRUCTURE
SAN JUAN COUNTY, NEW MEXICO
6/26/2011
Spatial Reference: NM Stateplane West, NAD 83, Feet


Ecosphere
Environmental Services
Williams Production Company
NORTHERN PAD
SOUTHERN PAD
La Plata
Archuleta
San Juan
Rio Arriba
64
Rosa Unit Boundary
Proposed Well Pads
Stimulation Pads
Mancamp
Specially Designated Areas
ACEC/Bald Eagle
ACEC/Bald Eagle Core Site
0 275 550 1,100
Meters
1:22,648
MIDDLE MESA PLAN OF DEVELOPMENT
FIGURE 3 - PROJECT AREA MAP
SAN JUAN COUNTY, NEW MEXICO
T32N, R6W SECTION 33
T31N, R6W, SECTIONS 4, 9, 16 AND 17
BANCOS MESA NW, NM 7.5 MIN QUADRANGLE
4/7/2011
Spatial Reference: NM Stateplane West, NAD 83, Feet


Ecosphere
Environmental Services
Williams Production Company
NORTH FRAC PAD
SOUTH FRAC PAD
La Plata
Archuleta
San Juan
Rio Arriba
64
Rosa Unit Boundary
Potential Gathering System Pipelines
Proposed Well Pads
Stimulation Pads
0 230 460 920
Meters
1:18,748
MIDDLE MESA PLAN OF DEVELOPMENT
FIGURE 4 - POTENTIAL GATHERING SYSTEM PIPELINES
SAN JUAN COUNTY, NEW MEXICO
6/27/2011
Spatial Reference: NM Stateplane West, NAD 83, Feet

APPENDIX B
REPRESENTATIVE PAD LAYOUTS


WILLIAMS PRODUCTION COMPANY ROSA UNIT #702
1840' FSL & 698' FWL, SECTION 33, T32N, R6W, NMPM
SAN JUAN COUNTY, NEW MEXICO ELEVATION: 6437'
LAT: 36.93421°N LONG: 107.47098°W DATUM: NAD1983
EDGE OF TOTAL DISTURBANCE (MARKED WITH STEEL T-POSTS)
METER ASSEMBLY
WPX ROSA UNIT #242 WELLHEAD
WPX ROSA UNIT #151A WELLHEAD
PIT
EXISTING ROADWAY
METER RUN
COMPRESSOR
SEPARATOR
TANK
TELEMETRY STATION
CATHODIC GROUNDBED
WFS P/L
CUTTINGS PIT 150' X 100' X 15' DEEP
EXISTING ROADWAY NEEDS TO BE REROUTED
Wellhead to back 175'
Undefined
Undefined
Rosa #702
Rosa #702A
Rosa #702B
Rosa #702C
Rosa #703
Rosa #703A
Rosa #703B
Rosa #703C
Undefined
Undefined
WORKING SIDE 150'
EDGE OF EXISTING WELLPAD
EXISTING ROADWAY
EDGE OF TOTAL DISTURBANCE (MARKED WITH STEEL T-POSTS)
54!'N 175' LAYDOWN Wellhead to front
WPX CABLE
WFS P/L
150'
F5
F12
C1
C2
C10
C20
A
A'
B
B'
C
C'
GRAPHIC SCALE 1"=70'
0
70
140
~ SURFACE OWNER ~
Bureau of Land Manangement
Steel T-Posts have been set to define the Edge of Disturbance limits which are 50' offset from the edge of the staked wellpad.



							DRAFTING	BY	DATE
							DRAWN		
							CHECKED		
							APPROVED		
							ENGINEERING	BY	DATE
NO.	DATE	BY	DESCRIPTION		W.O. NO.	CHK.	APP.	PROJ. APPROVED		

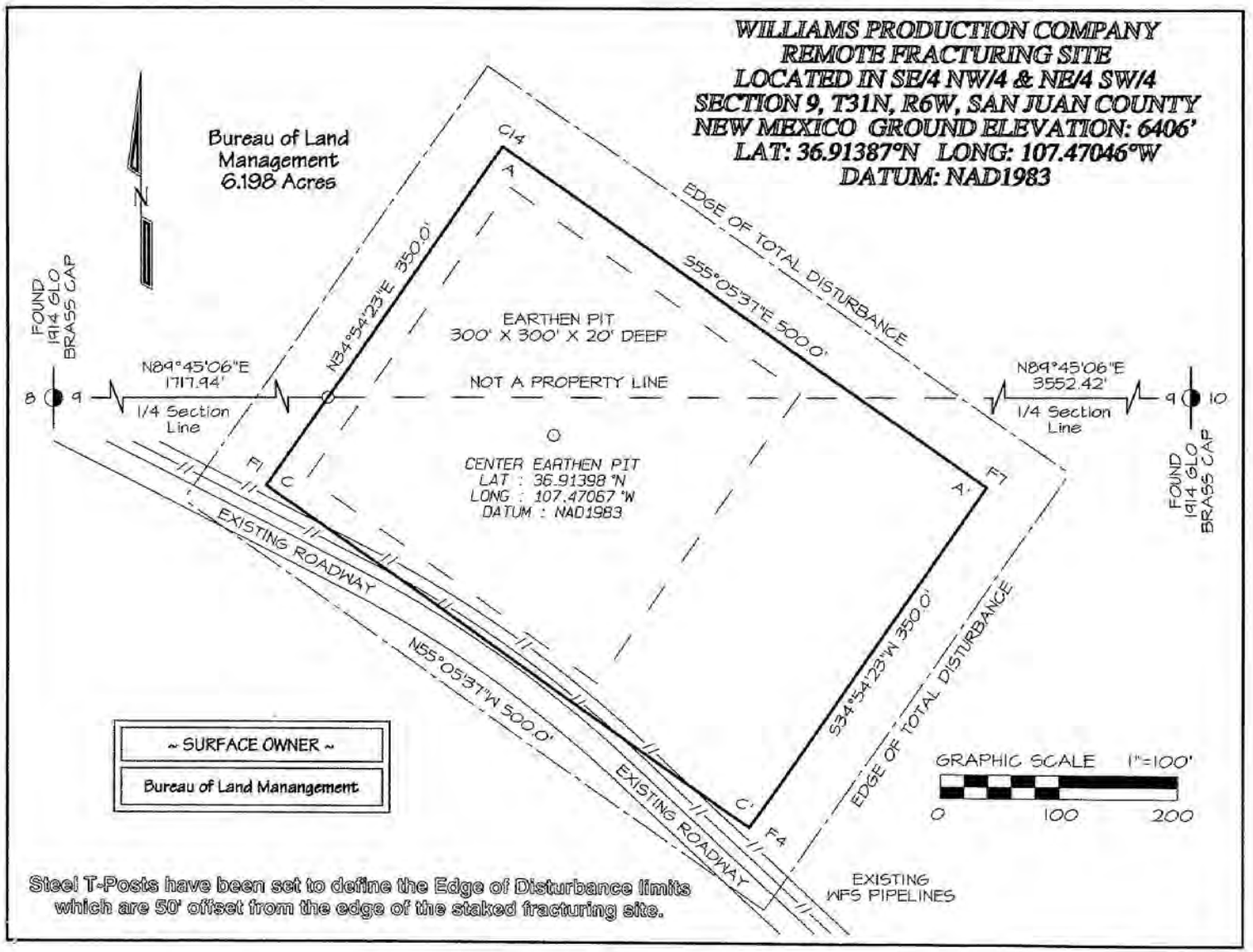
REVISIONS

SCALE:
W.O. NO.

SCHALK 32-1A
S32 T31N R4W
N36.85798, W107.28501

DWG. NO. XXX-x-xxxx

REV. 0


WILLIAMS PRODUCTION COMPANY
REMOTE FRACTURING SITE
LOCATED IN SE/4 NW/4 & NE/4 SW/4
SECTION 9, T31N, R6W, SAN JUAN COUNTY
NEW MEXICO GROUND ELEVATION: 6406'
LAT: 36.91387°N LONG: 107.47046°W
DATUM: NAD1983
Bureau of Land Management
6.198 Acres
N
EDGE OF TOTAL DISTURBANCE
EARTHEN PIT
300' X 300' X 20' DEEP
NOT A PROPERTY LINE
CENTER EARTHEN PIT
LAT : 36.91398 °N
LONG : 107.47067 °W
DATUM : NAD1983
FOUND 1914 GLO BRASS CAP
N89°45'06"E 1717.94'
1/4 Section Line
N89°45'06"E 3552.42'
1/4 Section Line
N34°54'23"E 350.0'
S55°05'31"E 500.0'
S34°54'23"W 350.0'
N55°05'31"W 500.0'
EXISTING ROADWAY
EXISTING WFS PIPELINES
~ SURFACE OWNER ~
Bureau of Land Manangement
GRAPHIC SCALE 1"=100'
0 100 200
Steel T-Posts have been set to define the Edge of Disturbance limits which are 50' offset from the edge of the staked fracturing site.

APPENDIX C
BIOLOGICAL SURVEY REPORT

BIOLOGICAL SURVEY REPORT
WILLIAMS PRODUCTION COMPANY, LLC
THE MIDDLE MESA PLAN OF DEVELOPMENT PROJECT

This report describes the potential for U.S. Fish and Wildlife Service (USFWS) and Bureau of Land Management (BLM) listed threatened, endangered, candidate, and other designated species to occur in the project and action areas. The BLM defines the action area as any area that may be directly or indirectly impacted by the proposed action. This report is prepared in accordance with the BLM's biological survey guidelines and is intended to provide the agency with information to make determinations of effect on species with special conservation status.

PROJECT DESCRIPTION

Williams Production Company, LLC (Williams) is proposing the phased development of eight well pads, which would be twinned or co-located with existing vertical well locations within the Middle Mesa Wildlife Area Specially Designated Area (SDA). Figure 1 in Attachment A shows the locations of the proposed well pads within the Middle Mesa Wildlife Area SDA.

Under the proposed action alternative, Williams' projects that 53 horizontal wells would be drilled from eight existing well pads to fully develop the Basin Mancos pool in the Middle Mesa portion of the Rosa Unit. Additionally, twelve directional Mesaverde wells would also be drilled from the proposed eight well pad locations. Up to 13 wells could be drilled on each pad location; an average of seven horizontals in the Basin Mancos and five or six additional directional wells are considered on each pad for development of non-Mancos reservoirs. All wells proposed for a single well pad would be drilled consecutively

Under this alternative, drilling would occur during the winter closure at six of the eight pads. No drilling would occur during the winter closure on pads #7 and #8. Only one rig would be used for drilling operations between December 1 and March 31. Williams would plan drilling activities to avoid moving the rig during the winter closure to the extent practicable to avoid further disturbance to wintering elk and mule deer. During the winter closure, the rig would be moved no more than once and no more than 1.5 miles. Applications for Permit to Drill (APDs) would be prepared as specified by BLM for the drilling program. Each well pad would be subject to additional site-specific environmental analysis at the time of APD submittal, as determined by the BLM/FFO.

For the proposed Plan of Development, two well stimulation pads would be constructed. Each pad would be approximately 350 feet by 500 feet in dimension, for a total disturbance of 4.0 acres. An approximate 2-acre produced water holding pond would be located on each well stimulation pad. The centralized holding ponds would be built and shared by the eight drilling locations so individual holding ponds or tanks would not be required on every pad. The well stimulation pads would be completely reclaimed following completion of well stimulation. The total surface disturbance associated with the proposed action alternative would be 52 acres in the short-term and 8 acres of long-term disturbance.

The project would be developed entirely within land and mineral resources administered by the BLM Farmington Field Office (FFO). A project area map showing the location of the proposed action on the

Bancos Mesa, New Mexico U.S. Geological Survey (USGS) 7.5-minute topographic map is provided as Attachment A.

Location: The proposed development would be contained within Sections 4, 9, 16, and 17, Township 31 North, Range 6 West, and Section 33, Township 32 North, Range 6 West, New Mexico Principal Meridian (NMPM) in San Juan County, New Mexico. The proposed action would be located east of Cottonwood Canyon and west of Navajo Reservoir.

Previous Disturbance: The eight drill pad locations would be twinned with existing well pads. The two well stimulation pads would result in new disturbance.

METHODOLOGY

Off-site Methods: Prior to conducting fieldwork, Ecosphere biologists compiled a list of USFWS and BLM species with special conservation status that occur or have the potential to occur in San Juan County, New Mexico. USFWS listed species were obtained from the USFWS Southwest Region Endangered Species List (Table 1) (USFWS 2011). BLM special status species (Table 2) were compiled from the BLM Farmington Field Office (FFO) Instruction Memorandum No. IM-NM 200-2008-01 (BLM 2008) and the Farmington Resource Management Plan (BLM 2003).

On-site Methods: Pedestrian surveys of the proposed project were conducted by Ecosphere Environmental Services (Ecosphere) on April 12 and on May 12, 2011. Transects spaced approximately 20 feet apart were surveyed on each pad area. The weather was partly cloudy and breezy with ambient temperatures ranging between 40 and 50º F during the survey. All plant and wildlife species and signs of wildlife observed in the project area were recorded and digital photos of the project area were taken. Binoculars were used to survey for raptors, potential nesting habitat, and whitewash. The habitat was evaluated for all USFWS and BLM species with special conservation status that have the potential to occur in the project area or action area (Tables 1-3).

ACTION AREA

Action Area: The action area consists of the proposed project area and surrounding terrain within a 1/3-mile radius of the project area.

Physical Description: The project would be located on the southeast portion of Middle Mesa within the Rosa Unit. The locations of the proposed wells are west of Navajo Reservoir at an average of 0.7 mile and east of Cottonwood Canyon. Elevation within the area ranges between 6,400 to 6,600 feet.

The proposed drill pad #1 would be the farthest north and twinned with Rosa Unit #151 and #242A well pads. The drill pad would be located on a southeast sloping mesa top at an elevation of approximately 6,450 feet. The existing pad is flat with the perimeter slightly contoured. The surrounding terrain includes an approximately 200 foot high terraced sandstone finger mesa situated an estimated 300 feet north of the proposed drill pad location. Approximately 500 feet south of the location is an eroded sandstone knoll approximately 30 feet in height. The sandstone cliffs of Navajo Reservoir are located about 1,500 feet east of the proposed location, and the water-body is within line of sight of the project area.

The proposed drill pad #2 and the north stimulation pad are located 2,200 feet southwest of drill pad #1 on the west side of the eroded sandstone slope. An existing road, running east to west, is located between the two proposed pads. Drill pad #2 would be located upslope from the stimulation pad on a hillside. The drill pad would be twinned with the existing Rosa Unit #242 well pad. The slope on the southeast side of the drill pad near corner six was estimated in the field to be approximately eight degrees with a northwestern aspect. The other portions of the drill pad slope between zero and three degrees. The southeast corner of the stimulation pad would be located adjacent to the northwest side of the drill pad. The terrain within the stimulation pad is mild with southwest facing aspects between zero and three degrees. The proposed pad would be located approximately 600 feet south of the base of a sandstone terraced ridge characterized by a small band of sandstone ledges approximately 200 feet long and 5-10 feet high. Navajo Reservoir is located approximately 2,500 feet east of the proposed pads and is not visible from the location.

As proposed, drill pad #3 would be located approximately 2,500 feet south of drill pad #2 on a narrow mesa top between Navajo Reservoir and Cottonwood Canyon. The mesa rim dropping down into Cottonwood Canyon is located approximately 50 feet from the proposed pad southwest corner. The drill pad would be twinned with the existing Rosa Unit #60 well. Slopes are mild and range between zero and three degrees to the southeast, with the greater slope created by a drainage berm along the north side of the well pad. A sandstone knob, approximately 100 feet in height, with a small band of sandstone ledges five feet high circling it, is located approximately 950 feet east of the proposed pad. Navajo Reservoir is located approximately 2,500 feet east of the proposed drill pad #3, but is not within line of site.

The proposed drill pad #4 would be located on a narrow mesa approximately 1,300 feet south of drill pad #3. An existing road bisects the pad from north to south. The drill pad would be twinned with the recently developed Rosa Unit Com #60B. The south edge of the well pad would be located about 25 feet from the rim of Cottonwood Canyon and contains massive sandstone outcrops and boulders. Slopes within the project area range between zero and six degrees. The recontoured sides of the existing well pad have slightly steeper slopes at two to three degrees, and the northeast corner outside of the existing disturbance slopes between five and six degrees. Navajo Reservoir is located approximately 3,000 feet east of the project area and is not visible from the project location.

Drill pad #5 is proposed to be located 870 feet south of drill pad #4 and would be twinned with the existing Rosa Unit #180A. As proposed, the southeast edge of the drill pad would be located at the base of a sandstone hill. An existing road runs along the proposed western well pad boundary. Navajo Reservoir is approximately 3,600 feet east of the project area and is not within line of sight. The majority of the drill pad would be located on flat terrain associated with the existing well pad; however, the existing pad cut slope is characterized by slopes up to approximately 30 degrees. The undisturbed portions of the project area contain steeper slopes, ranging between six and seven degrees.

The proposed south stimulation pad would be situated approximately 1,100 feet south of drill pad #5 on the south facing side slope between two sandstone knolls. The knolls are approximately 100-140 feet in height and characterized by large, blocky boulders and talus covered side slopes. The proposed southwest pad boundary would be located on the edge of an existing access road and pipeline ROW. The majority of the pad would be located within undisturbed terrain that mildly slopes south at approximately one degree. Navajo Reservoir is located approximately 4,200 feet east of the project area and is not visible

from the project area. Two small erosional drainages cross the stimulation pad through the middle and east corner of the project area.

As proposed, drill pad #6 would be twinned with existing Rosa Unit #180D and #234 well pads at the base of a sandstone knob approximately 200 feet in height. Overall, the area is relatively flat. The undisturbed portions and recontoured areas slope between two and six degrees, with the steeper slopes within the southwest corner. The overall direction of the variable slopes is toward the east. Navajo Reservoir is approximately one mile directly east of the project area, but it is not visible from the project area.

Drill pad #7 is proposed to be located 1,100 feet southwest of drill pad #6 and twinned with the Rosa Unit #145A well. The drill pad would be located at the upper end of a south flowing canyon, which drains into Navajo Reservoir about 2,000 feet to the south. The proposed pad lies within a low area surrounded by eroded sandstone hills, that rise 200 feet or less in elevation. The hills contain sandstone outcrops and small cliff bands less than five feet high. The slope within the existing well pad is flat, while the cut slopes created by well pad construction are steeper and range between three and seven degrees. The undisturbed portions of the project area contain slopes ranging between three and five degrees.

Drill pad #8 would be twinned with the existing Rosa Unit #276, #138C and #138D wells. The project is located at the base of a sandstone hill to the north that rises approximately 200 feet in elevation. The northern edge of the proposed pad would be located on the cut slope of the existing pad that has been recontoured to blend back with the hill slope. The steep sandstone cliffs of Navajo Reservoir are approximately 700 southwest. The reservoir is not visible from the project area. The existing well pad location is flat and the cut slopes created and recontoured from the previous locations have slopes between five and 30 degrees. The northern cut slope is the steepest. The undisturbed portions slope southwest at approximately two degrees.

Two major soil mapping units occur within the proposed project area; Penistaja-Buckle association, gently sloping and Travessilla-Weska-Rock outcrop complex, extremely steep (Keetch 1980). Both the north and south stimulation pads and drill pads #2 and #8 are located entirely on the Penistaja-Buckle association. The remaining drill pads contain both soil units.

Surface run off from the project sites and the general area flows in various directions; however all the paths of flow eventually lead into Navajo Reservoir. There are no perennial surface water resources or wetlands within the proposed pads.

Biological Description: Three major vegetation communities occur within the Middle Mesa portion of the Rosa Unit: reclaimed shrub grassland habitat associated with the existing disturbance, piñon-juniper woodland, and Great Basin desert scrub sagebrush series. The eight proposed drill pads under the proposed action would utilize previous disturbance associated with existing well pads, access roads and pipeline corridors to minimize disturbance to native plant communities.

Dominant species in the reclaimed shrub grassland habitat include western wheat (*Pascopyrum smithii*), crested wheat (*Agropyron cristatum*), and smooth brome (*Bromus inermis*), with scattered four-winged saltbush (*Atriplex canescens*), rubber rabbitbrush (*Ericameria nauseosa*), and big sagebrush (*Artemisia tridentata*). Typically vegetative cover ranges widely from 2-70% in this vegetation type.

The piñon-juniper woodland is dominated by piñon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) with and understory dominated by broom snakeweed (*Gutierrezia sarothrae*), big sagebrush, Indian ricegrass (*Achnatherum hymenoides*), and James' galleta grass (*Pleuraphis jamesii*). Trees in the woodland vary widely in size and stature and are a mix of juvenile and mature. Tree canopy varies within woodland areas and ranges from 25 to 40% with understory cover widely ranging from approximately 15 to 30%.

The Great Basin desert scrub sagebrush series is dominated by big sagebrush, broom snakeweed, Indian ricegrass, and James' galleta grass. Vegetative cover varies from an estimated 25-40

The vegetation within drill pad #1 is described as a piñon-juniper/desert scrub transition zone and also contains reclaimed shrub grassland. The southwest corner contains approximately 1.2 acres of undisturbed piñon-juniper/desert scrub, with approximately 30-35 immature piñon and juniper trees scattered throughout. The southeast corner contains approximately 0.6 acres that was previously chained and has re-vegetated into desert scrub with James' galleta grass, big sagebrush, and five immature juniper trees. The middle and northern portions of the proposed pad (1.7 acres) are barren and/or reclaimed areas.

Drill pad #2 is vegetated with desert scrub and reclaimed shrub grassland. Approximately 1.7 acres in the southwest half of the proposed well pad area is previously undisturbed and supports piñon-juniper/desert scrub vegetation, which is dominated by big sage and contains approximately 35 scattered piñon and juniper trees. The drill pad northeastern half contains barren areas and reclaimed vegetation. The dominant species within the reclaimed areas is crested wheat grass.

The north stimulation pad would be located entirely within an undisturbed piñon-juniper/desert scrub transition zone with approximately scattered 50 piñon and juniper trees.

Approximately 1-acre of drill pad # 3 would be located on bare ground associated with the existing well pad and access road. Of the remaining 2.5 acres, approximately 2-acres would be located within a reclaimed area, dominated by crested wheat grass and scattered big sagebrush. The remaining 0.5 acre, which is mainly located on the corners and along the southern edge of the project area, is undisturbed and consists of piñon-juniper woodland with a sagebrush dominated understory.

Drill pad #4 is characterized by approximately 2-acres of bare ground associated with a recently developed well pad. The eastern half contains about 1-acre of previously chained woodland which is now dominated by big sagebrush with approximately 12-15 immature juniper trees reestablishing in the mid section. The western well pad boundary and construction zone is located within piñon-juniper woodland.

An estimated 1.5 acres of drill pad #5 contains reclaimed vegetation dominated by crested wheat grass with scattered rubber rabbitbrush and big sagebrush. The northern portion of the drill pad is located within an area that was historically chained and has revegetated into desert scrub. This area contains approximately 35 scattered piñon and juniper trees. The southeastern and southwestern well pad perimeters fall within undisturbed piñon-juniper woodland and contain approximately 15 trees.

The southwest edge of the south stimulation pad is located along an existing access road and pipeline ROW. This accounts for approximately 0.3 acre of previous disturbance within the proposed pad. The remainder of the pad is located within undisturbed piñon-juniper/desert scrub interface. There are approximately 150-200 mixed aged piñon-juniper trees within the boundaries of the proposed pad.

Drill Pad #6 is located on previous disturbance associated with a recently drilled well. The south corner and a small strip along the eastern edge of the project area, approximately 1-acre, are located within undisturbed piñon-juniper woodland and contain approximately 100 trees. The remainder of the project area lies within a reclaimed area. The northern corner recently is reclaimed and has very little vegetation, at less than 2 percent cover. The areas to the east, south and southwest adjacent to the existing well pad is reclaimed and vegetation cover within these areas was visually estimated between 65-70 percent.

Drill Pad # 7 is located on an existing well pad at a road y-intersection. The portions of the well pad not used for access and surface facilities are located within reclaimed shrub grassland and piñon-juniper woodland. The reclaimed portion, approximately 2-acres, surrounds the existing well and is located on the roadsides. The piñon-juniper woodland is located on the edges of the pad and makes up approximately 0.5 acre of the total pad acreage. An approximate 20 percent canopy cover characterizes the woodland. The dominant vegetation found within the reclaimed areas is composed of western wheat grass, crested wheat grass, rubber rabbitbrush and yellow clover (*Melilotus officinalis*). Approximately 40-50 mature piñon-juniper trees are located within the proposed well pad.

Drill Pad #8 utilizes previous disturbance associated with an existing well and access road for approximately half of the project area. Approximately 0.5 acre of the existing disturbance remains bare. The remaining 1.5 acres of previous disturbance is reclaimed with crested wheat as the dominant species. Approximately 1.5 acres in the southeastern half is undisturbed piñon-juniper/desert scrub interface and dominated by big sage with approximately 50 trees scattered throughout. The surrounding area southeast of the project area contains approximately four to five scattered ponderosa pine trees.

One BLM/FFO listed invasive and non-native plant species, musk thistle (*Carduus nutans*), was observed at Drill pads #5, #6, and #8 during the field survey.

Wildlife and sign identified throughout the project area included mule deer (*Odocoileus hemionus*), and black-tailed jackrabbit (*Lepus californicus*). For a complete list see Attachment B. No prairie dog burrows were identified within the boundaries of any of the proposed well locations. According to the BLM/FFO, there are no recorded historic or currently active raptor nests within 10 miles of the project area (BLM 2009, unpublished data). The BLM-designated Bald Eagle Areas of Critical Environmental Concern (ACEC) San Juan #5, #6, and #7 units are located within the Middle Mesa portion of the Rosa Unit. These three ACEC units are located within 2,250 feet of the proposed drill pads #7 and #8, and the southern remote stimulation pad.

Specially Designated Areas: The proposed project lies within the 46,052-acre Middle Mesa Wildlife Area SDA managed to support wildlife. The Middle Mesa Wildlife Area has a seasonal restriction on oil and gas drilling and construction activities from December 1 through March 31.

SURVEY RESULTS

USFWS Threatened and Endangered Species: According to the USFWS, there are 11 federally listed threatened, endangered, or candidate species with potential to occur in San Juan County, New Mexico (USFWS 2011). Table 1 lists these species, their conservation status, habitat associations, and potential to occur in the project or action area. No federally listed species, or potential habitats, were identified during the field survey.

Table 1: Species listed by the USFWS under the authority of the Endangered Species Act of 1973 for San Juan County, New Mexico and their potential to occur in the proposed project and action areas based on habitat associations. (E = endangered; T = threatened; C = candidate.).

SPECIES	CONSERVATION STATUS	HABITAT ASSOCIATIONS	POTENTIAL TO OCCUR IN THE PROJECT OR ACTION AREA
MAMMALS			
Black-footed ferret *(Mustela nigripes)*	E	Open grasslands with year-round prairie dog colonies of 200 acres or greater.	No prairie dog colonies identified in the project or action area.
Canada lynx (*Lynx canadensis*)	C	Generally occurs in boreal and montane forests dominated by coniferous or mixed forest with thick undergrowth.	No boreal or montane forests in project or action area.
BIRDS			
Southwestern willow flycatcher *(Empidonax traillii extimus)*	E	Breeds in dense, shrubby riparian habitats, usually in close proximity to surface water or saturated soil.	No riparian habitat exists in the project or action area.
Mexican spotted owl *(Strix occidentalis lucida)*	T	Nests in caves, cliffs, or trees in steep-walled canyons of mixed conifer forests.	No mixed conifer forests or designated critical habitat occurs in the project or action area.
Yellow-billed cuckoo *(Coccyzus americanus occidentalis)*	C	Breeds in riparian woodlands with dense, understory vegetation.	No riparian habitat exists in the project or action area.
FISH			
Colorado pikeminnow *(Ptychocheilus lucius)*	E	Large rivers with strong currents, deep pools, and quiet backwaters.	No perennial water sources occur in the action area. Not known to occur in Navajo Reservoir.
Razorback sucker *(Xyrauchen texanus)*	E	Medium to large rivers with silty to rocky substrates. Prefers strong currents and deep pools.	No perennial water sources occur in the action area. Not known to occur in Navajo Reservoir.
Roundtail chub *(Gila robusta)*	C	Large rivers. Present in low numbers in the San Juan, Mancos, La Plata, and Animas rivers in Colorado and New Mexico.	No perennial water sources occur in the action area. Not known to occur in Navajo Reservoir.
PLANTS			

SPECIES	CONSERVATION STATUS	HABITAT ASSOCIATIONS	POTENTIAL TO OCCUR IN THE PROJECT OR ACTION AREA
Knowlton's cactus *(Pediocactus knowltonii)*	E	Alluvial deposits that form rolling, gravelly hills in piñon-juniper and sagebrush communities (6,200-6,400 ft). A type locality of the Los Piños River area.	No suitable habitat occurs in the project or action area. No rolling gravelly hills or river terraces occur in the project or action area.
Mancos milkvetch *(Astragalus humillimus)*	E	Cracks of Point Lookout Sandstone of the Mesa Verde series (5,000-6,000 ft).	Project and action area do not contain appropriate geologic substrate for this species.
Mesa Verde cactus *(Sclerocactus mesae-verdae)*	T	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland Formations (4,000-5,550 ft).	Project and action area do not contain appropriate geologic substrate for this species.

BLM Special Management Species: Of the 10 species warranted for special management consideration by the BLM/FFO (BLM 2008), golden eagle (*Aquila chrysaetos*), American peregrine falcon (*Falco peregrinus anatum*), and bald eagle (*Haliaeetus leucocephalus*) have the potential to occur within the project area. Species listed by the BLM/FFO and their potential to occur in the project or action area are summarized in Table 2. None of these BLM special management species were observed during the field survey and their potential to occur is based on evaluation of the proposed project area and action area habitats and the known habitat associations of the listed species.

Table 2. BLM/FFO species with special management status and their potential to occur in the project and action areas based upon habitat associations.

SPECIES	HABITAT ASSOCIATIONS	POTENTIAL TO OCCUR IN PROJECT OR ACTION AREA
BIRDS		
American peregrine falcon *(Falco peregrinus anatum)*	Rugged terrain with rocky cliffs and canyons (30-1,000+ ft high), adjacent to rivers, lakes, or streams. Urban areas with towers and buildings also inhabited.	**Incidental occurrence of the species within the project area is a possibility.**
Bald eagle *(Haliaeetus leucocephalus)*	Nest in forested areas adjacent to large bodies of water.	**Known to winter at Navajo Reservoir. Potential foraging and roosting habitat occurs in the project and action area.**
Burrowing owl *(Athene cunicularia)*	Rarely dig their own burrows and are typically associated with prairie dog colonies. Found in dry, open, short-grass, treeless plains. Use areas that include shrubs such as four-wing saltbush and rabbit-brush. Also inhabit human-modified landscapes, such as golf courses and parking lots	No prairie dog colonies or short grassland occur within the project or action area.
Ferruginous hawk *(Buteo regalis)*	Flat or rolling terrain in grasslands, shrub-steppes, and deserts; badlands. Prefers elevated nest sites (e.g., buttes, utility poles, trees and on the ground.	There are no flat or rolling grasslands or badlands within the project or action area.
Golden eagle *(Aquila chrysaetos)*	In the West, mostly open habitats in mountainous, canyon terrain. Nests primarily on cliffs and trees.	**Action area provides potential foraging habitat.**
Mountain plover *(Charadrius montanus)*	Breeds in flat, open grasslands. Often associated with prairie dog towns and intensive grazing.	No flat, open grasslands occur in the project or action area.
Prairie falcon *(Falco mexicanus)*	Arid, open regions of grassland or scrub vegetation with cliff formations that are at least 30 ft high. Breeding cliffs are sometimes in semi-open regions with scattered conifer trees and occasionally dense woodlands.	Open regions within the project and action area are minimal.
Yellow-billed cuckoo *(Coccyzus americanus)*	Breeds in riparian woodlands with dense, understory vegetation.	No riparian habitat exists in the project or action area.
PLANTS		

SPECIES	HABITAT ASSOCIATIONS	POTENTIAL TO OCCUR IN PROJECT OR ACTION AREA
Aztec gilia *(Aliciella formosa)*	Salt desert scrub communities in soils of the Nacimiento Formation (5,000-6,000 ft).	Project and action area are not on the appropriate geologic substrate.
Brack's hardwall cactus *(Sclerocactus cloveriae ssp. brackii)*	Sandy clay of the Nacimiento Formation in sparse shadscale scrub (5,000-6,000 ft).	Project and action area are not on the appropriate geologic substrate.

Source: BLM 2008

DISCUSSION

Navajo Reservoir located east and southeast of the project area provides perching and foraging opportunities for bald eagle, however, this species is not known to nest in San Juan County New Mexico (BLM 2003). Bald eagles are common winter residents in the area. Because of the project area's proximity to Navajo Reservoir, and designated ACEC units, bald eagle is likely to occur in the area between November and March.

According to the BLM/FFO, there are three recorded historic or currently active golden eagle nests and three American peregrine falcon nests within 15 miles of the project area (BLM 2009, unpublished data). Estimated home range during nesting of American peregrine falcons in Enderson and Craig, Colorado, was found to be between 138-582 square miles (White et al. 2002). No documented American peregrine falcon nests are located on Middle Mesa or the surrounding vicinity; however, large cliff faces on the southern end of Middle Mesa and the proximity of the proposed project area to Navajo Reservoir afford the opportunity for yet undocumented territories creating the potential for the incidental occurrence of peregrine falcon.

The open scrubland throughout the proposed project and action area is excellent foraging habitat for golden eagles. Average hunting territory size for golden eagles was found to be 19-59 square miles in California and 25-35 square miles in Utah (Weidensaul 1996). Given the distance of known territories and suitable nesting habitat from the proposed location and the possibility of yet undocumented territories, these raptor species may forage in the proximity or fly through the proposed action area.

The proposed action alternative would directly impact 52 acres of potential foraging habitat for these raptor species. Direct impacts would include the removal and modification of vegetation, including the loss of piñon and juniper trees which could serve as perch sites. There would be no direct impacts to potential nesting habitat. There would be a long-term loss of approximately 8-acres of marginal foraging habitat which overlaps existing disturbance. Direct impacts from habitat loss and modification to golden eagles, bald eagles, and American peregrine falcons, are expected to be low in the short-term. Because the proposed well pads would be located adjacent to, and overlapping existing disturbance, impacts to habitat are minimized. . During construction, increased human and vehicular activity may cause these raptors to avoid the area of potential effect. Since only one well pad would be drilled during the winter closure period in each of the next 5 years, these impacts would be localized. Given the amount of suitable

habitat on Middle Mesa as compared to the amount of habitat that would be impacted at any one time, these impacts are not expected to be significant. Additionally, drill pad #7 and #8 would not be drilled from during the winter closure period due to their close proximity to BLM-designated bald eagle ACEC units. Impacts from avoidance would be low to moderate and short-term. Indirect impacts could include a change in prey species composition for raptors from the disturbance and modification of vegetation. Given the abundant adjacent habitat These impacts would be low, and short to long-term.

Removal of piñon-juniper woodland and understory vegetation would result in a loss of habitat for a variety of birds protected under the Migratory Bird Treaty Act (MBTA). No nests were identified in the proposed project area during the biological surveys; however detailed nest surveys were not conducted during the survey and it was conducted outside the breeding period. Direct impacts would include the disturbance and modification of up to 52 acres of piñon-juniper woodland and disturbed reseeded vegetation. Based on the availability of suitable adjacent habitat, these impacts would be low and short to long-term. There would be no direct impacts to migratory birds during drilling between December 1 and March 31.

CERTIFICATION

Conclusions are based on actual field examination and are correct to the best of my knowledge.

Signature of Field Biologist: Theresa Ancell

Date: 6/23/2011

Theresa Ancell, Biologist
Ecosphere Environmental Services
4801 N. Butler Avenue, Suite 15101
Farmington, NM 87401
(505) 327-3088

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ATTACHMENT A

PROJECT AREA MAP


Ecosphere
Environmental Services
Williams Production Company
NORTH FRACPAD
SOUTH FRAC PAD
La Plata
Archuleta
San Juan
Rio Arriba
64
Rosa Unit Boundary
Proposed Well Pads
Stimulation Pads
Mancamp
Specially Designated Areas
ACEC/Bald Eagle
ACEC/Bald Eagle Core Site
0 275 550 1,100
Meters
1:22,648
MIDDLE MESA PLAN OF DEVELOPMENT
FIGURE 1 - PROJECT AREA MAP
SAN JUAN COUNTY, NEW MEXICO
T32N, R6W SECTION 33
T31N, R6W, SECTIONS 4, 9, 16 AND 17
BANCOS MESA NW, NM 7.5 MIN QUADRANGLE
4/7/2011
Spatial Reference: NM Stateplane West, NAD 83, Feet

ATTACHMENT B

PLANTS AND WILDLIFE FOUND IN THE PROJECT AREA

Forbs

Arabis perennans	Rockcress
Artemisia frigida	Sage
Astragalus sp.	Astragalus
Calochortus nuttallii	Sego lily
Carduus nutans	Musk thistle
Castellija chromosa	Indian paintbrush
Cirsium neomexicana	Native thistle
Crepis occidentalis	Hawksbeard
Cryptantha sp.	Cryptantha
Cymopterus purpureus	Spring parsley
Eriogonum alatum	Winged buckwheat
Eriogonum jamesi	Wild buckwheat
Eriogonum racemosum	Redroot buckwheat
Erodium cicutarium	Filare
Gilia aggregata	Gilia
Heterotheca villosa	Goldenaster
Hymenopappus filifolius	Hymenopappus
Leptodactylon pungens	Spiny gilia
Machaerantha canescens	Purple aster
Melilotus officinalis	Yellow sweet clover
Orobanche fasciculata	Clustered broomrape
Penstemon angustifolius	Penstemon
Penstemon linarioides	Penstemon
Phlox longifolia	Phlox
Salsola iberica	Russian thistle, tumbleweed
Sanguisorba minor	Burnet
Schoencrambe linifolia	Schoencrambe
Senecio multicapitatus	Groundsel
Sisymbrium altissimum	Tumble mustard
Sphaeralcea coccinea	Globe mallow
Townsendia incana	Hoary Townsend daisy
Tragopogon dubius	Goatsbeard
Verbena bracteata	Prostrate vervain

Grasses

Agropyron cristatum	Crested wheat
Achnatherum hymenoides	Indian ricegrass
Bouteloua gracilis	Blue grama
Bromus tectorum	Cheatgrass
Bromus inermis	Smooth brome
Poa fendleriana	Muttongrass
Pleuraphis jamesii	Galleta

Pascopyrum smithii	Western wheatgrass
Koeleria macrantha	Prairie junegrass

Shrubs

Gutierrezia sarothrae	Broom snakeweed
Artemisia tridentate	Big sagebrush
Atriplex canescens	Four winged saltbush
Lycium pallidum	Pale desert-thorn
Quercus gambelii	Gambel's oak
Purshia tridentata	Antelope bitterbrush
Cercocarpus montanus	Mountain mahogany
Amelanchier utahensis	Serviceberry
Ericameria nauseosa	Rubber rabbitbrush

Cacti

Echinocereus triglochidiatus	Hedgehog cactus
Opuntia polyacantha	Prickly pear cactus
Opuntia whipplei	Rat-tail cholla
Yucca angustissima	Soapweed
Yucca baccata	Spanish bayonet

Trees

Juniperus osteosperma	Utah Juniper
Pinus edulis	Piñon pine

Mammals

Lepus californicus	Black-tailed jackrabbit
Odocoileus hemionus	Mule deer
Citellus sp.	Ground squirrel

Birds

Corvus corax	Common raven
Empidonax wrightii	Gray flycatcher
Colaptes auratus	Northern flicker
Pipilo erythrophthalmus	Rufous-sided towhee