U.S. Department of the Interior
Bureau of Land Management

Normally Pressured Lance Natural Gas Development Project

Wyoming - Pinedale Field Office
May 2018

Final Environmental Impact Statement
Volume I (Chapters 1-3)

The Bureau of Land Management is responsible for the stewardship of our public lands. The BLM's mission is to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/WY/PL-18/008+1310

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, WY 82003-1828
www.blm.gov/wy

June 22, 2018

Dear Reader:

The Final Environmental Impact Statement (EIS) for the Normally Pressured Lance (NPL) Natural Gas Development Project is hereby submitted for your review and comment. The Bureau of Land Management (BLM) prepared the Final EIS to analyze the potential impacts of and alternatives to a proposal by Jonah Energy, LLC (Jonah Energy) for natural gas development operations on its federal leases within a portion of Sublette County, Wyoming. The proposed NPL Project is located approximately 35 miles south of Pinedale, Wyoming and encompasses 140,859 acres, including approximately 135,655 acres of BLM-administered public land surface managed by the BLM Pinedale Field Office (PFO) and Rock Springs Field Office (RSFO).

The Proposed Action and action Alternatives A and B include drilling up to 3,500 directionally drilled natural gas wells during an approximate 10-year development period. Jonah Energy anticipates drilling at an average well density of one bottom-hole per 40 acres. Disturbance for each multi-well pad location would range between approximately 5 and 19 surface acres. Ancillary facilities associated with the proposed natural gas wells include standard equipment on well pads (e.g., well heads, solar panels), water disposal wells, existing and new pipelines, powerlines, access roads, and regional gathering facilities (RGFs). The Proposed Action would result in an estimated 1,890 acres of long-term disturbance and the Preferred Alternative would result in an estimated 1,741 acres of long-term disturbance.

This Final EIS analyzes the Proposed Action and three alternatives in detail:

- **Proposed Action** – Jonah Energy proposes to develop up to 3,500 natural gas wells within the NPL project area over a 10-year period, employing directional drilling techniques from multi-well pads. Most wells would be co-located on multi-well pads with no more than 4 well pads per 640 acres outside of Greater Sage-grouse Priority Habitat Management Areas (PHMA) and no more than 1 disturbance per 640 acres within PHMA. Well pad size would average 18 acres.
- **Alternative A** – The Project Area would be developed sequentially in three geographically defined phases over a slightly longer period than the Proposed Action. Additional resource protection measures and density limitations would be applied in delineated wildlife habitats to protect sensitive wildlife resources.
- **Alternative B (BLM Preferred Alternative)** – The Project Area would be divided into three Development Areas with varying densities of development based on the range of resources including wildlife resources, visual resources, paleontological resources, surface water features, identified lands with wilderness characteristics, and other resources. Under Alternative B, the maximum number of wells would be the same as for the Proposed Action but there would be reduced density of development in the

- northwestern portion of the Project Area due to the range of resources present in that area.
- **No Action Alternative** – Under the No Action alternative, the BLM would not approve Jonah Energy's Proposed Action. Development and production would continue at the rate that has been seen in the Project Area since 1997—drilling and completion of approximately three new wells and ancillary facilities per year.

The Final EIS was prepared pursuant to the National Environmental Policy Act (NEPA), as well as other regulations and statutes, to address possible environmental, social, and economic impacts that could result from each alternative. This Final EIS discloses to the public and the Decision Maker the impacts associated with the proposed action, and evaluates alternatives to the proposal, including a No Action alternative.

This Final EIS is not a decision document. The publication of the Notice of Availability (NOA) in the Federal Register for this Final EIS initiates a 30-day availability period. Following conclusion of that period, a Record of Decision (ROD) will be prepared and signed to disclose the BLM's final decision. Availability of the ROD will be announced through the local media and the project mailing list, and posted on the project website.

The Final EIS may be viewed or downloaded from the BLM website at: https://go.usa.gov/xNwWJ.

The Final EIS is also available for review during normal business hours at the following locations:

- BLM Pinedale Field Office, 1625 West Pine Street, Pinedale, Wyoming
- BLM Rock Springs Field Office, 280 Highway 191 North, Rock Springs, Wyoming
- BLM Wyoming State Office, 5353 Yellowstone Rd, Cheyenne, WY 82009

Thank you for your interest in this project. For further information, please contact Kellie Roadifer, NPL EIS Project Manager, at (307) 367-5309.

Sincerely,

Mary J. Rugwell

Mary J. Rugwell
State Director

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

LIST OF MAPS

ACRONYMS & ABBREVIATIONS

°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
ACC	Aster Canyon Consulting, Inc.
ACHP	Advisory Council on Historic Preservation
ADT	Average Daily Traffic
AGWA	Automated Geospatial Watershed Assessment
AIRFA	American Indian Religious Freedom Act
AMLs	Appropriate Management Levels
AMPs	allotment management plans
ANC	Acid Neutralizing Capacity
AO	BLM Authorizing Officer
APD	Application for Permit to Drill
APLIC	Avian Power Line Interaction Committee
ARPA	Archaeological Resources Protection Act of 1979
AUMs	Animal Unit Months
BACT	Best Available Control Technology
bbls	barrels
BCF	Billion Cubic Feet
BGEPA	Bald and Golden Eagle Protection Act of 1940
BLM	Bureau of Land Management
BLM Road 5406	Burma Road
BMPs	Best Management Practices
BOLA1	Boulder Lake
BP	Before Present
BRID1	Bridger Wilderness
cm	Centimeter
C-1	General Commercial
CAA	Clean Air Act
CAP	Coordinated Activity Plan
CASTNet	Clean Air Status and Trends Network
CDPs	Central Delivery Points
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH-1	Highway Commercial
CH_4	methane
CIAAs	Cumulative Impact Analysis Areas
CO	carbon monoxide
COAs	Conditions of Approval
Core Areas	Sage-Grouse Core Population Areas
CRA	Cultural Resources Analysts, Inc.
CSC	Central Service Centers
CSU	controlled surface use
CWA	Clean Water Act
DAs	Development Areas
dB	decibels
dBA	A-weighted decibels
DCI	Wyoming Attorney General, Division of Criminal Investigation
DDCT	density/disturbance calculation tool
DEQ	Department of Environmental Quality
DOI	Department of the Interior
DRO	Diesel Range Organics
dv	Deciviews
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPA ID	Environmental Protection Agency Identification
ERMAs	Extensive Recreation Management Areas
ESA	Endangered Species Act
EUR	Estimated Ultimate Recovery
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FLPMA	Federal Land Policy and Management Act of 1976
FMP	Fire Management Plan
FMU	Fire Management Unit
FRCC	Fire Regime Condition Class

GAP	Northwest Gap Analysis Program
GCRP	Global Change Research Program
GHGs	greenhouse gases
GHMA	Sage-Grouse General Habitat Management Area
GIS	Geographic Information System
GLO	General Land Office
Gold Book	BLM Surface Operating Standards for Oil and Gas Exploration and Development
GRB	Green River Basin
GRO	Gasoline Range Organics
H_2SO_4	sulfuric acid
HAPs	hazardous air pollutants
Herd Unit 401	Sublette Pronghorn Antelope Herd
HFC	hydrofluorocarbons
HMA	Herd Management Area
HNO_3	Nitric Acid
HUC	Hydrologic Unit Code
HW	Hazardous waste
HWRR	Wyoming Hazardous Waste Rules and Regulations
Hz	Hertz
ICCP	Impressed Current Cathodic Protection
ID	Interdisciplinary
IDF	Intensively Developed Fields
I-H	Heavy Industrial
I-L	Light Industrial
IM	Instruction Memorandum
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPCC	Intergovernmental Panel on Climate Change
ISAC	Invasive Species Advisory Committee
JIDPA	Jonah Infill Drilling Project Area
kg/ha	Kilograms per Hectare
kHz	Kilohertz
KINEROS2	Kinematic Runoff and EROSion model
km	Kilometers
kV	Kilovolt
Kw Factor	Erodibility of the Surface Soil
L_{50}	Median Sound Level
L_{dn}	Day-Night Levels
L_{eq}	Equivalent Sound Level
L_{eq}(h)	Average hourly equivalent
L_{max}	Maximum Sound Level
L_{min}	Minimum Sound Level
L_N	Percentile sound levels
LOCs	Levels of Concern
LORS	Laws, Ordinances, Regulations, and Standards
LWG	Local Working Group
MA	Management Area
MBTA	Migratory Bird Treaty Act
MMCF	Million Cubic Feet
MMCF/d	Million Cubic Feet per Day
mg/l	Milligrams per Liter
MLA	Mineral Leasing Act
MMHOS/CM	Millimhos per Centimeter
MOU	Memorandum of Understanding
mph	Miles per Hour
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NAGPRA	Native American Graves Protection and Repatriation Act
NAIP	National Agriculture Imagery Program
NCSHPO	National Conference of State Historic Preservation Officers
NEI	National Emission Inventory
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NEPA	National Environmental Policy Act
NH_4^+	ammonium
NHPA	National Historic Preservation Act
NHT	National Historic Trail
NHTSA	National Highway Traffic Safety Administration
NISC	National Invasive Species Council
NLCS	National Landscape Conservation System
NO_2^-	Nitrogen Dioxide

NO_3	Nitrates
NOA	Notice of Availability
NOI	Notice of Intent
NOS	Notice of Staking
NO_x	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	Normally Pressured Lance
NPL Project	Normally Pressured Lance Natural Gas Development Project
NPS	National Park Service
NR	Not Reported
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
NSR	New Source Review
NTU	Nephelometric Turbidity Units
NVCS	National Vegetation Classification System
NW	Northwest
NWI	National Wetlands Inventory
O_3	ozone
OCPs	Operator-Committed Practices
OHV	Off-Highway Vehicle
ORO	Oil Range Organics
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PAPA	Pinedale Anticline Project Area
Pb	Lead
PFC	Perfluorocarbons
PFO	Pinedale Field Office
PFYC	Potential Fossil Yield Classification
PHMA	Priority Habitat Management Area (Sage-Grouse)
PHMSA	Pipeline Hazardous Materials Safety Administration
PM_{10}	Coarse particulate matter
$PM_{2.5}$	Fine particulate matter
PND165	Pinedale
ppb	Parts per billion
ppm	Parts per million
PSD	Prevention of Significant Deterioration
Q	Fiscal Year Quarter
R	Range
RAS	Rangeland Administration System
RC	Resource Conservation
RCRA	Resource Conservation and Recovery Act
Recovery Plan	Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin
RFAs	Reasonably Foreseeable Actions
RFD	Reasonably Foreseeable Development
RGFs	Regional Gathering Facilities
RHR	Regional Haze Rule
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
RSFO	Rock Springs Field Office
Sage-Grouse	Greater Sage-Grouse
Sage-Grouse Core Habitat	Governor's Greater Sage-Grouse Core Populations Areas
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SDWS	Secondary Drinking Water Standards
Sec.	Section
SESA	Socioeconomic Study Area
SF_6	Sulfur Hexafluoride
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_4^{--}	Sulfate
SPCC	Spill Prevention Control and Countermeasure
SPL	Sound Pressure Level
SRMAs	Special Recreation Management Areas
SSURGO	Soil Survey Geographic

SU	Standard Units
SUPO	Surface Use Plan of Operations
SVR	standard visual range
SWAT	Soil and Water Assessment Tool
T	Township
TCP	Traditional Cultural Property
TDS	Total Dissolved Solids
TLS	Timing Limitation Stipulation
TMDL	Total Maximum Daily Load
TNM	Traffic Noise Model Lookup
TSD	Treatment, Storage, or Disposal
TSS	Total Suspended Solids
TWS	Wyoming Wildlife Society
U.S.	United States
U.S.C.	United States Code
UCR	Uniform Crime Reporting
UGRB	Upper Green River Basin
UIC	Underground Injection Control
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDW	Underground Source of Drinking Water
USEPA PDWS	USEPA Primary Drinking Water Standards
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
VRM	Visual Resource Management
W.S.	Wyoming Statute
WAAQS	Wyoming Ambient Air Quality Standards
WAQSR	Wyoming Air Quality Standards and Regulations
WCAs	Winter Concentration Areas
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WISDOM	Wyoming Interagency Spatial Database and Online Management
WOGCC	Wyoming Oil and Gas Conservation Commission
WOS	Wildlife Observation System
WQD	Water Quality Division
WWQRR	Wyoming Water Quality Rules and Regulations
WY	Wyoming
WY06	Pinedale
WY97	South Pass
WyGISC	Wyoming Geographic Information Science Center
WyNDD	Wyoming Natural Diversity Database
WYPDES	Wyoming Pollutant Discharge Elimination System

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CHAPTER 1 – INTRODUCTION

1.1 Introduction

In compliance with the National Environmental Policy Act (NEPA) of 1969, as amended, the United States (U.S.) Department of the Interior (DOI), Bureau of Land Management (BLM), prepared this Environmental Impact Statement (EIS) to identify and disclose potential effects of a full-field natural gas development project proposed by Jonah Energy LLC (Jonah Energy). The proposed Normally Pressured Lance Natural Gas Development Project (NPL Project) is located in Sublette County, Wyoming, approximately 35 miles south of Pinedale and immediately south and west of the existing Jonah Infill Development Project and south of the Pinedale Anticline Project (Map 1). The Project Area encompasses approximately 140,859 acres, including approximately 135,655 acres of BLM-administered public land (96.3 percent), approximately 5,123 acres of land administered by the State of Wyoming (3.6 percent), and approximately 81 acres of private lands (0.06 percent).

The BLM, State of Wyoming, and private landowners have issued oil and gas leases within the Project Area. The Federal leases grant certain rights to explore, develop, and produce the oil and gas resources underlying the leases. The Federal leases also carry the responsibility to develop the oil and gas resources in accordance with environmental laws, including without limitation the Clean Water Act (33 United States Code [U.S.C.] § 1251), Clean Air Act (42 U.S.C. § 7401), Federal Land Policy and Management Act of 1976 (43 U.S.C. § 1701) (FLPMA), and Endangered Species Act of 1973 (16 U.S.C. § 1531).

In compliance with NEPA, preparation of this EIS and the associated Record of Decision (ROD) will enable the BLM to make future decisions that approve, modify, or deny anticipated permits for Federal natural gas exploration and development, including, but not limited to, Applications for Permits to Drill (APDs), sundry notices, and associated rights-of-way (ROWs) on BLM-administered land in the Project Area.

1.2 Project Location and Setting

The Project Area is located primarily on BLM-administered lands managed by the BLM Pinedale Field Office (PFO) and Rock Springs Field Office (RSFO) within Townships 27 through 29 North, Ranges 107 through 110 West, 6th Principal Meridian, in Sublette County, Wyoming (Table 1-1). The Project Area is located entirely in Sublette County, Wyoming; however, the southern boundary of the Project Area is directly adjacent to the Sweetwater County line. The Project Area is bordered to the north by two large-scale oil and gas development projects including the Jonah Infill Development Project to the northeast and the Pinedale Anticline Project to the north (Map 2).

Topography in the Project Area is characterized by low rolling hills interspersed with buttes, rock outcrops, and large draws. The Project Area consists primarily of shrub-steppe habitat dominated by Wyoming big sagebrush. Other sagebrush species, rabbitbrush, saltbush, and a variety of forbs and grasses are also in the area. The Project Area experiences a semi-arid, cold desert climate and is dotted with ephemeral streams. Existing development in the Project Area includes 55 producing natural gas wells, access roads, livestock water wells and other range improvements, and other development as described in Section 2.3.1 (*Existing Development in the Project Area*). Characteristic fauna inhabiting the Project Area and surrounding areas include pronghorn antelope, mule deer, Greater Sage-Grouse, various raptor and passerine species, white-tailed prairie dog, and other species of mammals and reptiles.

Table 1-1. Legal Description of the Project Area

Township	Range	Section
27 North	107 West	6, 7, 18, 19, 30, 31
27 North	108 West	1-36
27 North	109 West	1-6, 8-16, 22-27, 34-36
28 North	107 West	5-8, 17-19, 30, 31
28 North	108 West	1-3, 8-36
28 North	109 West	2-11, 14-36
28 North	110 West	1-36
29 North	107 West	31-33
29 North	108 West	6,7,18,19,30
29 North	109 West	1-36
29 North	110 West	21-29, 32-36

Source: BLM 2012a.

1.3 Overview of Proposed Project

Jonah Energy proposes to expand natural gas development operations on its Federal leases in the Project Area.

Approximately 116 wells have been drilled in the Project Area, including:

- 55 producing natural gas wells;
- 19 dry/junked/abandoned wells;
- 1 permitted Class II Underground Injection Control (UIC) well (deep disposal of produced water);
- 10 water supply wells for oil and gas operations (drilling and completion operations, road construction, maintenance, dust control and reclamation) including 4 water supply wells for water to support drilling in the Jonah Infill Drilling Project Area (JIDPA), and 1 water supply well for the Jonah workforce facility; and;
- 31 existing stock water wells.

Under the Proposed Action, Jonah Energy proposes to directionally drill natural gas wells within the Project Area on an average of one disturbance location per 640-acre area in Greater Sage-Grouse (Sage-Grouse) Priority Habitat Management Area (PHMA)[1] and four disturbance locations per 640-acre section of land in non-PHMA Habitat (approximately 3,500 wells total), in accordance with the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e). Surface disturbance for multi-well pad locations would range between approximately 5.5 and 19 surface acres and would support up to

[1]*In accordance with State of Wyoming EO 2015-4 (State of Wyoming 2015) and a 2017 maintenance action updating the BLM Wyoming Sage-Grouse RMP Amendments, PHMA refers to State of Wyoming Version 4 Core Management Area maps and data (Map 40).*

64 wells. Under the Proposed Action, the wells, along with associated infrastructure, would be constructed over a 10-year period at a rate of up to 350 wells per year based on an average of 10 drill rigs working at any one time, or until the resource base is fully developed. The Proposed Action includes a 10-year development phase during which all wells would be developed and would start producing, followed by a 30-year full production phase for a total estimated project life of 40 years.

Jonah Energy would transport oil and gas and associated liquids from wells via pipeline to Regional Gathering Facilities (RGFs) for operations, including gas/liquid separation, electric compression, liquid storage, gas dehydration, water disposal at injection wells, and truck loading. The trucks would be used to haul produced water to disposal facilities for processing and condensate to sales locations. To minimize air emissions, Jonah Energy would use electric compression at each RGF. The NPL Project would also include construction of associated facilities and infrastructure—including roads, gas pipelines, powerlines, and separation, dehydration, metering, and fluid storage facilities—to the extent such facilities are not already constructed.

Exact placement of future well locations is currently unknown. Jonah Energy would develop criteria for selecting well locations to delineate the extent of the gas resources and would be able to refine those criteria as more information on subsurface conditions and hydrocarbon resources becomes available from delineation drilling. On average, Jonah Energy anticipates wells to be developed throughout the Project Area on a one bottom-hole per 40-acre density basis. However, bottom-hole density could increase to 10-acre spacing where necessary to extract the natural gas resources as described in the Memorandum of Understanding (MOU) between the Wyoming Oil and Gas Conservation Commission and the BLM (WOGCC 1994).

Target formations would include the Lance Pool with total depths ranging from approximately 6,500 to 13,500 feet. Jonah Energy could attempt deeper tests as technical and economic conditions warrant. Placement of final surface locations on BLM-administered land would be contingent on any environmental constraints identified during the site-specific environmental reviews and NEPA compliance during the APD process and the onsite inspection reviews conducted by the BLM. The exact placement of future surface locations, facilities, and access roads would be determined during the APD process.

Jonah Energy estimates that initial production for each well will be 1 to 2 million cubic feet per day (MMCF/d), with an estimated ultimate recovery of 1 to 2 billion cubic feet (BCF) of gas per well. Jonah Energy estimates that the NPL Project could yield 3,500 to 7,000 BCF of gas and 17.5 to 140 million barrels (bbls) of condensate over the life of the project. Actual production would depend on reservoir conditions encountered during exploration.

1.4 Purpose and Need

The BLM's purpose is to respond to the proposal by Jonah Energy to develop and extract hydrocarbon resources underlying Jonah Energy's Federal oil and gas leases within the Project Area. The need for the action is to facilitate exploration and development of Federal oil and gas leases, within the constraints of lease terms and conditions, allowing the lessee(s) or their designated operators to drill for, extract, remove, and market Federal hydrocarbon resources. This need is established by the BLM's responsibility under applicable mineral leasing and development statutes, regulations, and policies, as described in Section 1.6 (*Regulatory Setting*).

The BLM will decide whether to approve, approve with modification, or deny Jonah Energy's proposal. Subsequent to a ROD, the BLM would require site-specific APDs and other necessary permits and authorizations, as required by applicable statutes and regulations, to develop the natural gas resources in the Project Area. If the site-specific APD or other permit authorization is approved, the BLM will determine the Conditions of Approval (COAs) associated with the action.

Decisions made in the NPL Project ROD would apply to all lessees and operators for development on BLM-administered land in the Project Area through land use authorizations and/or written orders of the Authorized Officer.

1.5 Decision Framework

As stated in Chapter 5 (*Consultation and Coordination*), this EIS has been prepared with input from:

- An interdisciplinary team of resource specialists from the BLM PFO (the lead BLM office for this EIS), the BLM RSFO, the BLM High Desert District, and the BLM Wyoming State Office;
- cooperating agencies including Federal and state agencies and local governments based on their jurisdictional authority and special expertise; and
- potentially affected Tribes.

During preparation of this EIS, the BLM used public comments, cooperating agency input, and BLM-staff knowledge to inform, among other things, development of alternatives, resource issues and concerns, and cumulative impacts analysis.

1.5.1 Environmental Impact Statement Decision-Making Framework

NEPA and directives by the Council on Environmental Quality (CEQ) require the BLM to analyze proposed actions that would involve Federal lands in terms of their potential effects on the natural and human environment. The BLM prepared this EIS to assess the direct, indirect, and cumulative impacts of the Proposed Action, a no action alternative, and other reasonable alternatives on the natural and human environment. This EIS also identifies mitigation measures and best management practices (BMPs) that may limit or reduce adverse impacts on the natural and human environment. The BLM will consider the analysis and information in this EIS when making a decision regarding the NPL Project.

The EIS process consists of a series of procedural steps to ensure an adequate and open analysis of the issues associated with a Proposed Action and alternatives. The analysis describes and compares both the potential impacts from implementing the alternatives as well as the relationship between the short-term uses of the land (i.e., the Proposed Action and alternatives) and long-term productivity of the land. It also identifies any irreversible or irretrievable commitment of resources that would result from implementing the Proposed Action or alternatives. The impact analysis provides adequate information for the BLM's Authorized Officer (AO) to select an alternative that meets the purpose and need and the BLM's management goals and objectives.

The preparation of an EIS consists of the following general steps:

- Issue the Notice of Intent (NOI) in the *Federal Register* to prepare an EIS;
- conduct public and agency scoping;
- prepare internal versions of the Draft EIS for the BLM and cooperating agency review;
- prepare and issue the Draft EIS and publish a Notice of Availability (NOA) in the *Federal Register;*
- solicit public review and comment on the Draft EIS;

- revise the Draft EIS based on public comments and issue the Final EIS, including responses to comments;
- issue the Final EIS; and
- issue the ROD.

The BLM will document decisions made regarding the Proposed Action and alternatives in a ROD signed by the BLM AO. In the ROD, the AO will determine the following:

- whether the analysis contained in this EIS is adequate for the purposes of reaching an informed decision regarding selection of one of the alternatives analyzed in detail in this EIS;
- whether the Proposed Action is in conformance with applicable Federal, state, and county plans, including BLM Resource Management Plans (RMPs);
- whether to select the Proposed Action, a different alternative (including the No Action alternative), or select a combination of alternatives; and
- mitigation measures that may be attached as COAs to any individual permit issued subsequent to the ROD.

As part of its management responsibilities under the Mineral Leasing Act (MLA) and the FLPMA, the BLM will review and act on any APDs and ROW applications submitted within the NPL Project Area. These applications would seek approval to construct wells, pipelines, flowlines, roads, or other ancillary facilities associated with project development. Submission and approval of such applications are required prior to surface disturbance. Consequently, the ROD itself does not authorize any surface disturbance or entitle the project proponent to take any action that may result in surface disturbance or other impacts.

Prior to approving an APD or ROW, the BLM would conduct an onsite inspection of the proposed well pad, access road, and/or other areas of proposed surface use. The BLM would complete site-specific environmental review, in accordance with the NEPA, in response to any applications received. During the site-specific review, the BLM would identify the need for any specific mitigation measures. The BLM would then approve APDs and ROWs once they demonstrate compliance with the ROD.

1.6 Regulatory Setting

The BLM prepared this EIS in accordance with regulations promulgated by the CEQ for implementing the procedural provisions of NEPA (40 CFR 1500–1508); the DOI's NEPA regulations, 43 CFR Part 46; and the BLM NEPA Handbook, H-1790-1. It was also prepared in compliance with all other applicable regulations and laws. This EIS incorporates key provisions of the FLPMA, which direct the BLM to manage public lands and their resource values for multiple use to "best meet the present and future needs of the American people" (Section 103 [43 U.S.C. 1702]).

The NPL Project would be developed in accordance with the FLPMA, as amended; the MLA of 1920, as amended; 43 CFR Part 3100; and other applicable statutes and regulations. The intent of the MLA (30 U.S.C. § 181 *et seq*.) and its implementing regulations is to allow, and encourage, lessees or potential lessees to explore for oil and gas underlying public lands. The FLPMA mandates that the BLM manage public lands on the basis of multiple use (43 U.S.C. 1701[a][7]), with minerals being identified as one of the principal uses of public lands under Section 103 of the FLPMA (43 U.S.C. 1702[c]), while, at the same time, protecting the environment by preventing unnecessary or undue degradation of the lands (43 U.S.C 1732[b]).

Development of Federal oil and gas is also subject to the BLM's Onshore Oil and Gas Orders applied to operators under 43 CFR § 3160 and 43 CFR § 3164, which govern onshore oil and gas operations. Onshore Oil and Gas Orders include:

- Onshore Order No. 1—Approval of Operations;
- Onshore Order No. 2—Drilling Operations;
- Onshore Order No. 3—Site Security;
- Onshore Order No. 4—Measurement of Oil;
- Onshore Order No. 5—Measurement of Gas;
- Onshore Order No. 6—Hydrogen Sulfide Operations; and
- Onshore Order No. 7—Disposal of Produced Water.

The BLM would issue pipeline and road ROWs associated with oil and gas development on Federal lands under the authority of the MLA, as amended, or the FLPMA, as amended. ROW grants authorizing construction of ancillary facilities, access roads, and pipelines would afford the operators certain rights that are subject to the terms and conditions incorporated into the grant by the BLM.

In accordance with Executive Order (EO) 13783, "Promoting Energy Independence and Economic Growth", released on March 31, 2017 (82 FR 16093), and associated implementation directives in DOI Secretarial Order 3349, the BLM and other Federal agencies are "review[ing] all existing regulations, orders, guidance documents, policies, and any other similar actions that potentially burden the development or utilization of domestically produced energy resources." This document reflects any applicable changes in laws, policy, or guidance implemented as a result of this ongoing review process prior to the publication of the Final EIS.

1.6.1 Applications for Permit to Drill

Once a Federal oil and gas lease is issued, the leaseholder or holder of operating rights must apply for and receive site-specific authorization(s) before drilling within the Project Area. To meet required environmental obligations, the leaseholder or holder of operating rights must submit to the BLM an APD and any associated applications for ROW so that the appropriate environmental review may be prepared. Environmental documents such as Environmental Assessments, Categorical Exclusions, or the appropriate environmental records of review for APD or ROW authorizations often include site-specific COAs that add further site-specific operation requirements. At the APD stage, site-specific conditions of approval could be applied, consistent with valid existing lease rights.

1.6.2 Federal, State, and Local Permits and Authorizing Authorities

Table 1-2 provides an overview of Federal, state, and local permits, approvals, and actions required for the NPL Project and their associated authorities (e.g., policy, regulation, EO). Federal, state, county, and local regulatory and permitting actions required to implement any of the alternatives would generally be the same for all alternatives. Local ordinances and regulations would be followed for applicable actions under local jurisdiction.

Table 1-2. Major Federal, State, and Local Permits, Approvals, and Authorizing Actions Necessary for Construction, Operation, Maintenance, and Abandonment of the NPL Project

Responsible Agency	Permit, Approval, or Action	Regulation/Authority
Bureau of Land Management or other Federal agency, as appropriate	Protection and enhancement of environmental quality	EO 11514
	Protection and enhancement of the cultural environment	EO 11593
	Floodplains management	EO 11988
	Protection of wetlands	EO 11990
	Federal compliance with pollution control standards	EO 12088
	Intergovernmental review of Federal programs	EO 12372
	Environmental justice	EO 12898
	Native American sacred sites	EO 13007
	Invasive species	EO 13112
	Safeguarding the Nation From the Impacts of Invasive Species	EO 13751
	Consultation and coordination with Indian tribal governments	EO 13175
	Protection of migratory birds	EO 13186
	Trails for America in the 21st century	EO 13195
	Actions to expedite energy-related projects	EO 13212
	Preserve America	EO 13287
	Promoting Energy Independence and Economic Growth	EO 13783
	American Energy Independence	Department of the Interior Secretarial Order 3349
Bureau of Land Management	On Federal onshore lands: permit to drill, deepen, or plug back (APD/Sundry process); authorization for flaring and venting of natural gas; plugging and abandonment of a well	MLA, as amended (30 U.S.C. 181 et seq.); 43 CFR 3162, Onshore Oil and Gas Orders No. 1 and No. 2; Approval of Operations; 43 CFR 3180
	ROW grants and temporary use clearances on Federal lands	MLA, as amended (30 U.S.C. 185); 43 CFR 2880; FLPMA (43 U.S.C. 1761–177 1); 43 CFR 2800
	Antiquities and cultural resource clearances on BLM-administered land	Antiquities Act of 1906 (16 U.S.C. Section 431–433); Archaeological Resources Protection Act of 1979 (16 U.S.C. Sections 470aa–470ll); Preservation of American Antiquities (43 CFR 3); National Historic Preservation Act Section 106 (Title 54 36 CFR 60.4), 36 CFR 800, (42 U.S.C. 1996 et seq.), (25 U.S.C. 3001–3013); Wyoming BLM and State Historic Preservation Office Wyoming State Protocol (BLM and SHPO 2014)
	Approval to dispose of produced water from BLM/Federal oil and gas wells	MLA, as amended (30 U.S.C. 181 et seq.); 43 CFR 3164; Onshore Oil and Gas Order No. 7
	Endangered species clearances on BLM-administered lands	Endangered Species Act of 1973, as amended et seq. (16 U.S.C. 1531)
Bureau of Reclamation	ROW grants and temporary use clearances on Federal lands	MLA, as amended (30 U.S.C. 185); 43 CFR 2880

Table 1-2. Major Federal, State, and Local Permits, Approvals, and Authorizing Actions Necessary for Construction, Operation, Maintenance, and Abandonment of the NPL Project

Responsible Agency	Permit, Approval, or Action	Regulation/Authority
U.S. Army Corps of Engineers	Section 404 permits and coordination regarding placement of dredged or fill material in area waters and adjacent wetlands	Section 404 of the Clean Water Act of 1972 (40 CFR 122-123, 230), 33 U.S.C. 1344
U.S. Fish and Wildlife Service	Coordination, consultation, and impact review on Federally listed threatened and endangered species, species proposed for Federal listing, and migratory birds	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.); Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1536 et seq.); Bald and Golden Eagle Protection Act, as amended (16 U.S.C. 668–668d); Migratory Bird Treaty Act (16 U.S.C. 703-712)
U.S. Environmental Protection Agency	Spill Prevention, Control, and Countermeasure Plans	40 CFR 112
	Regulation of hazardous waste treatment, storage, and/or disposal	Resource Conservation and Recovery Act (42 U.S.C. 6901)
U.S. Department of Transportation	Control of pipeline maintenance and operation by the Pipeline Hazardous Materials Safety Administration (PHMSA)	49 CFR 191 and 192
Wyoming Department of Agriculture	Weed and pest control managed by the Sublette County Weed and Pest Control District	Wyoming Weed and Pest Control Act (W.S. 11-5-102)
Wyoming Board of Land Commissioners/Office of State Lands and Investments	Approval of oil and gas leases, ROWs for long-term or permanent off-lease/off-unit roads and pipelines, temporary use permits, and developments on state lands	W.S. 37-1-101 et seq., W.S. 36-9-118
Wyoming Department of Environmental Quality—Water Quality Division	Regulation of off-lease disposal of drilling fluids and produced water	Wyoming Environmental Quality Act (WS 35-11-301 through 35-11-311)
	WYPDES permits for discharging wastewater and stormwater runoff	Wyoming DEQ Rules and Regulations, Chapter 2, Wyoming Environmental Quality Act (WS 35-11-301 through 35-11-311); Section 405 of the Clean Water Act (40 CFR 122–124)
	Administrative approval for discharge of hydrostatic test water	Wyoming Environmental Quality Act (WS 35-11-301 through 35-11-311)
Wyoming Department of Environmental Quality—Air Quality Division	Permits to construct and permits to operate	Clean Air Act; Wyoming Environmental Quality Act (WS 35-11-201 through 35-11-212)
Wyoming Department of Environmental Quality—Solid Waste Division	Construction fill permits and industrial waste facility permits for solid waste disposal during construction and operations	Wyoming Environmental Quality Act (WS 35-11-501 through 35-11-520)
Wyoming Department of Transportation	Permits for oversize, overlength, and overweight loads	Chapters 17 and 20 of the Wyoming Highway Department Rules and Regulations
Wyoming Oil and Gas Conservation Commission	Permit for oil and gas related pits	WOGCC Rules and Regulations Chapter 4 Section 1
	Approval to close all pits by treatment	WOGCC Rules and Regulations Chapter 4 Section 1
	Regulates downhole spacing of all oil and gas wells	WOGCC Rules and Regulations Chapter 3 Section 2
	Authorization for flaring venting of gas for all wells	WOGCC Rules and Regulations Chapter 3 Section 39
	Permit for all Class II underground injection/disposal wells	WOGCC Rules and Regulations Chapter 4 Section 5, 7 and 12

Table 1-2. Major Federal, State, and Local Permits, Approvals, and Authorizing Actions Necessary for Construction, Operation, Maintenance, and Abandonment of the NPL Project

Responsible Agency	Permit, Approval, or Action	Regulation/Authority
	Permit to drill/deepen (APD process) all wells	WOGCC Rules and Regulations Chapter 3 Section 8
	Spill reporting on all wells	WOGCC Rules and Regulations Chapter 4 Section 3
	Well stimulation for all wells	WOGCC Rules and Regulations Chapter 3 Section 45
	Baseline water testing for all wells	WOGCC Rules and Regulations Chapter 3 Section 46
	Permit for seismic projects	WOGCC Rules and Regulations Chapter 4 Section 6
	Surface setbacks to occupied structures	WOGCC Rules and Regulations Chapter 3 Section 47
Wyoming State Engineer's Office	Permits to appropriate groundwater (use, storage, wells, dewatering)	W.S. 41-121 through 147 (Form UW-5)
	Permits to appropriate surface water	W.S. 41-201 (Form SW-1)
State Historic Preservation Office	Cultural resource protection, programmatic agreements, consultation	Section 106 of National Historic Preservation Act and Advisory Council Regulations (Title 54, 36 CFR 800); Wyoming BLM and State Historic Preservation Office Wyoming State Protocol (BLM and SHPO 2014)
	Avoid adverse effects to significant cultural sites, guidelines for mitigation measures, and guidelines for evaluation of historic setting associated with significant sites	Wyoming BLM and State Historic Preservation Office Wyoming State Protocol
Sublette County	Zoning and Development Regulations of Sublette County	Section 7. W.S. 18-5-207
	Energy Pipeline Permit	Planning and Zoning Department
	County road use agreement	Office of Planning and Development
	County road bore permits (if crossing county road)	Road and Bridge Department
	Building Permit	Planning and Zoning Department
Sweetwater County	Construction / Use Permits	Development Code of Sweetwater County and W.S. 18-5-201 et seq.
	Conditional Use Permits for Man Camps, Construction Yards, waste water disposal ponds and other similar facilities	Development Code of Sweetwater County and W.S. 18-5-201 et seq.
	Small Waste Water Disposal Permits	Sweetwater County Health Department: Authority County Resolution and Wyoming State Statutes
	County Road Use and Maintenance Agreements, County Road Access Permits, County Road Crossing Licenses	Sweetwater County Resolution and Wyoming State Statutes
	Noxious Weed and Pest Control Coordination with Sweetwater County Weed and Pest Department	Wyoming State Statutes
	Compliance with the International Fire Code	Sweetwater County Resolution and the International Fire Code

Table 1-2. Major Federal, State, and Local Permits, Approvals, and Authorizing Actions Necessary for Construction, Operation, Maintenance, and Abandonment of the NPL Project

Responsible Agency	Permit, Approval, or Action	Regulation/Authority

APD	Application for Permit to Drill	ROW	Right-of-way
CFR	Code of Federal Regulation	SHPO	State Historic Preservation Officer
DEQ	Department of Environmental Quality	U.S.C.	United States Code
EO	Executive Order	W.S.	Wyoming Statute
FLPMA	Federal Land Policy and Management Act, as amended	WOGCC	Wyoming Oil and Gas Conservation Commission
MLA	Mineral Leasing Act	WYPDES	Wyoming Pollutant Discharge Elimination System
PHSMA	Pipeline Materials Safety Administration		

Note: This list is intended to provide an overview of key regulatory requirements that would govern project implementation under any Alternative. Additional approvals, permits, and authorizing actions could be necessary.

1.6.3 Conformance with BLM Resource Management Plans

The Project Area encompasses approximately 140,859 acres, including 59,586 BLM-administered acres in the Rock Springs Field Office and 76,069 BLM-administered acres in the Pinedale Field Office (Map 1). Policies and guidelines for development within the Project Area are contained in the BLM Approved PFO RMP and ROD (BLM 2008a) and the BLM Approved Green River RMP and ROD (BLM 1997a), including maintenance actions and amendments. Both RMPs allocate lands and/or Federal minerals for leasing and provide development guidelines. The RODs associated with each RMP indicate that Federal minerals will be made available for orderly and efficient development, and they require all minerals actions to comply with goals, objectives, and resource restrictions (mitigations) required to protect other resource values.

The BLM Approved PFO RMP and ROD (BLM 2008a) provides management direction for portions of the Project Area in the PFO. The objective for managing oil and gas resources, as stated in the BLM Approved PFO RMP and ROD, is to provide opportunities for mineral extraction and energy exploration and development to provide resources to meet national and local needs while avoiding or otherwise mitigating significant impacts on other resource objectives (BLM 2008a). The majority of the Project Area lies within the Traditional Leasing Area of the PFO. The objective within Traditional Leasing Areas is to make Federal lands and mineral estates available for oil and gas leasing and exploration in concert with maintaining the viability of non-oil and -gas resource values and land uses. Traditional Leasing Areas can convert to Intensively Developed Fields (IDF) if site-specific development meets all the criteria for designation as an IDF as outlined in the BLM PFO Approved RMP and ROD (BLM 2008a), including: (1) development is adjacent to an existing IDF; (2) development has a bottom-hole spacing of at least one well per 160 acres; and (3) development has a surface density of more than four well pads per 640-acre area. Consideration for conversion to an IDF would depend on: (1) a geology and reservoir analysis determination that additional well density is needed to efficiently and adequately produce the gas or oil resource, (2) that surface resources can be satisfactorily mitigated, and (3) that project-specific environmental documentation is prepared to analyze impacts and to determine operating methods, mitigation, and BMPs to be used in the efficient and comprehensive development of the field (BLM 2008a).

The BLM Approved Green River RMP and ROD (BLM 1997a) provides management direction for portions of the Project Area in the RSFO. The BLM Approved Green River RMP and ROD has been updated by several maintenance actions and amendments since 1997 including revised management objectives, actions, and land use allocations. In February 2011, the BLM published an NOI in the Federal Register to revise the Green River RMP as the Rock Springs RMP. Since this Rock Springs RMP Revision is ongoing, conformance is assessed against the existing Green River Approved RMP and ROD (BLM 1997a). Management decisions in the pending Rock Springs RMP and ROD could affect development within the Project Area in the future.

The objective for managing oil and gas resources, as stated in the BLM Green River Approved RMP, is to provide for leasing, exploration, and development of oil and gas while protecting other resource values. The BLM Green River Approved RMP and ROD states that public lands within the Project Area are open to mineral leasing and development to promote mineral recovery on behalf of the U.S., along with the appropriate mitigation of disturbance on a case-by-case basis.

The BLM PFO and Green River Approved RMPs and RODs both stipulate certain restrictions on oil and gas activities to conserve other resource values. The restrictions vary based on geographic location, timing, and other factors but can include controlled surface use (CSU), no surface occupancy (NSO), and timing limitations. Other mitigation measures, such as the application of oil and gas BMPs, are also required for development within the Project Area.

The air quality objectives of the Green River Approved RMP are, in general, to maintain and enhance current air quality. The objectives of the BLM PFO Approved RMP are more specific: to maintain concentrations of criteria and Prevention of Significant Deterioration (PSD) pollutants and reduce visibility-impairing and atmospheric deposition pollutants. Given the historic and anticipated levels of energy development in the PFO, the BLM PFO Approved RMP acknowledges the need for additional air quality monitoring and air modeling associated with individual energy development projects. As a part of this EIS, the BLM conducted modeling of gas development within the Project Area to determine conformance with the BLM PFO and Green River Approved RMP objectives and assess compliance with applicable laws.

The proposed development of natural gas within the Project Area is in conformance with the BLM Green River and PFO Approved RMPs. This EIS and subsequent decisions would incorporate decisions, terms, and conditions of use described in the BLM PFO and Green River Approved RMPs.

1.6.3.1 BLM Wyoming Greater Sage-Grouse Resource Management Plan Amendments

In September 2015, the BLM finalized the Greater Sage-Grouse Approved Resource Management Plan Amendments for the BLM Wyoming Casper, Kemmerer, Newcastle, Pinedale, Rawlins, and Rock Springs field offices (BLM Wyoming Sage-Grouse RMP Amendments) (BLM 2015e). The BLM Wyoming Sage-Grouse RMP Amendments amended the BLM PFO Approved RMP (BLM 2008a) and the BLM Approved Green River RMP (BLM 1997a) in response to the U.S. Fish and Wildlife Service's (USFWS) March 2010 "warranted, but precluded" Endangered Species Act (ESA) listing petition decision for the Sage-Grouse. The BLM Wyoming Sage-Grouse RMP Amendment is the baseline plan for management of Sage-Grouse in Wyoming in the High Desert District.

The BLM Wyoming Sage-Grouse RMP Amendments identify and incorporate appropriate measures in existing land use plans to enhance, and restore Sage-Grouse habitat. Changes in management of Sage-Grouse habitats were determined to be necessary to avoid the continued decline of populations across the species' range. The RMP Amendments focused on areas affected by threats to Sage-Grouse habitat identified by the USFWS in the March 2010 listing decision and in the USFWS 2013 COT Report (USFWS 2013c).

This EIS considers and incorporates goals, objectives, management decisions, and required design features from the BLM Wyoming Sage-Grouse RMP Amendments for the NPL Project, as appropriate.

1.6.4 Conformance with Local Plans

1.6.4.1 Sublette County Comprehensive Plan

The Project Area is located within Sublette County, Wyoming (Map 1) and is therefore covered by the goals and policies of the Sublette County Comprehensive Plan (Sublette County 2003). Wyoming State statutes provide for the development of county-level comprehensive plans under Title 9-8-301 and Title 18-5-202(b). As stated within the Sublette County Comprehensive Plan, locally developed, adopted, and implemented county plans apply to the unincorporated areas within the county and may address public health, safety, moral, and general welfare issues. These statutes also highlight the expectation that county governments will coordinate their land use plans and planning efforts with incorporated communities and other local entities, including conservation districts. In addition, through Title 18-5-208(b), Wyoming planning statutes encourage the coordination of county planning efforts with Federal land and resource management agencies.

The BLM considers the goals and objectives in the Sublette County Comprehensive Plan during development of BLM Resource Management Plans and has done so during the development of alternatives to the Proposed Action for the NPL Project. Sublette County participated as a cooperating agency during preparation of the NPL Project EIS in part to assist with incorporating the goals and objectives of Sublette County, as described in the Sublette County Comprehensive Plan, with the Proposed Action and alternatives.

1.6.4.2 Sublette County Federal and State Land Use Policy

In addition to the Sublette County Comprehensive Plan, Sublette County has also enacted the Sublette County Federal and State Land Use Policy (Sublette County 2009a). The land use policy represents Sublette County's distinct recommendations and policies for land management and use on federal and state lands within the county. In adopting the land use policy, Sublette County's intent is to:

- Protect the integrity of environmental systems and natural resources;
- preserve resource-based industries;
- promote a robust, diverse and stable economy;
- minimize conflicts between land uses;
- protect public health, safety and welfare;
- promote an understanding of the dynamics and benefits to and from agriculture and other multiple use activities and federal land concerning wildlife;
- preserve culture, customs, heritage, and economic diversity; and
- recognize and protect private rights and interests in federal and state land resources including rights-of-way and public access, grazing permits, water rights, special use permits, leases, contracts, and recreation use permits and licenses.

The BLM considers the Sublette County Federal Land Use Policy during development of BLM Resource Management Plans and during the development of alternatives to the Proposed Action for the NPL Project. Sublette County participated as a cooperating agency during preparation of the NPL Project EIS in part to assist with incorporating Sublette County Federal and State Land Use Policy, with the Proposed Action and alternatives.

1.6.4.3 Sublette County Conservation District Long Range Plan

The Project Area is located within the Sublette County Conservation District. Conservation districts are local government units organized to provide for the development, conservation, and protection of natural resources in accordance with W.S. 11-16. In 2013, the Sublette County Conservation District developed a Long Range Plan for years 2014 to 2019 (Sublette County Conservation District 2013) that establishes objectives for planning and monitoring the District's progress with respect to the Sublette County Federal and State Land Use Policy (Sublette County 2009a). Specific objectives of the Long Range Plan with direct relevance to the NPL Project include, but are not limited to:

- Conduct soil surveys and developing Ecological Site Descriptions (ESDs) that would be applied to evaluate soil capabilities and suitability limitations for development and reclamation;
- monitor surface and groundwater quality;
- participate in mineral development decisions that affect the interest and responsibilities of the District; and
- seek and participate in planning processes as a coordinating agency.

1.6.4.4 Sweetwater County Comprehensive Plan

While the Project Area is not located in Sweetwater County, the southern boundary of the Project Area is directly adjacent to the Sweetwater County line (Map 1). As a result, Sweetwater County could be affected indirectly or cumulatively by actions associated with the NPL Project. The Sweetwater County Comprehensive Plan includes goals, objectives, and implementation strategies that serve as a framework for County decision-makers as they consider future private and public land use and development decisions. The plan also provides a policy foundation for improving county and community cooperation, fostering county (government) and citizen relations, coordinating infrastructure planning, and pursuing economic development opportunities (Sweetwater County 2002). Specific goals from the Sweetwater County Comprehensive Plan with direct relevance to the NPL Project include, but are not limited to:

- Encourage growth and development to continue in an orderly manner and in locations that contribute to the economic and social well-being of County residents;
- balance future growth and development with facility/service capacity (e.g., water, sewer, waste disposal, transportation and roads, law enforcement, and emergency services);
- encourage industrial development near available facilities, services, and resources;
- as feasible, locate worker housing within existing communities where services are/can be provided;
- consider the region's limited water resources as part of the County land use and development decisions;
- encourage and support environmentally responsible resource exploration/development within the region; and
- lessen congestion in the streets (highways) and reduce the waste of excessive amounts of streets and highways.

The BLM considers the goals and objectives in the Sweetwater County Comprehensive Plan during development of BLM Resource Management Plans and has done so during the development of alternatives to the Proposed Action for the NPL Project. Sweetwater County participated as a cooperating agency during preparation of the NPL Project EIS in part to assist with incorporating the goals and objectives of Sweetwater County, as described in the Sweetwater County Comprehensive Plan, with the Proposed Action and alternatives.

1.6.4.5 Sweetwater County Conservation District Land and Resource Use Plan and Policy

In 2011, the Sweetwater County Conservation District developed a Land and Resource Use Plan and Policy to identify goals, objectives, and policies to facilitate, protect, and preserve the utilization and conservation of natural resources; protect local values and customs; and provide for the public health, safety, and welfare of the County's citizens (Sweetwater County Conservation District 2011). Specific goals and objectives of the Long Range Plan with direct relevance to the NPL Project include, but are not limited to:

- Recognize the continued importance of mineral and energy development;
- monitor and evaluate the effects and impacts of local, state, and federal land management actions on the custom and culture of Sweetwater County; and
- ensure compliance with all existing local, state, and federal laws regarding oil, gas and mineral exploration and/or their production, so that the District's mandate to conserve rangeland, soil, and water resources are met.

The Plan also establishes a process for the District and associated Land and Resource Advisory Committee to coordinate in advance with government agencies regarding any proposed action that would impact land uses in the County.

1.6.5 Federal Agency MOU Regarding Air Quality Analyses for Oil and Gas Development Projects in the Mountain West

In June 2011, the U.S. Department of Agriculture (on behalf of the U.S. Forest Service), the U.S. Department of the Interior (on behalf of the BLM, the Fish and Wildlife Service, and the National Park Service), and the U.S. EPA, signed an MOU entitled: "Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process" (EPA 2011). The MOU describes a set of recommended and standardized procedures for conducting air quality analyses for NEPA documents (i.e., EISs and EAs) that provide a framework for the agencies to work cooperatively to assess and mitigate potential impacts to air quality resources, including Air Quality Related Values (AQRVs) of "…Federal oil and gas planning, leasing, or field development decisions". The MOU specifically addresses analyses for assessing impacts on the National Ambient Air Quality standards and AQRVs, and suggests that it can also be used to assess impacts of hazardous air pollutants (HAPs) and greenhouse gases (GHGs). The MOU provides recommendations for identifying appropriate analysis approaches; for establishing agency communication, review, and resolution procedures; and for the documentation of any resulting decisions.

The MOU establishes and identifies the legal authorities (e.g., CAA, NEPA, etc.) of the agreement along with the roles and responsibilities of each agency, provides details on conducting air quality and AQRV analyses, including a detailed appendix summarizing available air quality modeling approaches, and lists procedures for identifying and evaluating emission reduction and mitigation measures.

The air quality analysis conducted for the NPL EIS has followed the MOU, with the establishment of an Inter-Agency Review Team (IART) consisting of participants from the BLM, U.S. EPA, National Park Service, National Forest Service, Fish and Wildlife Service, and Wyoming Department of Environmental Quality, who have reviewed the air quality modeling protocol, provided input to the air quality modeling approaches, reviewed preliminary and final results, and reviewed and provided comments on Appendix L (*Air Quality Technical Support Document*).

1.6.6 Tribal Consultation

The U.S. has a special legal relationship with Indian tribal governments as set forth in the U.S. Constitution, treaties, statutes, regulations, EOs, and court decisions. In recognition of this unique relationship, the BLM consults with tribes on a government-to-government basis. Prior to the scoping period, the BLM mailed tribal consultation letters to potentially affected tribes, formally initiating government-to-government consultation regarding the NPL Project. The tribal consultation letters provided an overview of the NPL Project; requested government-to-government consultation and invited input on the NPL Project; provided contact information to submit any questions, concerns, or comments on the NPL Project; and offered the opportunity for a project site visit. Subsequent to mailing the tribal consultation letters, BLM cultural resource specialists followed up with tribes through telephone calls and other contact to solicit input and provide updates to the tribes. The BLM contacted the following tribes through mailing consultation letters and subsequent phone calls:

- Eastern Shoshone Tribe;
- Northern Arapaho Tribe;
- Shoshone-Bannock Tribes of Fort Hall; and
- Ute Tribe of the Uinta and Ouray Reservation.

During EIS development, the BLM also invited tribes to participate in the alternatives development workshops, the cumulative effects workshop, and other meetings. Consultations with tribes that have an interest in the NPL Project continued throughout the EIS process, consistent with applicable regulations and guidance, including the National Historic Preservation Act (NHPA). In accordance with the NHPA, consultations with the Wyoming State Historic Preservation Office were also coordinated with tribal consultation, as appropriate. Coordination with tribes and other appropriate parties helped identify potential cultural-resource related issues, appropriate scale of analysis for the EIS, and provided other information that was utilized for the NPL Project EIS process.

1.7 Public and Agency Scoping

The formal scoping process for the NPL Project began with publication of the NOI in the *Federal Register* on April 12, 2011 (76 FR 20370). The NPL Project scoping period ran from April 12 to May 12, 2011. The BLM accepted comments and included them in the *NPL Natural Gas Development Project Scoping Report* (BLM 2011a) if the comments were received within 15 days after the last scoping meeting (i.e., by May 19, 2011). The BLM hosted three scoping meetings held May 2–4, 2011 in Pinedale, Marbleton, and Rock Springs, Wyoming. The scoping meetings gave agencies, organizations, the public, and other interested parties an opportunity to learn and ask questions about the NPL Project and to share issues and concerns with the BLM.

Scoping for the NPL Project provided an early and open process for determining the scope of issues addressed in this EIS. The BLM used scoping for the NPL Project to solicit internal and external input and comments on the issues, impacts, and potential alternatives the agency addresses in this EIS and the scope of the analysis.

The BLM received 1,238 separate scoping comments in comment forms submitted at the scoping meetings, through email submittal of comment documents, and in scoping documents mailed to the BLM PFO. For a detailed description of the scoping process and comments and issues identified during scoping, refer to the *NPL Natural Gas Development Project Scoping Report* (BLM 2011a).

Issues identified during scoping fell into two general categories:

- issues within the scope of the EIS that the BLM used to define the scope of analysis in the EIS, to develop alternatives, or to consider during the preparation of other components of the EIS; and
- issues outside the scope of the EIS, including those that require policy, regulatory, or administrative actions. This EIS does not address issues outside the scope of the EIS.

1.7.1 Issues Identified during Scoping

This section summarizes the issues determined to be within the scope of the NPL Project EIS. Based on the comments submitted during scoping, the BLM developed 29 issue statements, in the form of questions, which describe the general issues and concerns identified during scoping. The *NPL Natural Gas Development Project Scoping Report* provides additional detail on the issues identified during the scoping period (BLM 2011a). The BLM used the issues to define the scope of the analysis of this EIS and to develop and refine alternatives. In addition to the issues identified during scoping, the BLM also continued to consider issues and concerns during the EIS process as the BLM received additional input from the public, cooperating agencies, and other interested parties. Appendix A (*Scoping Issue Tracking*) further describes the scoping issue statements, the specific concerns and questions encapsulated within each issue statement, and how the issue statements were considered and addressed during the NEPA process and the NPL Project EIS.

1.7.1.1.1 Air Quality

Issue 1: How would the NPL Project affect air quality?

- Existing air-quality conditions, trends, and issues in the area should be adequately characterized.
- Will the NPL Project contribute to exceedance of National Ambient Air Quality Standards?
- How will the NPL Project affect local and regional ozone?
- Will the NPL Project contribute to visibility impacts in Class I areas?
- Will the NPL Project result in increased deposition of contaminants in National Parks or other sensitive locations?
- Incorporate robust and quantitative modeling for all appropriate air pollutants resulting from NPL Project drilling, production, vehicle use, and other sources.
- How will the NPL Project minimize or mitigate air quality impacts?

1.7.1.1.2 Climate Change

Issue 2: While considering current, applicable agency policy, how would climate change affect the proposed NPL Project and how would the NPL Project affect climate change?

- Include quantitative estimates of greenhouse gas emissions.
- How will the NPL Project impact or be affected by climate change?
- How will potential greenhouse gas emissions be minimized or mitigated?

1.7.1.1.3 Cultural Resources

Issue 3: How would the proposed NPL Project affect cultural and tribal resources?

- Consider the NHPA, Native American Graves Protection and Repatriation Act, and other relevant cultural resource related policy and guidance in the NPL Project and process.
- How will the BLM identify and monitor cultural resources in the Project Area?
- How will the BLM avoid or mitigate adverse impacts to the integrity of cultural and historic sites, including National Historic Trails and their cutoffs?
- How will the BLM incorporate consultation with tribes to identify and protect Traditional Cultural Properties?

1.7.1.1.4 Cumulative Impacts

Issue 4: What are the cumulative impacts associated with current and future development in the region?

- What past, present, and reasonably foreseeable projects and their connected actions would be appropriate to include in the cumulative impacts analysis?
- Consider a landscape level scale when determining the region of impact for cumulative impacts.
- What would the cumulative impacts be on air quality, biological resources, soils, traffic and transportation, recreation, socioeconomics, and other resources and resource uses?

1.7.1.1.5 Health and Safety

Issue 5: How would the NPL Project affect human health in the region?

- If the NPL Project results in declines in air quality, how would it contribute to human health impacts?
- How will the EIS analyze the effects of ground level ozone to human health?
- What are the potential health and safety impacts from NPL Project traffic?

1.7.1.1.6 Invasive Species

Issue 6: How would the NPL Project affect the establishment and spread of invasive species?

- What methods and practices would the NPL Project employ to control the establishment and spread of invasive species?

1.7.1.1.7 Land Use

Issue 7: How will the EIS identify and address land use?

- Clearly identify land ownership on areas affected by the NPL Project and any land use changes.
- The NPL Project needs to be consistent with Federal, state, and local land use plans.

1.7.1.1.8 Livestock Grazing

Issue 8: How will the NPL Project affect livestock grazing in the area?

- How will the NPL Project affect grazing lessees and their allotments?
- Consider the Wyoming Standards for Healthy Rangelands.
- Include appropriate mitigation to reduce impacts to livestock and grazing.

1.7.1.1.9 Mitigation

Issue 9: How will potential adverse impacts to resources and resource uses be reduced or eliminated?

- Include appropriate onsite and offsite mitigation measures.
- Consider a mitigation fund.
- Is mitigation banking appropriate for the NPL Project?
- Adequately describe the rationale and implementation of mitigation measures for all phases of the NPL Project in the EIS.

1.7.1.1.10 NEPA Process

Issue 10: What are the necessary steps to ensure an adequate and defensible NEPA process and EIS?

- Include an appropriate and reasonable range of alternatives in the EIS that are feasible and responsive to the purpose and need.
- Base the alternatives, information, and analysis in the EIS on science.
- Establish adequate baseline data needs for the NPL Project and affected area.
- Consider presenting information and conducting analysis at the landscape scale.
- Include appropriate public and stakeholder participation during the NEPA process.

Issue 11: How will the NPL Project EIS consider and incorporate other appropriate NEPA documents?

- Consider management identified in the BLM PFO and Green River Approved RMPs.
- Coordinate the NPL Project EIS with the ongoing Wyoming Greater Sage-Grouse RMP Amendments.

1.7.1.1.11 Oil and Gas Operations

Issue 12: What equipment, techniques, and design features will be implemented on the NPL Project to respond to local and regional conditions?

- Design the NPL Project facilities, infrastructure, and activities to reduce the potential for adverse impacts, including considering the use of emission reduction technology, siting of pipelines and other infrastructure, directional drilling, the use of natural gas-powered drill rigs, and covering and lining shallow reserve pits.
- Consider technologies and options that balance extraction of hydrocarbon resources with environmental considerations.
- Consider options for phased development for the NPL Project.
- The proponent and any contracted workers should adhere to all applicable policies, regulations, and BMPs.

1.7.1.1.12 Policies, Regulations, and Permitting

Issue 13: How will the NPL Project and approval process consider applicable policies, regulations, and permitting?

- The NPL Project needs to be consistent with Federal, state, and local policies, regulations, executive orders, and other applicable legislation and guidance.
- Coordinate acquisition of appropriate permits with Federal, state, and local governments.
- Recognize the State of Wyoming as having the authority to regulate air quality.

Issue 14: Under what circumstances will the BLM grant exceptions, waivers, or modifications to oil and gas lease stipulations on leases within the NPL Project Area?

- Follow the exception/waiver/modification criteria developed in the BLM PFO Approved RMP and the BLM Green River Approved RMP.

1.7.1.1.13 Reclamation

Issue 15: How will the NPL Project and NEPA Process support appropriate and successful reclamation?

- Reclamation should support the reestablishment of native vegetation.
- Consider interim reclamation measures such as mulching, irrigation, fencing, and reseeding with native and nonnative mixes to establish suitable conditions for the establishment of native vegetation.
- Coordinate reclamation with appropriate stakeholders and ongoing reclamation efforts.
- Reclamation plans should account for site-specific conditions, comply with Wyoming reclamation policy, and include a monitoring component.

1.7.1.1.14 Recreation

Issue 16: How will the NPL Project affect outdoor recreation?

- Adequately describe current recreation use in the NPL Project vicinity in the EIS.

- How would impacts on fish, wildlife, and other resources affect recreational hunting and fishing?
- How will the BLM consult with appropriate stakeholders to minimize impacts to outdoor recreation?
- Identify and implement methods to limit impacts to big game hunting and other forms of recreation.

1.7.1.1.15 Social and Economic

Issue 17: How will the NPL Project affect economic conditions on local, regional, and national levels?

- How will the NPL Project affect local, regional, and national economies in the immediate future and over the full term of development and operation?
- Include in the analysis the impact of revenues from royalties and taxes to the Federal, state, and local governments.
- Minimize the potential for adverse socioeconomic impacts to local communities.
- How will the NPL Project affect other industries in the area such as tourism, hunting, and fishing?

Issue 18: How will the NPL Project affect social conditions and quality of life?

- How will the NPL Project affect public services demand and local governments' ability to provide them?
- How will the NPL Project affect health care, traffic, public infrastructure, and other quality of life issues?

1.7.1.1.16 Soils

Issue 19: How will the NPL Project affect soils?

- How will topsoil removal and surface disturbance affect soil?
- Consider techniques such as limiting soil removal, mowing rather than blading vegetation, and the use of topsoil live haul to limit impacts to soils.
- Based on a site-specific soil analysis, weather, slope, and other relevant information, consider immediate site stabilization after disturbance.
- Incorporate guidance from the BLM Gold Book and other appropriate techniques to limit soil disturbance from roads (e.g., paving roads when they serve more than five well sites).

1.7.1.1.17 Special Status Species

Issue 20: Will the NPL Project affect special status species and their habitat?

- Potential special status species of concern include Greater Sage-Grouse, white-tailed prairie dog, mountain plover, pygmy rabbit, and rare plant species.
- Characterize special status species habitat and populations within the Project Area and include appropriate avoidance and minimization measures (e.g., disturbance buffers).
- Comply with existing regulations and policy associated with special status species.

- Incorporate contemporary research and conservation strategies for the Greater Sage-Grouse to inform the project design, alternatives, and impacts analysis.
- Minimize impacts to Greater Sage-Grouse and its habitat.
- How will the EIS analyze potential effects to special status species outside the Project Area (e.g., downstream fish populations)?

1.7.1.1.18 Stakeholder Involvement

Issue 21: How will the NEPA process and the proponent facilitate stakeholder involvement?

- What ongoing methods or strategies will the BLM and the proponent employ to achieve active stakeholder involvement to resolve issues related to the NPL Project?
- How will the NEPA process involve local, state, and federal agencies and interest groups?

1.7.1.1.19 Surface Disturbance

Issue 22: To what extent should the BLM limit surface disturbance within the Project Area?

- Consider limiting surface disturbance through feasible design features, BMPs, and mitigation (e.g., co-locating pipelines and roads, siting pipelines above ground).
- Will any limitations in surface disturbance attributable to the NPL Project be prospectively applied to other use-authorizations?
- What will be the positive and negative impacts of any surface disturbance limitations on the NPL Project?

1.7.1.1.20 Traffic and Transportation

Issue 23: How will the NPL Project affect traffic and transportation and local roads?

- How will the NPL Project affect county roads in terms of usage, condition, dust abatement, maintenance, and traffic safety?
- Include a transportation plan developed in coordination with local and state governments in the EIS.
- How will the NPL Project minimize adverse effects to traffic and the local transportation network?

1.7.1.1.21 Vegetation and Wetlands

Issue 24: How will the NPL Project avoid, minimize, or mitigate any adverse effects to wetlands?

- Characterize all wetland resources in the Project Area.
- Include BMPs and other protective measures for wetlands.

1.7.1.1.22 Visual

Issue 25: How will the NPL Project affect viewsheds and visibility?

1.7.1.1.23 Water

Issue 26: How will the NPL Project affect surface water and groundwater resources?

- Fully characterize the hydrology including springs, aquifers, recharge zones, Waters of the U.S., and existing water wells that may be affected by the NPL Project.
- Provide an appropriate analysis of impacts to all water resources in the EIS. The analysis should consider direct impacts and impacts from transportation and disposal of water throughout all phases of the NPL Project.
- Identify all source-water protection areas under each alternative.
- How will Jonah Energy and the BLM minimize water quality impacts, including those resulting from erosion and sedimentation?
- Incorporate methods to monitor groundwater and surface water quantity and quality during all phases of the NPL Project.
- What are the potential impacts to surface and groundwater from hydraulic fracturing?
- What impacts would stream crossings have on water quality and how would impacts be minimized?
- Where feasible, locate NPL Project facilities to avoid floodplains, riparian areas, ephemeral drainages, and other surface water features.

Issue 27: How will the proponent collect, store, treat, or dispose of produced water?

- What methods will the proponent use to detect and report spills or leaks of produced water?
- Are there any beneficial uses of produced water that may be considered for the NPL Project?

1.7.1.1.24 Wild Horses

Issue 28: How will the NPL Project minimize impacts on wild horses?

- Consider wild horse friendly fencing and other mitigation and design features that benefit wild horses.

1.7.1.1.25 Wildlife

Issue 29: How will the NPL Project affect wildlife and habitat?

- Consider and limit impacts to big game migration (e.g., pronghorn, elk, and mule deer) through the Project Area.
- Analyze impacts to big game winter ranges and consider methods to limit impacts to these areas.
- Analyze the NPL Project's effects on habitat fragmentation and connectivity and the possible displacement of wildlife at the landscape scale.

- Incorporate the most recent and applicable scientific studies to analyze potential impacts to wildlife.
- Include mitigation, design features, and BMPs to avoid or limit adverse impacts to wildlife.
- How will wildlife displaced from the Project Area affect surrounding areas?
- How will avian species be impacted from shallow pits during drilling operations?

1.7.2 Comments Outside the Scope of Analysis for the NPL Project EIS

During scoping, the BLM received scoping comments that were outside the scope of analysis for the NPL Project EIS. Scoping comments that were not within the scope of analysis for the NPL Project EIS included:

- general opinions of the NPL Project (e.g., I support/I oppose),
- comments on projects or areas outside the geographic range of analysis in the EIS,
- comments associated with decisions and actions that will not be made in the NPL Project EIS, and
- comments associated with funding of government agencies and programs.

The *NPL Natural Gas Development Project Scoping Report* (BLM 2011a) provides additional information on all scoping comments, including comments outside the scope of analysis for the NPL Project EIS.

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CHAPTER 2 – PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

The National Environmental Policy Act (NEPA) requires federal agencies to consider and evaluate a reasonable range of alternatives for a proposed action. The range of alternatives must meet the Bureau of Land Management (BLM) purpose and need and be technically and economically practical and feasible. Pursuant to 40 Code of Federal Regulations (CFR) 1502.14(a), the BLM "shall rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."

The reasonable range of alternatives described in this chapter addresses issues and concerns raised by the public, agencies, and other stakeholders during scoping and alternatives development for the Normally Pressured Lance Natural Gas Development Project (NPL Project). The Proposed Action satisfies the stated purpose and need for the federal action. The alternatives represent other means of meeting the purpose and need (e.g., technologies, processes, locations, timing, sequences). Alternatives that were considered during the Environmental Impact Statement (EIS) process, but were eliminated from further detailed analysis, are briefly described in Section 2.9 (*Alternatives Considered but Eliminated from Detailed Analysis*), along with the rationale for their elimination.

This chapter presents four alternatives that the BLM considered in detail for the NPL Project EIS, including:

- <u>No Action Alternative</u>: Consideration of the No Action Alternative provides a baseline for analyzing impacts (including cumulative impacts) resulting from implementation of the Proposed Action and other action alternatives and is required under CEQ Regulations (Section 1502.14(d)). For the No Action Alternative, the BLM Authorized Officer would not approve the Proposed Action and associated land-use applications. However, existing federal oil and gas leases within the Project Area would remain valid unless they were not otherwise in compliance with applicable laws and regulatory requirements. Federal oil and gas resources could continue to be developed and produced on an individual-lease or unit-area basis. For the purpose of analysis, the BLM assumes that development and production would continue at the rate that has been seen in the Project Area since 1997: drilling and completion of approximately three new wells per year from single or multi-well pads, for a 10-year development period, along with construction and maintenance of ancillary facilities associated with productive wells.
- <u>Proposed Action</u>: The Proposed Action is Jonah Energy's development proposal for the NPL Project and includes a maximum of 3,500 directionally drilled wells during a 10-year development period within the 140,859 acre Project Area. The rate of well development would be up to 350 new wells per year along with associated well pads, access roads, pipelines, regional gathering facilities, and other ancillary facilities. The life of the project is assumed to be 40 years. Directionally drilled wells would be drilled from multi-well pads, with an average of up to four multi-well pads per 640-acre section of land in areas outside designated Sage-Grouse Priority Habitat Management Areas (PHMA). Inside Sage-Grouse PHMA, Jonah Energy would construct an average of up to one multi-well pad per 640-acre section, consistent with state of Wyoming Executive Order (EO) 2015-4, *Greater Sage-Grouse Core Area Protection* (State of Wyoming 2015), and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e).
- <u>Alternative A</u>: This alternative was developed primarily to address sensitive wildlife resources identified during scoping (BLM 2011a) and the alternatives development process. For

Alternative A, the maximum number of wells would be the same as the Proposed Action, but the location, timing, and pattern of development would be different than the Proposed Action with the timing of development occurring sequentially in three geographically defined Phases (Map 4). The maximum allowable density of development within identified Development Areas (DAs) would be largely driven by the presence or absence of delineated wildlife habitats in a given DA and the expanse of those habitats, if present (Map 5). The BLM would apply additional resource protection measures for wildlife species within delineated habitats of DAs where species are considered a focus species[2]. The development period would be slightly longer than that of the Proposed Action resulting in slightly fewer new wells drilled per year, on average. Development under Alternative A would occur sequentially within the DAs identified for the three Phases starting with Phase 1, adjacent to the Jonah Infill Drilling Project Area (JIDPA). Development in Sage-Grouse PHMA would be phased during the development period with the PHMA divided into three DAs with one DA occurring in each Phase (Map 5).

- Alternative B: Alternative B is the BLM Preferred Alternative and was developed to address concerns expressed during scoping associated with conserving a broad range of resource values and focusing development in the least environmentally sensitive areas. In contrast to Alternative A, where the density of development and development limitations would be based primarily on wildlife habitat for focus species, development for Alternative B would be based on a broader range of resources including visual resources, paleontological resources, surface water features, identified lands with wilderness characteristics, and other resources (including wildlife habitat). Under Alternative B, the maximum number of wells would be the same as for the Proposed Action, but the DA 1 area (Map 6) would have a reduced density of development, reduced surface disturbance, and more clustering of disturbance locations to reduce impacts to a range of sensitive resources in this area. For Alternative B, the development period would be slightly longer than that of the Proposed Action resulting in slightly fewer new wells drilled per year (on average).

  In addition to the Alternative B development prescriptions in the identified DAs (e.g., an average of up to 1 disturbance location per 640 acres in DA 1), Alternative B includes two potential development scenarios for Sage-Grouse Winter Concentration Areas: 1.) Winter Concentration Area development scenario 1 applies a seasonal timing limitation on development during the wintering period as identified in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e), and 2.) Winter Concentration Area development scenario 2 applies the seasonal timing limitation as well as additional resource protection measures in Winter Concentration Areas including a disturbance threshold and other measures to reduce potential impacts. Under both scenarios, development would be allowed on a limited scale in Winter Concentration Areas. A study would be conducted concurrently with development activities to better understand the impacts of developing in Winter Concentration Areas. The results of the study, current information available at the time of site-specific permitting, and current guidance at the time of site-specific permitting would inform BLM understanding of impacts and subsequent development in Winter Concentration Areas, which would inform analysis during site-specific NEPA reviews.

[2] *Focus species are species with existing delineated habitats that warrant additional management focus due to species status, quantity and quality of habitat, issues identified during scoping, or other factors. Refer to Section 2.7.6 (Resource Protection Measures for Alternative A) for more information.*

The sections below further describe the No Action Alternative, the Proposed Action, and the two action alternatives, as well as the alternatives considered but eliminated from detailed analysis. Section 2.10 (*Comparison of Alternatives*) at the end of this chapter provides a comparison of surface disturbance (Table 2-27) and Table 2-28 presents a comparison of the key features of the alternatives.

2.2 Development of Alternatives

The BLM used the scoping process to determine the scope of issues to be analyzed in the NPL Project EIS and to drive the development of a reasonable range of alternatives (Section 1.7.1 – *Issues Identified during Scoping*). In addition, the BLM implemented a comprehensive alternatives development process that invited participation from the BLM Interdisciplinary (ID) Team, tribes, cooperating agencies, and other applicable agencies. On July 13, 2011 the BLM hosted an alternatives development workshop at the BLM Rock Springs Field Office (RSFO) that was attended by cooperating agencies, a tribal representative, and the BLM ID Team. During the workshop, the BLM provided information and received input on resource issues, the Proposed Action, and potential options for alternatives. The BLM used input received at this alternatives development workshop to identify preliminary alternatives to carry forward for further consideration. The original operator for the NPL Project, Encana Oil & Gas (USA) Inc. (Encana), was invited to participate in the last portion of the workshop to provide an opportunity for attendees to ask questions directly to Encana to clarify elements of the Proposed Action that would subsequently be used to inform alternatives, BMPs, and mitigation measures.[3] After Encana transferred ownership of the leases in the NPL Project Area to Jonah Energy, Jonah Energy confirmed that the Proposed Action, as previously proposed by Encana, would remain the same.

After attending an alternatives development workshop in July of 2011, the BLM ID Team developed content for the alternatives; coordinated with cooperating agencies and other state and federal agencies on the implication of regulatory changes on potential alternatives (e.g., Upper Green River Basin [UGRB] ozone nonattainment designation by the U.S. Environmental Protection Agency [EPA]); and refined the alternatives which could then be presented to the cooperating agencies.

On September 27, 2012, the BLM hosted a second alternatives meeting at the BLM Pinedale Field Office (PFO) attended by cooperating agencies and the BLM ID Team. Prior to this meeting, the BLM distributed the preliminary alternatives for cooperating agency review and comment. Updates to the alternatives development process were provided by the BLM during the meeting and input was solicited from cooperating agencies and the BLM ID Team. Subsequent to the meeting, the BLM refined the alternatives based on feedback received from the cooperating agency review and input from the BLM ID Team and other sources. This version of the alternatives was included in the Preliminary Draft EIS distributed for review by cooperating agencies in November 2013.

Following the Preliminary Draft EIS, the BLM further refined the alternatives based on cooperating agency comments on the Preliminary Draft EIS, Clean Air Act General Conformity requirements in the UGRB ozone non-attainment area (*Section 2.4.2 – General Conformity*), and required design features in the BLM Wyoming Greater Sage-Grouse RMP Amendments (BLM 2015e). The BLM distributed an updated version of the Preliminary Draft EIS, including the refined alternatives, to cooperating agencies in February 2016. Following cooperating agency review of the revised Preliminary Draft EIS and the refined alternatives, the BLM finalized the alternatives for inclusion in the Draft EIS.

[3] *Jonah Energy and Encana did not participate in the alternatives development portions of the workshop.*

Throughout the EIS process, the BLM provided additional opportunities for cooperating agencies to review and comment on the alternatives, resulting in further refinements.

2.3 Project Area

The Project Area encompasses 140,859 acres located primarily on BLM-administered lands in the BLM PFO and RSFO, within Townships 27 through 29 North, Ranges 107 through 110 West, 6th Principal Meridian in Sublette County, Wyoming (Map 1). The Project Area is entirely in Sublette County, but the southern boundary of the Project Area is directly adjacent to the Sweetwater County line (Map 1).

2.3.1 Existing Development in the Project Area

Table 2-1 identifies the existing development and associated estimated surface disturbance in the Project Area. Map 3 depicts the existing development in the Project Area. The existing surface disturbance and development provide the baseline for the No Action Alternative, Proposed Action, and Alternatives A and B. The surface disturbance thresholds associated with certain habitat types described in this Chapter (e.g., no more than 5 percent surface disturbance in Sage-Grouse PHMA) include both new and existing development and disturbance.

Approximately 116 wells have been drilled in the Project Area, including:

- 55 producing natural gas wells;
- 19 dry/junked/abandoned wells;
- 1 permitted Class II Underground Injection Control (UIC) well (deep disposal of produced water);
- 10 water supply wells for oil and gas operations (drilling and completion operations, road construction, maintenance, dust control and reclamation) including 4 water supply wells for water to support drilling in the JIDPA, and 1 water supply well for the Jonah workforce facility; and
- 31 existing stock water wells.

Table 2-1. Existing Development and Disturbance in the Project Area

Feature	Number of Features	Disturbance Assumptions and Multipliers	Estimated Existing Surface Disturbance (acres)
Wells			
Producing Oil and Gas Wells[1]	55 wells	1.5 acres per well	82.5
Existing Stock Water Wells[2]	31 wells	0.1 acre per well	3.1
Dry/Junked/Abandoned Wells	19 wells	1.5 acre per well	28.5
Class II UIC Well	1 well	0.1 acre per well	0.1
Water Supply Wells for Oil and Gas Operations	10 wells	0.1 acre per well	1.0
Well Subtotal	**116 Wells**	-	**115.2**
Linear Features			
Primary Roads[3]	55 miles	50-foot width	333
Secondary Roads[4]	119 miles	23.5-foot width	338

Table 2-1. Existing Development and Disturbance in the Project Area

Feature	Number of Features	Disturbance Assumptions and Multipliers	Estimated Existing Surface Disturbance (acres)
LaBarge to Bridger Compressor Station 230 kV power line[5]	9 miles	150-foot maintenance corridor	164
Bird Canyon Corridor[5]	13 miles	125-foot maintenance corridor	197
JIDPA Corridor[5]	9 miles	320-foot maintenance corridor	349
Bridger to Luman Corridor[5,6]	2 miles	180-foot maintenance corridor	44
Linear Feature Subtotal	**207 miles**	-	**1,425**
Construction/Production Facilities			
Compressor Station[7]	1	11 acres for facility	11
Work Force Facility[8]	1	22 acres for facility	22
Facilities Subtotal	**2**	-	33
Total Existing Disturbance	**-**	**-**	***1,573***
Total Existing Disturbance as percent of Project Area	**-**	**-**	***1.1%***

[1]Source: Includes 55 producing gas wells identified in WOGCC 2015. Disturbance assumptions from the BLM Pinedale Proposed Resource Management Plan and Final EIS (BLM 2008b).
[2]Source: BLM 2015a. Disturbance assumptions from the BLM Pinedale Proposed Resource Management Plan and Final EIS (BLM 2008b).
[3]BLM 2015a. Road width disturbance assumption based on approximate average width of primary roads in the Project Area.
[4]Source: BLM 2015a. Road width disturbance assumption from the BLM Pinedale Proposed Resource Management Plan and Final EIS (BLM 2008b).
[5]Source: BLM provided utility corridor width assumptions.
[6]Corridor includes a produced water and condensate pipeline between Bridger and Luman and a powerline to Bridger Substation.
[7]Existing compressor stations based on geographic information system (GIS) data provided by Jonah Energy depicting a single compressor station present in the Project Area.
[8]Digitized from 2012 NAIP aerial imagery using GIS software.

JIDPA Jonah Infill Drilling Project Area
UIC Underground Injection Control

Note: Minor differences in acreages are due to rounding.

2.4 Features Common to All Alternatives

2.4.1 Applicable Laws, Ordinances, Regulations, and Standards

For all alternatives, Jonah Energy would comply with all applicable Laws, Ordinances, Regulations, and Standards (LORS), and would meet the requirements of all needed permits. Local ordinances and regulations would be followed for applicable actions under local jurisdiction. Section 1.6 (*Regulatory Setting*) describes key federal, state, and local LORS as well as major permits, approvals, and actions required, along with their associated authorities, for the NPL Project (Table 1-2). Chapter 3 (*Affected Environment*) describes the affected environment and its management, including a description of applicable LORS by resource. Where specific permit requirements would affect the environmental consequences to a particular resource, those requirements are discussed in Chapter 4 (*Environmental Consequences*).

Following the completion of the NEPA process, but prior to any project-related operations occurring on public lands other than casual use, applications for permits to drill wells and construct ancillary facilities must be submitted to and considered by the BLM as part of the requirements set forth, in part, by Onshore Oil and Gas Order No. 1, "Onshore Oil and Gas Operations; Federal and Indian Oil and Gas Leases; Approval of Operations," issued under 43 CFR 3160. This process includes two procedural options for seeking approval to drill a well. When operators propose to drill a well on BLM-administered lands, either an Application for Permit to Drill (APD) or a Notice of Staking (NOS) followed by an APD must first be submitted to the BLM. No surface disturbance can be initiated on BLM-administered land until the APD or other related application is approved by the BLM, following site-specific environmental review and NEPA compliance during the APD process.

In general, roads, pipelines, utility corridors, and other surface facilities constructed on BLM-administered lands, but outside of the lease or unit, would require a federal right-of-way (ROW) grant from the BLM. Roads, pipelines, utility corridors, and other linear surface infrastructure needed to support oil and gas development in a unitized area would generally not require a separate ROW application or grant. In certain cases (e.g., sales pipelines) infrastructure within lease or on unit boundaries may require a ROW. A bond is held by the BLM conditioned upon compliance with all of the terms and conditions of the lease(s) covered by the bond, including complete and timely plugging of the well(s), reclamation of the lease area(s), and the restoration of any lands, surface water, or groundwater adversely affected by lease operations.

2.4.2 General Conformity

Wyoming's UGRB was officially designated by the EPA as an ozone nonattainment area (for the 2008 ozone standard) with a Marginal classification on April 30, 2012.[4] Per the current nonattainment regulations contained in Chapter 8, Section 3 of the Wyoming Air Quality Standards and Regulations (WAQSR) (WDEQ 2012b), the BLM must demonstrate that new actions occurring within the nonattainment area will conform with the Wyoming State Implementation Plan (SIP) either through an applicability analysis to demonstrate that the total of direct and indirect emissions from the proposed federal action do not exceed the *de minimis* emission levels specified in 40 CFR 93.153(b) and Chapter 8, Section 3 of the WAQSR, or through a conformity determination if approval of the federal action will exceed the *de minimis* emission levels of 100 tons/year of nitrogen oxides (NOx) or volatile organic compounds (VOC), the precursor pollutants that form ozone in the atmosphere. Federal actions estimated to have an annual net emissions increase less than the *de minimis* levels are not required to demonstrate conformity through additional analysis or a formal Conformity determination. In addition, any portion of the project or action that requires a permit under the State of Wyoming's New Source Review (NSR) or Prevention of Significant Deterioration (PSD) programs is also excluded from the federal agency's general conformity analysis per 40 CFR 93.153(d).

While the Wyoming Department of Environmental Quality (WDEQ) Air Quality Division has primacy for implementing the General Conformity requirements within the State of Wyoming, the BLM is the federal

[4] *On November 16, 2017, EPA published a final designation of attainment for Sublette, Sweetwater, and Lincoln counties for the 2015 8-hour ozone standard, effective January 16, 2018 (81 FR 54232, 40 CFR 81). This attainment designation for the 2015 ozone standard does not affect compliance requirements for the UGRB nonattainment area under the 2008 ozone standard.*

agency responsible for demonstrating conformity for any federal action it authorizes, approves, or permits within the UGRB ozone nonattainment area. A demonstration of conformity must be made before any project can be authorized, approved, or permitted.

General Conformity can be addressed in conjunction with the NEPA process for a project; however, there is not a specific requirement to do so. Furthermore, the General Conformity regulations require specific public notification requirements for draft and final conformity determinations that are distinct from the NEPA process. Therefore, a conformity analysis and determination for the NPL Project will be made for the alternative that is developed or selected for the Record of Decision and will be based on the year of projected maximum emissions for the project.

The NPL Project air quality analysis described in Section 4.2 (*Air Quality*) and in Appendix L (*Air Quality Technical Support Document*) was used to inform the NPL Project conformity determination in Appendix M (*NPL Project Conformity Determination*). Per the existing federal and state regulations, proposed emission sources that are not permitted or regulated through existing WDEQ permitting mechanisms, such as the New Source Review Program, must be addressed for the purposes of General Conformity. For the NPL Project, these sources include completion rigs and ancillary equipment used during completion operations, mobile equipment sources used for construction, drilling, completion, and production activities and commuting vehicle traffic associated with all of these activities. If necessary, NPL Project drilling and development will be restricted to ensure that development activities meet the requirements contained within the General Conformity regulations before the project is ultimately approved. Conformity can be demonstrated through development of state emission budgets, emission offsets, reduced pace and scale of development, or any combination of these methods.

2.4.3 Greater Sage-Grouse Habitat Management

In September 2015, the USFWS determined that protection for the Greater Sage-Grouse under the Endangered Species Act was no longer warranted and the species was withdrawn from the candidate species list. In explaining the decision not to list the Greater Sage-Grouse as Threatened or Endangered, the USFWS (USFWS 2015) provided the following summary relative to the regulatory mechanisms developed by the BLM and states of Wyoming and Montana to reduce the impacts of non-renewable energy development on the Greater Sage-Grouse.

> *"Our analysis indicates that regulatory mechanisms reduce the risk of nonrenewable energy exposure to the Population Index and breeding habitat by more than 35 percent in MZ [Management Zone] I and more than 60 percent in MZ II, the areas with the greatest potential for nonrenewable energy development. State and Federal Plans emphasize protection of the most important habitats from habitat loss, habitat fragmentation, and disturbance, ensuring that large, contiguous expanses of habitat will remain to support sage-grouse populations. Rangewide, the Federal Plans, Wyoming Plan, and Montana Plan reduce impacts from nonrenewable energy development on approximately 90 percent of the modeled breeding habitat…"*

The regulatory mechanisms referred to in the USFWS finding consist of management tools developed by federal and state governments to protect Greater Sage-Grouse habitat throughout the range of the species. In Wyoming, those tools are contained in the State of Wyoming Greater Sage-Grouse Core Area Protection Strategy (State of Wyoming 2015) and in the BLM Wyoming Sage-Grouse RMP Amendments approved by the BLM in September 2015 (BLM 2015e). Under all alternatives, the NPL Project would be developed accordance with the State of Wyoming Greater Sage-Grouse Core Area Protection Strategy (State of Wyoming 2015) and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e). Those strategies have been found to provide sufficient regulatory mechanisms to limit potential population level impacts and support the conservation of Greater Sage-Grouse (USFWS 2015).

The terms of leases in the existing Crimson, Hacienda, and Sol oil and gas units in the Project Area (Map 1) pre-date the BLM Wyoming Sage-Grouse RMP Amendments and are therefore not required to adopt the stipulations contained therein; however, Jonah Energy has committed to applying existing Sage-Grouse protection measures and management in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e).

The following protection measures from the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) would be applied to the Proposed Action and alternatives, unless more current guidance is adopted by the BLM, subject to valid existing lease rights. Refer to the BLM Wyoming Sage-Grouse RMP Amendments for additional information and description of applicable management decisions, stipulations, and required design features (BLM 2015e).

Density and Disturbance

- In PHMA, the density of disturbance of an energy or mining facility will be limited to an average of one site per square mile (640 acres) within the density and disturbance calculation tool (DDCT), subject to valid existing rights. The one location and cumulative value of existing disturbances will not exceed 5 percent of suitable habitat of the DDCT area. Inside PHMA, all suitable habitat disturbed (any program area) will not exceed 5 percent within the DDCT area using the DDCT process.

Timing and Distance Restrictions

- **Sage-Grouse Leks Inside PHMA:** Surface occupancy and surface-disturbing activities will be prohibited on or within a 0.6 mile radius of the perimeter of occupied Sage-Grouse lek.
- **Sage-Grouse Leks Outside PHMA:** Surface occupancy and surface-disturbing activities will be prohibited on or within a 0.25 mile radius of the perimeter of occupied Sage-Grouse lek.
- **Sage-grouse breeding, nesting, and early brood-rearing habitat inside PHMA:** Surface disturbing and/or disruptive activities will be prohibited from March 15 – June 30 to protect Sage-Grouse breeding, nesting, and early brood rearing habitat. This timing limitation will be applied throughout the PHMA. Activities in unsuitable habitats will be evaluated under the exception and modification criteria and shall be allowed on a case by case basis.
- **Sage-Grouse Breeding, Nesting, and Early Brood-rearing Habitat Outside PHMA:** Surface disturbing and/or disruptive activities will be prohibited from March 15 – June 30 to protect Sage-Grouse nesting and early brood rearing habitats within 2 miles of the lek or lek perimeter of any occupied lek located outside PHMA.
- **Sage-Grouse Winter Concentration Areas:** Surface disturbing and/or disruptive activities in sage-grouse winter concentration areas would be prohibited from December 1 – March 14. Protection of additional mapped winter concentration areas in General Habitat Management Area (GHMA) would be implemented only where winter concentration areas are identified as supporting biologically significant numbers[5] of sage-grouse nesting in PHMA and/or attending

[5] *"Biologically significant numbers" would be based on site-specific data collected when identifying new winter concentration areas, usually from collaring data. Any new winter concentration areas would be identified through WGFD and BLM coordination, with involvement by other appropriate parties (e.g., Sage-Grouse Implementation Team).*

leks within PHMA. Appropriate seasonal timing restrictions and habitat protection measures would be considered and evaluated in consultation with the WGFD in all identified winter concentration areas.

Noise

- New project noise levels, either individual or cumulative, should not exceed 10 dBA (as measured by L50) above baseline noise at the perimeter of the lek from 6:00 pm to 8:00 am during the breading season (March 1 – May 15). Specific noise protocols for measurement and implementation will be developed as additional research and information emerges. This restriction would apply to both development and production activities.

Co-location of Infrastructure

- New ROWs (e.g., powerlines, pipelines, access roads) will be co-located within or adjacent to existing ROWs where technically feasible.

Powerlines

- New electric distribution lines will be buried where feasible and economically feasible. If not economically feasible, distribution lines may be authorized when effectively designed/mitigated to protect Sage-Grouse and the AO determines that overhead installation is the action alternative with the fewest adverse impacts while still meeting the project need.
- Power lines (distribution and transmission) will be designed to minimize wildlife related impacts and constructed to the latest Avian Power Line Interaction Committee (APLIC) standards.

Pipelines

- New pipelines through PHMA will be allowed: (1) within an RMP corridor currently authorized for that use or designated through future RMP amendments; or (2) constructed in or adjacent to existing utilities (buried and above-ground) or roads. Pipelines constructed in RMP corridors or adjacent to existing utilities or roads will require completion of a DDCT analysis for baseline data collection but the project is not required to meet the threshold of 5 percent. However, within 6 months of the completion of construction, the project proponent will provide the AO with as-built drawings so that total disturbance within core area can be calculated annually.

Access Roads

- New local or collector roads (as defined in BLM Manual 9113 [BLM 2015h;]) will be avoided within 1.9 miles of the perimeter of occupied Sage-Grouse leks within PHMA. All new roads will be prohibited within 0.6 miles of the perimeter of occupied Sage-Grouse leks within PHMA.
- Within PHMA, no upgrading of existing routes that will change route category or capacity will be allowed unless the upgrading will have minimal impact on Sage-Grouse in PHMA, is necessary for motorist safety, or eliminates the need to construct a new road.
- In PHMA, existing roads or realignments will be used to access valid existing rights that are not yet developed. If valid existing rights cannot be accessed via existing roads, any new road will be constructed to the absolute minimum standard necessary, and the surface disturbance will be added to the total disturbance in the PHMA.

Adaptive Management

- The BLM Wyoming Greater Sage-Grouse RMP Amendments (BLM 2015e) adaptive management plan provides a means of addressing and responding to unintended negative impacts to sage-grouse and its habitat before consequences become severe or irreversible. The BLM Wyoming Greater Sage-Grouse RMP Amendments (BLM 2015e) include the requirement for projects requiring an EIS to develop adaptive management strategies in support of the population management objectives for sage-grouse set by the State of Wyoming.

Onsite and Offsite Mitigation

- In undertaking BLM management actions, and, consistent with valid existing rights and applicable law, in authorizing third-party actions that result in habitat loss and degradation in PHMA, the BLM will require and ensure mitigation that provides a net conservation gain to the species, including accounting for any uncertainty associated with the effectiveness of such mitigation. This will be achieved by avoiding, minimizing, and compensating for impacts by applying beneficial mitigation actions. In Wyoming, the USFWS has found that “the core area strategy, if implemented by all landowners via regulatory mechanism, would provide adequate protection for sage-grouse and their habitats in the state.” The BLM will implement actions to achieve the goal of net conservation gain consistent with the Wyoming Strategy (EO 2015-4) that includes compensatory mitigation as a strategy that should be used when avoidance and minimization are inadequate to protect Core Population Areas for Sage-Grouse (BLM 2015e).

Required Design Features

- The BLM will apply appropriate required design features identified in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) as Stipulations/Conditions of Approval (COA)/Terms and Conditions within PHMAs for all program areas, as applicable.

Alternative A includes Sage-Grouse resource protection measures additional to existing guidance to address potential impacts to Sage-Grouse identified during scoping and the EIS process for the NPL Project.

In accordance with State of Wyoming EO 2015-4 (State of Wyoming 2015) and a BLM 2017 maintenance action updating the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2017), PHMA refers to State of Wyoming Version 4 Core Management Area maps and data (Map 40).

2.4.3.1 Density and Disturbance Calculation Tool

In accordance with State of Wyoming EO 2015-4[6], *Greater Sage-Grouse Core Area Protection* (State of Wyoming 2015), and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e), the BLM will utilize the Density Disturbance Calculation Tool (DDCT) process to assess the maximum allowable disturbance within Sage-Grouse PHMA, inclusive of existing disturbance, as described above in Section 2.4.3 (*Greater Sage-Grouse Habitat Management*). As part of this EIS process, the BLM developed GIS data identifying existing surface disturbance in PHMA that could be applied during the DDCT process. However, this EIS is a programmatic-level document that does not identify or analyze site-specific

[6]*Wyoming EO 2015-4 includes supplements such as supplements to the Greater Sage-Grouse Suitable Habitat Definitions, Executive Order 2017-2. Executive Order 2017-2 supplements Attachment F to Executive Order 2015-4 by clarifying how the State of Wyoming classifies wetlands and irrigated riparian meadows for Density Disturbance Calculation Tool purposes and conservation credit purposes.*

locations for development and the ROD for this EIS would not authorize site-specific surface-disturbing activities. Following the ROD for this EIS, the BLM would analyze and make decisions on site-specific surface-disturbing activities during the APD process as described in Section 1.5.2 (*Environmental Impact Statement Decision-Making Framework*) and Section 1.6 (*Regulatory Setting*). During the APD process, the BLM would determine maximum allowable new surface disturbance in PHMA using the DDCT process when exact development locations and site-specific surface-disturbing activities are proposed.

2.4.4 Delineation Wells

For all action alternatives, initial delineation wells would be drilled as needed to advance understanding of the location and extent of oil and gas resources in previously unexplored portions of the Project Area, typically using single-well pads. Findings of these initial delineation efforts would determine if further delineation efforts should be undertaken in the vicinity of the initial delineation wells. Delineation drilling would occur consistent with the development described under the Proposed Action and alternatives. Development of delineation wells would be subject to the same resource protection measures, site-specific Conditions of Approval (COAs), and terms and conditions as development wells.

Delineation wells would generally be located on 5-acre pads (on average). Delineation wells that indicate potential for economic recovery of gas resources may be developed into multi-well pads consistent with the description of well pads found in Section 2.6.2.1 (*Natural Gas Wells and Well Pads*). Delineation well pads that fail to identify recoverable oil and gas resources and are not successful would be plugged, abandoned, and reclaimed consistent with the reclamation and monitoring standards described in Appendix C (*Reclamation, Monitoring, and Weed Management Plan*). Delineation wells and associated surface disturbance are included in the well number and surface disturbance estimates for each alternative and analyzed as such in Chapter 4 (*Environmental Consequences*).

2.4.5 Reclamation and Monitoring

Reclamation and monitoring requirements for all alternatives are described in Appendix C (*Reclamation, Monitoring, and Weed Management Plan*). Reclamation practices that would vary by alternative are included under each alternative description in this chapter. For all alternatives, the BLM would actively monitor resource conditions (e.g., wildlife, soils, water quality, vegetation, naturalness in lands with wilderness characteristics) and reclamation success. Where deemed appropriate, the BLM would direct Jonah Energy to take corrective actions to improve reclamation methods and reduce short- and long-term impacts to resources. Air quality monitoring would be conducted in accordance with the findings of the *Air Quality Technical Support Document* (Appendix L), the *NPL Project Conformity Determination* (Appendix M) and the General Conformity requirements described in Section 2.4.2 (*General Conformity*).

2.4.6 Well Monitoring and Control

For all action alternatives, Jonah Energy would install supervisory control and data acquisition (SCADA) equipment on all well locations to remotely monitor well data. SCADA equipment would gather well data in real time from remote locations and would reduce traffic and human activity associated with well monitoring and control during production.

2.4.7 Development in Sage-Grouse Winter Concentration Areas

As indicated in Section 4.22.3.8.2 (*Impacts on BLM Wyoming Sensitive Species*), there is limited research on Sage-Grouse use of the Winter Concentration Areas in the NPL Project Area (Map 40) and the potential for direct, indirect, and cumulative impacts on concentrations of wintering Sage-Grouse. As a result, the potential impacts on Sage-Grouse resulting from development in the NPL Project Area Winter Concentration Areas are not well understood. For purposes of analysis, the NPL Project EIS analyzes impacts from potential development scenarios in Winter Concentration Areas based on the development scenarios and resource protection measures for development in Winter Concentration Areas described under the alternatives. Under all alternatives, development would be allowed on a limited scale in Winter Concentration Areas. A study would be conducted concurrently with development activities to better understand the impacts of developing in Winter Concentration Areas. The results of the study, current information available at the time of site-specific permitting, and current guidance at the time of site-specific permitting would inform BLM understanding of impacts and subsequent development in Winter Concentration Areas, which would inform analysis during site-specific NEPA reviews.

2.4.8 Exceptions, Modifications, and Waivers

For all alternatives, the BLM would consider granting exceptions to oil and gas lease stipulations, conditions of approval, and terms of conditions for ROW grants and waivers and modifications for lease stipulations in accordance with the process and criteria for exceptions, modifications, and waivers described in Appendix 8 of the BLM PFO Approved Resource Management Plan (RMP)/Record of Decision (ROD) (BLM 2008a), the BLM Green River Approved RMP and ROD (BLM 1997a), and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e). Exceptions and waivers are not intended to be used to extend normal operations into the timing limitation period (BLM 2008a). The BLM would consider exceptions to lease stipulations on a case-by-case basis based on current site-specific conditions. Modifications and waivers to lease stipulations would be considered based on site-specific analysis prepared at the APD stage and would be processed by the BLM Wyoming State Office.

2.4.9 Resource Protection Measures

Resource protection measures include Operator-Committed Practices (OCPs), BMPs, and other design features that are part of the Proposed Action or other action alternatives and that would be implemented by the proponent to eliminate or reduce potential adverse impacts on the environment. Appendix B (*Resource Protection Measures*) identifies BMPs, OCPs, limitations, and other resource protection measures that would apply to the alternatives. Resource protection measures were developed throughout the EIS process in coordination with cooperating agencies and tribes, development of supplemental documents (e.g., Biological Opinion), and other sources. Resource protection measures that are carried forward in the NPL Project ROD would be included as COAs as applicable during permitting for site-specific development of the NPL Project.

2.4.10 Valid Existing Lease Rights

Development under all alternatives would be in conformance with valid existing lease rights in the Project Area. The BLM reviewed existing lease stipulations in the Project Area for conformance with the BLM PFO Approved RMP and ROD (BLM 2008b) and the BLM Green River Approved RMP and ROD, as amended (BLM 1997b). The BLM determined that, in general, mitigation guidelines, BMPs, stipulations, and other resource protection measures in the applicable RMPs are consistent with existing lease stipulations and there are no identified conflicts between existing lease stipulations and the resource protection measures carried forward and analyzed in the NPL Project EIS.

At the APD stage, the BLM would apply COAs based on site-specific conditions and resources, applicable Onshore Oil and Gas Orders, site specific NEPA, and other applicable rules, acts and regulations in conformance with valid existing lease rights and applicable RMPs. Section 6 of the lease terms for each lease, as well as language included by lease notice or stipulation apprise the lessee that leases are subject to "reasonable measures" as necessary to "minimize adverse impacts" to land uses and other resource values not otherwise addressed in lease stipulations at the time operations are proposed. To the extent consistent with lease rights, such measures "may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures." (43 CFR 3101.1-2)

2.5 No Action Alternative

2.5.1 Introduction

Consideration of the No Action Alternative provides a baseline for analyzing impacts (including cumulative impacts) resulting from implementation of the Proposed Action and other action alternatives. The No Action alternative is the only alternative that is not required to respond to the purpose and need for the BLM's action.

Under the No Action Alternative, the BLM Authorized Officer (AO) would not approve Jonah Energy's applications related to the Proposed Action, and the associated land-use applications. However, existing federal oil and gas leases within the Project Area would remain valid unless they were not otherwise in compliance with applicable laws and regulatory requirements. Federal oil and gas resources could continue to be developed and produced on an individual-lease or unit-area basis. For the purpose of analysis, the BLM assumes that drilling, existing construction practices, and production would continue at the rate that has been seen in the Project Area since 1997: the drilling and completion of approximately three new wells per year, along with construction and maintenance of ancillary facilities associated with any productive wells. The three new wells per year would be drilled from single-well or multi-well pad locations.

2.5.2 Project Components

Components of the No Action Alternative would include vertically and directionally drilled natural gas wells from single-well or multi-well pads and ancillary infrastructure including water disposal wells, gas pipelines, and access roads. It is assumed that existing powerlines and compressor stations would be sufficient for the anticipated development under the No Action Alternative. Temporary construction and equipment laydown areas may also be needed periodically. It is assumed that temporary construction and laydown areas would be incorporated into the well pad areas and would not result in additional surface disturbance.

For the purpose of analysis, it was assumed that operators within the Project Area would use equipment similar to the equipment and components that have been used during the past 10 years. Development activities would require a scraper, at least one bulldozer, and gravel haulers for pad construction; a Tier III drilling rig engine, with the equipment necessary to move it to and from the site (e.g., diesel engines); vehicles for employee travel to the site; well completions equipment, and plugging and abandonment, reclamation, and decommissioning equipment. It is assumed that one drill rig would be used to drill the estimated three wells per year under the No Action Alternative.

2.5.3 Description of Drilling and Operations

The No Action Alternative would allow drilling, production, and related operations within the Project Area to continue at the historic, current, and reasonably foreseeable pace (Table 2-2). Such activity would continue to be governed by applicable mitigation measures outlined in the BLM PFO Approved RMP and ROD (BLM 2008a) and the BLM Green River Approved RMP and ROD (BLM 1997a), as amended, federal oil and gas lease stipulations, and site-specific COAs related to permits granted by the BLM. Refer to Section 2.4 (*Features Common to All Alternatives*) for additional features that would apply under the No Action Alternative.

Table 2-2. Estimated Development Summary for the No Action Alternative

Type of Development	Amount
Total New Vertical and Directional Wells/Locations Drilled from Single-well or Multi-well Pads (over 10-year duration)	30[1,2]
Estimated New Wells per year	3[3]
Development Period Duration (years)	10[3]
Development Timeframe (years)[4]	1–10[5]
Field Production Duration (years)	40[5]
Field Production Timeframe (years)[4]	1-40[5]
Full Production Phase Duration (years)	30[5]
Full Production Phase Timeframe (years)[4]	11–40[5]
Total Life of Project (years)	40[5]

[1]Assumes wells would be developed from single-well or multi-well pads.
[2]Total does not include the 55 producing natural gas wells in the Project Area.
[3]Estimates for development under the No Action Alternative are from historical drilling in the Project Area and the Proposed PFO RMP/Final EIS, Appendix 10 (BLM 2008b).
[4]Timeframes identify the years in which a certain project phase would occur. For example, the development phase timeframe would occur in years 1 through 10 and full production would occur in years 11 through 40.
[5]For comparison and analysis purposes, the same drilling and full development phase durations are assumed for the No Action Alternative as for the Proposed Action.

2.5.4 Development and Production Workforce and Transportation

This section provides estimates for the anticipated workforce and vehicle trips associated with the No Action Alternative. Workforce and vehicle trip estimates include 55 producing natural gas wells in the Project Area and the estimated three new wells per year over the 10-year development period (total of 30 new wells) for the No Action Alternative.

2.5.4.1 Development and Production Jobs

Under the No Action Alternative the Jonah Energy workforce facility would be utilized as needed to support well development and completion. Due to the relatively low level of development, full-time, year-round jobs would likely not be required. As a result, the total number of jobs could be less than presented in Table 2-3; however, these maximum job estimates under the No Action Alternative are included for purposes of analysis. The existing Jonah Energy workforce facility (Map 3) would be utilized to house workers to the extent possible. The number of workers at a given time may vary depending on the number of wells being drilled, time of year, and other factors. Table 2-3 identifies the estimated number of workers for the No Action Alternative.

Table 2-3. Type and Number of Jobs During Development and Production for the No Action Alternative

Type of Job	Development Phase (Years 1–10)	Full Production (Years 11–40)[1]
Drilling and Completions[1] (9.0 completions hands and supervisors per rig x 1 rig)	9.0	--
Production[2,3] 3.7 Pumpers (0.043 pumpers per well x 85 wells)[4] 0.8 Supervisors (1 per 5 pumpers) 0.0 Facility Operators 1.0 Liquids Haulers 0.0 Environmental Specialists[5]	5.5	5.3
Total	**14.5**	**5.3**

[1]Estimated number of jobs based on historic workforce and percent of development divided by the wells per year for the No Action Alternative compared to the wells per year for the Proposed Action (3/350).
[2]Actual number of production jobs at any one time will vary throughout the life of the project, depending on project phase.
[3]Estimated number of jobs includes 3 new wells per year during the 10-year development phase (30 total wells) and continuing production for the 55 producing natural gas wells in the Project Area (85 total wells).
[4]Estimates per well based on Proposed Action estimates per well.
[5]Assumes environmental specialists would be provided from staff in JIDPA.

Notes: (a) These estimates are based on existing information and subject to revision based on changing conditions. Changing circumstances would not be expected to affect the overall magnitude of jobs analyzed in this EIS. (b) The job numbers presented in the table above represent total jobs during the respective phase (i.e., jobs are not reported for each year, but the total number of jobs during the respective phase). (c) Due to the relatively low level of development for the No Action Alternative the jobs would not likely be full-time, year-round. As a result, the total number of jobs could be less than the reported jobs numbers. (d) Due to the nature of jobs associated with decommissioning and reclamation activities (not occurring every day or year round) and the relatively low levels of workforce for these activities it is assumed that jobs associated with decommissioning and reclamation would be negligible and within the scope of analysis for the estimated jobs for drilling, completions, and production.

2.5.4.2 Development and Production Transportation

Table 2-4 identifies the estimated number of vehicle trips per day during drilling, completion, production, and reclamation for the No Action Alternative. Vehicle trips per day would vary throughout the year depending on the timing of development of three new wells per year for the No Action Alternative.

Table 2-4. Type and Number of Vehicle Trips for the No Action Alternative (per 24-hour day)

Phase	Heavy Vehicle Trips	Light Vehicle Trips	Total Vehicle Trips by Phase
Drilling[1]	<1	3	3
Completion	1	0	1
Production[2]	19	186	205

[1]Estimated vehicle trips during the drilling and completion phases for the No Action Alternative are based on development of three new wells per year.
[2]Estimated vehicle trips during production includes the 30 new wells as part of the No Action Alternative and continuing production for the 55 existing/producing natural gas wells in the Project Area (85 total wells).

Notes: (a) Vehicle trips for the No Action Alternative were calculated based on the proportion of wells drilled per year compared to the Proposed Action and the number of vehicle trips for existing wells in the production phase ([3 wells per year/365 days]*[the respective vehicle trips for the Proposed Action for drilling, completion, and production]+[number of vehicle trips for existing wells in the production phase]).(b) Due to the nature of workforce associated with decommissioning and reclamation activities (not occurring every day or year round) and the relatively low levels of workforce and vehicle trips for these activities it is assumed that vehicle trips associated with decommissioning and reclamation would be negligible and within the scope of analysis for the estimated vehicle trips for drilling, completions, and production.

2.5.5 Surface Disturbance

The No Action Alternative would result in an estimated short-term surface disturbance of 213 acres in the Project Area (0.15 percent of the Project Area). After interim reclamation, an estimated total of 79 acres (0.06 percent of the Project Area) would remain disturbed for the life of the project, consisting of facilities, access roads, and equipment areas needed for ongoing production, servicing, and maintenance activities. Table 2-5 identifies estimated surface disturbance for the No Action Alternative.

Table 2-5. Estimated Surface Disturbance for the No Action Alternative

Project Component	Description	Disturbance Calculation Assumption	Number of Structure Sites or Length of Project Component	Total Short-term Disturbance (acres)	Total Long-term Disturbance (acres)
Single-well or Multi-Well Natural Gas Pads	Single well or Multi-Well Pads	3.7 acres initial surface disturbance per well for wells drilled from single-well or multi-well pad locations[1] 1.5 acres of long-term surface disturbance[1] per well	3 new wells/year x 10-year drilling period[1]	111	45
Pipelines	Includes disturbance for all pipelines	30-foot ROW 1.5 acres of initial surface disturbance per well[1]	12 miles of new gathering lines for 30 well pads	45	0[2]
Regional Gathering Facilities/Compressors	Facilities supporting gas/liquid separation, gas compression, gas dehydration, liquid storage for multiple wells	Assume no new Regional Gathering Facilities	No new facilities	0	0
Powerlines	Powerlines to support infrastructure	Assume no new powerlines	No new powerlines	0	0
Access Roads	Access roads connecting well pads and established roads	40-foot ROW 1.9 acres of initial surface disturbance per well[1] 1.14 acres of long-term surface disturbance per well[1]	12 miles of new access roads to 30 well pads	57	34
Total				213	79

[1]Estimates for the number of new wells per year under the No Action Alternative are from historical drilling in the Project Area provided by the BLM and the PFO Proposed RMP/Final EIS, Appendix 10 (BLM 2008b).
[2]Assumes buried pipeline disturbance would be fully reclaimed and result in no long-term surface disturbance.

ROW right-of-way

Note: Short-term impacts result in changes to the environment that are stabilized or mitigated rapidly, do not result in any long-term effects, and typically occur for less than five years. Long-term impacts result in lasting effects that typically occur for more than five years.

2.5.6 Resource Protection Measures for the No Action Alternative

Resource protection measures include BMPs, design features, stipulations, OCPs, and other measures that would reduce potential adverse impacts to resources and resource uses. Appendix B (*Resource Protection Measures*) identifies potential resource protection measures by resource and the alternative to which they would apply. Sources of resource protection measures include:

- The BLM PFO Approved RMP and ROD (BLM 2008a) and the BLM Green River Approved RMP and ROD, as amended (BLM 1997a);
- The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e);
- lease stipulations;
- standard BMPs identified in *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition* (BLM 2007a), commonly referred to as the Gold Book; and
- other applicable sources.

2.6 Proposed Action

2.6.1 Introduction

The Proposed Action includes development of up to 3,500 directionally drilled wells over a period of 10 years within the 140,859 acre Project Area boundary. Under the Proposed Action, multiple directionally drilled wells would be drilled from multi-well pads, with an average of up to four multi-well pads per 640-acre area (drilled at an average 40-acre bottom-hole density) of land in areas outside designated Sage-Grouse PHMA. Inside Sage-Grouse PHMA, an average of up to one multi-well pad per 640-acre area would be constructed consistent with State of Wyoming EO 2015-4, *Greater Sage-Grouse Core Area Protection,* and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) as described in Section 2.4.3 (*Greater Sage-Grouse Habitat Management*). The rate of drilling would not exceed 350 wells per year along with associated well pads, regional gathering facilities (RGFs), access roads, pipelines, and other ancillary facilities. Drilling and operations would occur throughout the year in areas that do not have seasonal restrictions, or as otherwise in conformance with the applicable BLM RMP.

The total number of wells drilled, and the rate of development, would depend largely on variables outside of Jonah Energy's control including production success, appropriate engineering technology, economic factors, commodity processes, availability of commodity markets, the availability of appropriate equipment and a trained workforce, and regulatory constraints including air quality General Conformity requirements (see Section 2.4.2 – *General Conformity*), lease stipulations, and COAs.

2.6.2 Project Components

Components of the Proposed Action include directionally drilled natural gas wells on multi-well pads, standard equipment on well pads (e.g., well heads, solar panels), water disposal wells, existing and new pipelines, powerlines, access roads, RGFs, standard construction equipment, and plugging and abandonment, reclamation, and decommissioning equipment. Temporary construction and equipment laydown areas may also be needed periodically. Temporary construction and laydown areas would be incorporated into the APD-specific development plan and generally would not result in additional disturbance.

2.6.2.1 Natural Gas Wells and Well Pads

Under the Proposed Action, multiple directionally drilled wells would be drilled from multi-well pads, with an average of up to four multi-well pads per 640-acre area outside Sage-Grouse PHMA. Inside Sage-Grouse PHMA, an average of up to one multi-well pad per 640-acre area would be constructed in accordance with State of Wyoming EO 2015-4, *Greater Sage-Grouse Core Area Protection,* and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e).

Jonah Energy is proposing to drill a maximum of 350 natural gas wells per year, with a maximum of 3,500 wells to be developed over a 10-year period. On average, Jonah Energy anticipates wells to be developed throughout the Project Area on a one-bottom-hole per 40-acre density basis. However, bottom-hole density could increase to a 10-acre spacing unit where necessary to recover the oil and gas resource and as described in the MOU between the Wyoming Oil and Gas Conservation Commission and the BLM (WOGCC 1994). Target formations would include the Lance Pool and other potentially productive formations identified during exploration and testing, with total depths ranging from about 6,500 to 13,500 feet.

Disturbance for each multi-well pad location would range between 5.0 and 19 surface acres (on average) with each multi-well pad supporting up to 64 wells. The size of well pads would depend on the number of wells needed to adequately recover the resources, well density limitations per section of land, and topographical, environmental, or other resource limitations. Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for assumptions on the well pad size based on well pads per section and wells per pad.

In general, delineation wells would be constructed on single-well pads of up to 5 acres and these would be expanded to multi-well pads to extract the resource depending on the drilling results. The final surface locations and density of spacing of the multi-well pads would be contingent on decisions in the NPL Project ROD, regulatory constraints, environmental constraints identified during the APD process, and the onsite inspection reviews conducted by the BLM that are associated with the APDs.

2.6.2.2 Pipelines

Jonah Energy is proposing to transport various products from well pads to approximately 11 RGFs via a three-phase (natural gas, condensate, and produced water) pipeline gathering system. To transfer the natural gas to market, pipelines would also be constructed from RGFs to the nearest existing pipeline network connecting to the existing mid-stream pipeline system. The pipeline gathering system would require an estimated 227 miles of new pipelines in the Project Area. Table 2-12 identifies surface disturbance from the three-phase pipeline gathering system and construction of pipelines to connect to new development to the existing pipeline network. Refer to Section 2.6.2.3 (*Natural Gas Sales Points*) for more information.

Jonah Energy would survey and stake new pipeline alignments in the Project Area prior to the start of construction activities and submit detailed design plans for BLM review during the APD and ROW applications processes. Buried pipelines would have an average 75-foot construction ROW and be buried at a depth of six feet to protect pipelines from surface freeze conditions. Whenever possible, pipelines would be located adjacent to new or existing access roads in a combined 100-foot wide ROW corridor. A pipeline trench would be excavated mechanically with trenching equipment, such as a backhoe or trencher. Trench dimensions would be between 18 and 24 inches wide. Pipelines would be placed at a depth of six feet to isolate pipelines from surface freeze conditions.

Jonah Energy would test all new pipelines for hydrostatic integrity and structural soundness using approved testing procedures to ensure full compliance with the mandatory BLM pipeline requirements. Jonah Energy would install, inspect, and test all pipeline installations in accordance with the applicable industry codes, such as ASME B31.8 and API 1104, as well as in accordance with standard engineering best practices, which would include the pressure testing of piping systems.

Jonah Energy would use water from shallow groundwater wells for testing pipeline integrity in the warmer months (April to November), and a freshwater/methanol mix kept in storage during colder months (December to March). Jonah Energy estimates the total use of approximately 260,000 barrels (bbls) of groundwater for hydrostatic testing during the 10-year development phase (26,000 bbls per year). The volume of water needed for hydrostatic testing of each pipeline would depend on the size and length of the pipeline being tested. Jonah Energy would test and process hydrostatic testing water to ensure that the water meets local, State or Federal water quality standards if any water is discharged. If hydrostatic water is discharged, Jonah Energy would take appropriate measures to ensure that discharges would not erode or scour natural channels. When not in use, all water/methanol mixtures would be stored on location at RGFs or other appropriate locations in two closed-top tanks with a capacity of 12,600 gallons.

Water used for well drilling would be trucked from groundwater well locations to well pads and stored in water tanks on site, and would not be transported by pipeline.

Jonah Energy would also continue their damage prevention program that includes underground pipeline and utility locating in accordance with Wyoming's 811, One Call of Wyoming, documentation requirements. Jonah Energy also employs three full-time utility locators pursuant to their damage prevention program. The utility locators identify and map existing and new pipelines to support an understanding of where pipelines are located. All data from the damage prevention program would be incorporated into Jonah Energy's GIS mapping system and would be used during site-specific permitting and subsequent construction. These combined practices would support an understanding of existing and proposed pipeline locations and reduce the potential for inadvertent damage to pipelines.

2.6.2.3 Natural Gas Sales Points

The sales points (i.e., gas metering locations) where custody of the natural gas is transferred would be located at the RGFs. Natural gas would be transported via pipeline from the RGFs to the nearest existing pipeline infrastructure connecting to the Bridger Compressor Station. The exact ownership and construction responsibilities for any new sales infrastructure would depend on a number of factors that are currently unknown (site-specific location of RGFs and other NPL Project infrastructure, timing of development, existing infrastructure companies at the time, etc.).

2.6.2.4 Regional Gathering Facilities

Eleven RGFs would be constructed in the most densely drilled portions of the Project Area to separate and store liquids from the natural gas stream. In most cases because of technical requirements, RGFs would need to be located within a three-mile radius of well pad clusters. Due to this general distance limitation, RGFs may also be needed within PHMA[7], but disturbance associated with RGFs in PHMA would not exceed the 5 percent disturbance threshold described in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e).

Each fully operational RGF would include liquids separation and gas dehydration equipment, temporary or long-term gas compression facilities, water injection wells and pumps, water and condensate storage tank batteries, liquids handling and offloading facilities, electrical transformers, and power control facilities. One or two of the RGFs would be designated as Central Service Centers (CSC). The CSC designation would not result in any additional disturbance than what is anticipated for the RGFs. Most workers would be based out of the CSCs, which could increase vehicle trips to and from CSCs, compared to the standard RGFs. To minimize air emissions, electric compression would be used at each RGF, powered by electrical distribution lines.

Jonah Energy would design RGFs to reduce surface disturbance and visual impacts, to the extent feasible. Any above-ground production facilities would be painted a BLM-accepted color that blends with the surrounding landscape, except for structures that require safety coloration to comply with Occupational Safety and Health Administration regulations. Directional lighting and fencing would be constructed to obscure ground-level activity. Noise mitigation measures (e.g., sound control devices) would be implemented at RGFs as necessary to minimize impacts and meet applicable regulatory requirements based on site-specific analysis of potential noise impacts during the APD stage.

RGFs would be permanent, long-term facilities. Therefore, Jonah Energy would not construct RGFs until after oil and gas resources in a given Development Area have been delineated to the point where it can be determined that construction of RGFs is warranted. Well pads constructed for delineation wells would have a limited number of wells (e.g., 1-5 wells) and would necessitate the use of small scale, temporary production facilities. Jonah Energy may rely on these production facilities until the density of development supports the construction of RGFs. In cases where reduced line pressure would be required for production, compression facilities and overhead power would be installed during RGF construction. If permanent compression is not needed initially, installation of compression and power facilities would be deferred until later in the production life of each RGF. In delineation areas of the Project Area, temporary compression may be constructed until the exploratory drilling demonstrates that the area is productive. Temporary compression facilities would be within existing disturbed areas and any emissions would be less than, and included within, the emissions for the proposed long-term facilities.

New wells would be connected, whenever feasible to the closest RGF by way of pipelines prior to completion operations. Upon completion flowback, gas and liquids would then be directed through these lines to the RGF. As productive areas are identified, additional wells would be drilled to delineate the extent of recoverable resources. These wells will be directionally drilled wells from multi-well pads.

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[7] *The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) indicate that liquids gathering facilities should be centralized/clustered and placed outside of Sage-Grouse priority areas. Jonah Energy has proposed the use of centralized RGFs within three-miles of well pad clusters. However, due to the contiguous acreage of Sage-Grouse PHMA (Map 40) in the Project Area, it may not be technically feasible to develop the NPL Project without placing RGFs in PHMA. For purposes of analysis, this EIS assumes that up to two RGFs would be located in PHMA. During site-specific permitting, placement of RGFs in priority habitats would be avoided, if possible. If RGFs in priority habitats are technically necessary to develop the NPL Project, appropriate mitigation (including appropriate additional mitigation) would be applied during site-specific permitting.*

2.6.2.5 Powerlines and Substation

Jonah Energy would construct overhead electrical distribution lines within the Project Area to power RGFs and to facilitate certain emission-control technologies to be used at RGFs[8]. Jonah Energy estimates that approximately 38.6 miles of new powerlines would be required for the NPL Project. The overhead powerlines, rated at 25 kilovolt (kV) capacity, would be constructed above ground. The exact location of the powerlines would be determined by the final site location of each RGF. Powerline siting would be coordinated with existing or proposed transportation corridors whenever possible. Prior to construction of electrical distribution lines, Rocky Mountain Power would apply for and, upon BLM approval, hold the powerline ROW. The authorized, but not yet constructed, Jonah Substation (#WYW-172154) that will be constructed in the JIDPA will step down the voltage from 230 kV to the proposed voltage for the NPL Project (25 kV).

Power use for the NPL Project would depend on the level of development and production and would vary throughout the life of the project, with the greatest power use between year 6 and year 22. Estimates indicate an average power requirement of 17,773 kilowatts per year, peaking around year 13 with an estimated power requirement of 48,983 kilowatts (Encana 2013a).

2.6.2.6 Roads and Access

Road design would comply with BLM Manual 9113 which provides road design requirements for collector, local, resource and primitive roads on BLM administered lands (BLM 2015h). The design and location of access roads would also consider guidance contained in Chapter 4 of the BLM Gold Book (BLM 2007a). Jonah Energy would construct roads as needed to accommodate drilling and production rigs and, subsequent to those operations, production equipment. Access roads connecting a location to the nearest existing primary road would have a running surface of approximately 16 feet wide and would be located within a 100-foot corridor (co-located with pipelines).

Regional access to the Project Area would be from U.S. Highway 191, generally via Luman Road to Burma and Crimson Roads (Map 25). The exact location of internal access roads would depend on the location of the multi-well pads and RGFs. For the Proposed Action, project-related traffic would not utilize North Burma Road north of the Project Area boundary.

All new access roads would be constructed, using standard equipment, with appropriate drainage and erosion control features and structures to include cut-and-fill slope and drainage stabilization, relief and drainage culverts, water bars, and wing ditches similar to those described in the Gold Book (BLM 2007a). Bulldozers and/or road graders would first clear vegetation and topsoil from the ROW. These materials may be windrowed for future redistribution during the reclamation process.

Road maintenance would be performed on an as-needed basis over the course of the year. Gravelling and repair operations would be common during the spring and summer months. During the winter months, plowing operations would be required primarily to clear snow and ice from main access roads serving the RGFs, with secondary service to clear roads to well pad locations.

Jonah Energy estimates that 35 miles of existing primary road would need to be maintained for year-round access to all RGFs. A total of 227 miles of new access roads would need to be maintained less often for access to well pad locations.

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[8] *Electricity may not be available for some components to operate during the initial years of the development, but will be phased in over time as powerlines and other equipment are brought online.*

2.6.3 Description of Drilling and Operations

The following sections summarize pre-construction activities, construction, drilling and completion operations, production and maintenance operations, and abandonment and reclamation associated with the Proposed Action. The described construction techniques and procedures could be applicable to all access road construction, location construction (such as construction of multi-well pads), and well drilling in the Project Area. However, techniques and procedures may vary somewhat from those presented in this section depending on site-specific conditions. Drilling and operations would occur year-round in areas that do not have seasonal restrictions, or as otherwise authorized by the applicable BLM RMPs.

The Proposed Action includes a 10-year development phase during which all wells would be developed and would start producing, followed by a 30-year full production phase, for a total estimated project life of 40 years, including final reclamation of production wells and ancillary facilities. Jonah Energy estimates that gas and condensate production would peak around year 10 and then decrease incrementally until the end of the Project.

Table 2-6 provides the estimated development summary for the Proposed Action.

Table 2-6. Estimated Development Summary for the Proposed Action

Type of Development	Amount
Total New Directionally Drilled Wells from Multi-well Pads	3,500
Maximum Number of New Wells Per Year (wells per year)	350
Development Duration (years)	10
Development Timeframe (years)[1]	1–10
Field Production Duration (years)	40
Field Production Timeframe (years)[1]	1–40
Full Production Phase Duration (years)[2]	30
Full Production Phase Timeframe (years)[2]	11–40
Total Life of Project (years)	**40**

[1]Timeframes identify the years in which a certain project phase would occur. For example, the development phase timeframe would occur in years 1 through 10 and full production would occur in years 11 through 40.
[2]Full production phase and timeframe includes initiation of final reclamation of production wells and facilities.

2.6.3.1 Surveying, Notice of Staking, and Application for Permit to Drill

Prior to the start of construction, Jonah Energy would complete the following activities:

- Stake and survey each location, access road, and pipeline;
- submit NOS(s), APD(s), and ROW application(s), as applicable, to the BLM;
- participate in onsite evaluations with BLM personnel;
- submit site-specific applications (e.g., 12-Point Surface Use Plan of Operations [SUPO]) and modify them, as needed;
- submit detailed construction plans, as needed; and

- perform cultural, paleontological, biological, and/or other surveys, as required by the BLM on a case-by-case basis

In accordance with Onshore Oil and Gas Order No. 1, "Onshore Oil and Gas Operations; Federal and Indian Oil and Gas Leases; Approval of Operations," issued under 43 CFR 3160, Jonah Energy would obtain a permit from the BLM before any ground disturbance takes place for wells on BLM-administered land. To initiate the permitting process, Jonah Energy would file either an APD or an NOS and an APD for each proposed well. These documents would be filed with the BLM RSFO or PFO as required by the BLM. The BLM would process the applications to determine if they meet all requirements and would subsequently notify the operator of dates, times, and places to meet for onsite inspections of the proposed locations.

A complete APD normally consists of a Surface Use Plan of Operations (SUPO), 9-Point Drilling Plan, evidence of bond coverage, accompanying information/exhibits/maps that might be required by the BLM. A SUPO contains information describing construction operations, access roadway(s) and pipeline corridors, water supply and haul route, well site layout, production facilities, waste disposal, and restoration or reclamation associated with the site-specific well development proposal. The drilling plan typically includes information describing the technical drilling aspects of the specific proposal, including subsurface resource protection and royalty accountability. The BLM would determine the suitability of Jonah Energy's design, construction techniques, and procedures during the APD permitting-review process.

2.6.3.2 Well Pad Construction and Drilling

Each multi-well pad site would range in size between approximately 5.5 and 19 surface acres. Initially, well pad construction would cover a smaller area (an average of five acres) and be expanded in size as needed to accommodate resource extraction. The maximum size of pads would be determined by the number of pads per section and the number of wells per pad in a section, assuming a 10-acre bottom-hole spacing.

Topsoil at well pad construction sites would be stripped and stockpiled onsite during construction and used for reclamation in accordance with Appendix C (*Reclamation, Monitoring, and Weed Management Plan*).

After topsoil-stripping operations are completed, standard earth-moving equipment would be used for construction of a level well pad location. Each well pad location would include one or more well locations and one or more cuttings vaults to store dried cuttings materials. Semi-closed loop drilling and flareless completions would be used, so no mud pits or flare pits would be required.[9] Flare stacks may be used for safety, when needed. Construction of a well pad location and associated facilities would usually take approximately 10 to 15 days to complete, depending on site and terrain limitations.

Jonah Energy anticipates that wells would be drilled directionally from the multi-well pads using one or more natural gas-powered drill rigs on each location. Jonah Energy estimates the use of approximately 10 drill rigs for the Proposed Action, with up to 10 rigs operating simultaneously. More than 10 drill rigs may need to be operated simultaneously depending on a variety of technical and economic factors. Jonah Energy estimates that up to three rigs per 640 acre-area could operate simultaneously in greater

[9]*The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) indicates that closed-loop drilling systems should be used to eliminate the need for reserve pits and associated impacts to Sage-Grouse. The proposed semi-closed loop system would meet the objective of this Required Design Feature as the semi-closed loop system would not require any mud pits, flare pits, or open reserve pits.*

Sage-Grouse PHMA sections (i.e., three rigs operating simultaneously to drill wells on a well pad), and up to eight rigs (two per location, four location-average per section) could operate simultaneously in non-PHMA Habitat sections. The use of drilling rigs and all drilling activities would be in accordance with all permits and applicable regulations at the time of drilling.

Setup of each rig at each multi-well location would typically require a one-time transport of approximately 10 to 20 heavy truckloads of drilling-related equipment and materials to facilitate the drilling operation. Once a multi-well location is occupied, set up time would be minimized between wells since rigs would be moved between closely spaced surface locations. Service trailers on the well pad would be self-contained and would not require a septic system. Sewage would be hauled to a government-approved disposal site. Total drill rig setup and installation of ancillary facilities for each multi-well pad would require three to five days to complete and would only typically occur once at initial occupation of each new location.[10]

In most cases, wells would be drilled with water-based mud, but in certain circumstances, oil-based mud may be required to address unique geological conditions or wellbore design requirements (e.g., increased wellbore lengths, curves, and dogleg severity). When conditions require the use of oil-based mud, Jonah Energy would do so in accordance with BLM's Onshore Order No. 2 and applicable Wyoming Oil and Gas Conservation Commission (WOGCC) and WDEQ rules and regulations. In accordance with Onshore Oil and Gas Order Number 2, oil-based mud would only be used if all usable water zones (waters containing less than 10,000 ppm total dissolved solids) have been protected by appropriate casing and cementing. Any use of oil-based mud during the drilling program would only occur when groundwater quality testing indicates that total dissolved solids are greater than 10,000 ppm. The use of oil-based mud would be considered on a case-by-case basis at the APD level when Jonah Energy requests the use of oil-based mud in site-specific development applications. Water used for well drilling would be trucked to well pads and stored in water tanks on site.

A semi-closed loop system would be used to process drilling mud and cuttings regardless of the mud system used. Only clean, dried cuttings would be placed in earthen cuttings vaults. Earthen cuttings vaults would consist of lined cuttings pits that are treated with a reagent to solidify and chemically stabilize the drilling mud and cuttings, then buried. Any oil-contaminated mud or cuttings would be removed from the site and processed at the JIDPA bioremediation facility in accordance with the procedures described in Appendix F (*Hazardous and Non-Hazardous Materials Management Summary*). Jonah Energy would not use any open reserve pits as part of the Proposed Action.

Drilling, completion, and production operations would continue over the 10-year development period for the Proposed Action. The exact number of wells drilled, completed, and put into production annually would depend on maintaining general conformity with air quality standards, market prices, permit approval, rig availability, and other relevant factors. Jonah Energy would carry out drilling operations in compliance with all applicable federal oil and gas regulations and Onshore Orders, rules and regulations of the Wyoming Oil and Gas Conservation Commission, and all applicable local rules and regulations. Refer to Section 1.6 (*Regulatory Setting*) for more information on applicable LORS.

[10]*In certain circumstances, if the operator does not have sufficient time to drill all wells at a well pad location after initial rig setup (due to timing limitations or other factors), the rig setup process could be required more than once at a well pad location.*

2.6.3.3 Well-Completion Operations

Simultaneous completion operations[11] would be implemented whenever possible to minimize equipment movement, truck traffic, air emissions, and disturbance of wildlife. Well-completion operations would involve perforation, stimulation, and testing of potentially productive zones and would include hydraulic fracturing in most cases. Completions operations would be accomplished using "slickwater" or "gel" type fluid mixtures. The slickwater design would consist primarily of water, sand, and friction reducer, clay stabilizer, and non-emulsifier additives. The gel design would consist primarily of water, sand, and gelling additives. All completions operations would be in accordance with existing Wyoming Oil and Gas Conservation Commission rules and regulations as well as regulations implemented by the BLM. Refer to Appendix F (*Hazardous and Non-Hazardous Materials Management Summary*) for more information on components and ingredients in the slickwater and gel type fluid mixtures.

Well completions processes would involve perforating the well casing at productive intervals and pumping an appropriate amount of the chosen fluid mixture under high pressure into the wellbore in several batches or stages. Depending on local geologic factors, a varying number of stages would be required to stimulate each well; current estimates indicate that approximately five stages would be required to stimulate wells in the Project Area. Pumping of each stage would hydraulically fracture a particular sand-rich interval in the target formation. This well completions process increases the flow capacity of the well, allowing larger volumes of natural gas and condensate to be more quickly transported to processing facilities for separation, dehydration, and sales.

Completion operations for each well would typically take approximately 1.25 days following the initiation of flow-back. Less commonly, completion operations could take as long as 20 days if flow-back is required between each stage. Flow-back water from the wells would be hauled to an approved water treatment/disposal facility for recycling. Flareless ("or green") flow-back technology would be used in an effort to avoid or minimize emissions from completion operations; in rare cases, flaring may be required for safety reasons. Completions equipment would generally be stationary and would be dedicated to each multi-well pad for most of the duration of well operations in an effort to minimize equipment-related truck traffic. Equipment used to conduct well completions would be powered by diesel engines.

Jonah Energy would install impressed current cathodic protection (ICCP) equipment at each well site as soon as practicable. The ICCP systems would consist of one or more ground-bed anodes connected to an externally powered rectifier. The rectifier would connect to each wellhead assembly and associated equipment in an effort to control corrosion of metallic components. Wherever possible, rectifiers would be powered by solar cell arrays. Otherwise, low-emission generators would be used. Regular preventative maintenance of the ICCP equipment would be conducted to maximize efficiency and proper functioning of each system.

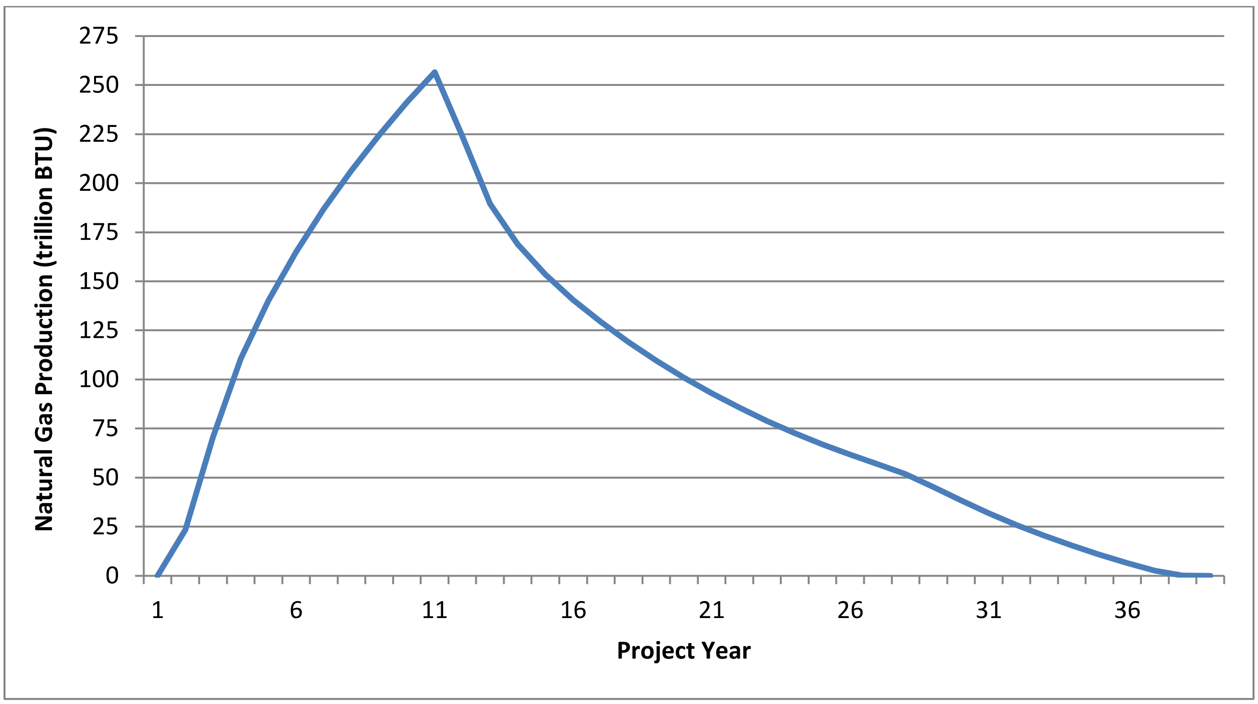
Jonah Energy would install supervisory control and data acquisition (SCADA) equipment on all well locations. SCADA equipment would gather well data in real time from remote locations and would reduce traffic associated with well monitoring and control.

[11] *Simultaneous Completion Operators describes the process whereby drilling, completion, and potentially production activities are occurring in close proximity at approximately the same time.*

2.6.3.4 Production

Jonah Energy estimates initial production for each well to be 1 to 2 million cubic feet of gas per day, with an Estimated Ultimate Recovery of 1 to 2 billion cubic feet of gas per well. Total cumulative production is estimated at 3,500 to 7,000 BCF of gas and 17.5 to 140 million bbls of condensate. Higher production volumes are anticipated at the beginning of a life of a well with production declining over time. Actual production would depend on reservoir conditions encountered during delineation and exploration. Figure 2-1 presents Jonah Energy provided estimates of annual natural gas production for the Proposed Action. These estimates could vary significantly from actual results, but are presented to provide a general understanding of production trends over the life of the project.

Figure 2-1. Estimated Annual Natural Gas Production for the Proposed Action



Source: Encana 2013c.

BTU British Thermal Units

Note: The production estimates are based on existing information and current understanding of the natural gas resource in the Project Area. These estimates are included to provide a general understanding of the production trends over the life of the project. These estimates could vary significantly from actual results depending on the number of new wells drilled per year, production rates for the wells, and other factors. Additionally, due to the limited number of wells drilled in the Project Area, Jonah Energy has yet to determine the best drilling locations/targets that would result in the estimated production rates.

Comingled well product (natural gas, condensates, and produced water) would be transported by pipeline from well pads to RGFs where liquids from the natural gas stream would be separated and stored. Condensates would be regularly transferred by truck from storage to existing condensate sales points.

The Proposed Action would result in an estimated 100,000 to 500,000 barrels of produced water during the life of each well. The primary factors that would affect the range of produced water per well include:

1. Total cumulative gas production for each well. Produced water as a proportion of gas production would be relatively constant over the life of an individual well with subtle increase in the water to gas ratio with time of production for that well. A well that produces more gas will produce more water compared to another well that produces less gas but exhibits the same water to gas ratio.
2. Geologic variation in water saturation conditions (and resulting water to gas ratio) that are presently not known due to limited existing well control and variable stratigraphic completion depths in that existing well control.

Most produced water (an estimated 225,000 barrels per well or 90 percent of produced water) would be disposed of in subsurface injection wells near each RGF. The location of injection wells is unknown at this time, since the location of RGFs has not been determined. The proposed injection wells to be located near RGFs in the Project Area would be similar to existing injection wells in the JIDPA and the Project Area. Underground Injection Control permits for new wells would be similar to existing wells, which are Class II permits approved by the Wyoming Oil and Gas Conservation Commission (WOGCC) for the injection of brines and other fluids associated with oil and gas production. The target zone for injection would most likely be the lower 2/3 of the high-salinity Upper Fort Union Formation. The upper 1/3 of the Upper Fort Union Formation contains a significant thickness of high-salinity porous sands interbedded with low-porosity mudstones, which act as barriers to upward migration of injected waters. Refer to Appendix K (*Water Resource Support Appendix*) for more information on subsurface geology and stratigraphy of target zones.

Smaller volumes of produced water would be transported to the JIDPA water treatment/disposal facility for treatment and reuse (an estimated 10 percent). Initially, produced water stored at the RGFs for treatment would be transported to the JIDPA water treatment/disposal facility, with additional facilities to be constructed if needed.

2.6.3.5 Water Use

The Proposed Action would require an estimated 35,000 bbls of water for drilling and completions of each well. Water for drilling operations (29 percent of total water for drilling and completions, 10,000 bbls per well) would generally come from shallow groundwater wells in the top 1,000 feet of the Wasatch Aquifer. Once usable water is protected by the surface casing, Jonah Energy could potentially use recycled water from the base of the surface casing to total depth. However, for purposes of analysis, this EIS assumes that all drilling water could come from groundwater wells.

All water for completions operations (71 percent of total water for drilling and completions, 25,000 bbls per well) would be obtained from recycled sources (e.g., JIDPA Water Treatment Facility) and would be trucked to well locations and stored onsite in tanks, if needed. The Proposed Action would require an estimated 13,620 bbls of groundwater per year for new road construction dust control during the development phase and an estimated 74,910 bbls of groundwater per year for road maintenance dust control during the development phase. The Proposed Action would require an estimated 63,000 bbls of groundwater per year for well pad construction dust control. The Proposed Action would also require an estimated 26,000 bbls of groundwater per year for hydrostatic testing of pipelines during the 10 year development phase.

Water for drilling operations, dust control, and hydrostatic testing would be obtained from existing shallow water wells in the JIDPA and NPL Project Area and would be used for drilling, cement production, casing surface aquifers, and hydrostatic testing of pipelines. If needed, new water wells may be drilled at appropriate locations in the Project Area. Water used for well drilling would be trucked from groundwater well locations to well pads and stored in water tanks on site, and would not be transported by pipeline. The primary factor driving the need for new water supply wells would be the distance from existing water supply wells to new development locations. As new areas are developed further away from existing water supply wells, the need for new water supply wells closer to these areas of development would increase. The new water supply wells could be located at the RGF locations servicing well clusters. The increased potential for new water supply wells in the Project Area would occur at a similar timeframe as the decline in water supply needs in the JIDPA. As a result, the total water withdrawal from the near-surface aquifers should remain relatively constant as NPL Project development and water use increases and JIDPA development and water use decreases.

Water supply wells that are no longer needed would be plugged and abandoned in accordance with Wyoming State Engineers Office standards and other applicable guidelines and regulations.

The Proposed Action would result in a total estimated groundwater water use of 3,677,530 bbls per year during the 10 year development phase (474.0 acre-feet per year) for a total estimated groundwater use of 36,775,300 bbls during the 10 year development phase (4,740.0 acre-feet). The Proposed Action would result in an estimated groundwater use of 136,200 bbls per year (17.6 acre-feet per year) for road maintenance dust control during the full production phase (years 11-40) for a total estimated groundwater use of 528.0 acre-feet during the 30 year full production phase. Refer to Table 2-28 for a description and comparison of water use and other key features of the Proposed Action and alternatives and refer to Appendix K (*Water Resource Support Appendix*) for additional information on water use and potential impacts for the Proposed Action and alternatives.

For the Proposed Action and all alternatives, in advance of development, Jonah Energy would work with appropriate federal, state, and local agencies to implement an acceptable groundwater monitoring program for the NPL Project consistent with WOGCC rules to establish and monitor the quality of groundwater around sites prior to, during, and after oil and gas development.

2.6.3.6 Reclamation

Appendix C (*Reclamation, Monitoring, and Weed Management Plan*) describes the guidance and practices for reclamation and monitoring for the NPL Project, including final reclamation and abandonment standards. Appendix B (*Resource Protection Measures*) describes best management practices that would be applied during reclamation to control erosion and noxious weeds and other measures that would support successful reclamation. All reclamation activities would be consistent with the guidance contained in Chapter 6 of the Gold Book (BLM 2007a) and BLM IM No. WY-2012-032, *Wyoming Bureau of Land Management (BLM) Reclamation Policy*. Reclamation work, including monitoring of the reclaimed areas, would continue until Jonah Energy receives written approval for cessation from the BLM in the form of a Final Abandonment Notice.

2.6.4 Development and Production Workforce and Transportation

2.6.4.1 Development and Production Jobs

Jonah Energy proposes the use of full-time jobs on a year-round basis. To the extent possible, the existing Jonah Energy workforce facility would be utilized to house workers. The number of jobs at any given time may vary depending on the project phase and other factors. Preliminary estimates by Jonah Energy indicate the continuation or addition of approximately 954 total jobs during the 10-year development phase (Table 2-7). After the 10-year development phase, Jonah Energy estimates a total of approximately 228 jobs for the remaining life of the project to support ongoing production activities.

Table 2-7. Type and Number of Jobs During Development and Production for the Proposed Action

Type of Job	Development Phase (Years 1–10)	Full Production (Years 11–40)[1]
Drilling and Completions 16 Production Staff 9 Drilling Supervisors 24 Completion Supervisors 12 Regulatory/Reclamation Staff 15 Construction Supervisors 150 Construction and Maintenance Staff (50 drilling and completions hands and supervisors per rig X 10 rigs) = 500 total completions hands	726	-
Production[1] 150 Pumpers 30 Supervisors (1 per 5 pumpers) 11 Facility Operators (1 per RGF) 33 Liquids Haulers (3 per RGF) 4 Environmental Specialists (1 per 3 RGFs)	228	228
Total	**954**	**228**[1]

Source: Encana 2013b. Job estimates are based on available current information provided by Jonah Energy and are subject to revision based on changing conditions. Changing circumstances would not be expected to affect the overall magnitude of jobs analyzed in this EIS.

[1]Actual number of production jobs at any one time will vary throughout the life of the project, depending on project phase.

RGF Regional Gathering Facility

Notes: (a) The job numbers presented in the table above represent total jobs during the respective phase (i.e., jobs are not reported for each year, but the total number of jobs during the respective phase). (b) For purposes of analysis, the EIS assumes that for the Proposed Action all jobs would be full-time, year-round, throughout the duration of the respective phase. (c) Due to the nature of jobs associated with decommissioning and reclamation activities (not occurring every day or year round) and the relatively low levels of jobs for these activities it is assumed that jobs associated with decommissioning and reclamation would be negligible and within the scope of analysis for the estimated jobs for drilling, completions, and production.

Jonah Energy estimates approximately 954 jobs during the 10-year development phase, including drilling, completions, production, and reclamation jobs. Drilling and completions operations would require approximately 50 jobs for each of the anticipated 10 active rigs and associated completions crews, as well as drilling, completion, regulatory/reclamation, and construction workers operating over the course of the 10-year development phase. Jonah Energy estimates a total of approximately 228 production-related jobs during the production phase. The number of production jobs would increase during the development phase and start declining after approximately 30 years of production, as wells are plugged and abandoned. Staff at each RGF would normally operate on 8- to 12-hour shifts and would be based in one of the CSCs. Some of these staff could be on day/night shift rotation. Pumpers and production supervisors may operate on day/night shifts if needed. Job estimates indicate a need for approximately 228 staff assigned to the one or two CSCs or the Jonah Energy workforce facility during production.

2.6.4.2 Development and Production Transportation

Transportation associated with the Proposed Action would occur during all phases of the project including drilling, completions, production, and reclamation. Table 2-8 identifies heavy and light vehicle trips per 24-hour day for the Proposed Action. Additional information on transportation and vehicle trips by phase is provided in the sections below and in Appendix E (*Transportation Plan*).

Table 2-8. Type and Number of Vehicle Trips for the Proposed Action, by Phase (per 24-hour day)

Phase	Heavy Vehicle Trips	Light Vehicle Trips	Total Vehicle Trips by Phase
Drilling	20	306	326
Completions	165	18	183
Production	121	1,163	1,284

Source: See Appendix E (*Transportation Plan*).

Notes: (a) Vehicle trips per day calculated based on the number of wells per year and the vehicle trips per well reported in Appendix E (*Transportation Plan*). (b) Vehicle trip estimates are based on available current information and are subject to revision based on changing conditions. It is assumed that these vehicle trip estimates include reclamation-related vehicle trips. (c) Due to the nature of workforce associated with decommissioning and reclamation activities (not occurring every day or year round) and the relatively low levels of workforce and vehicle trips for these activities it is assumed that vehicle trips associated with decommissioning and reclamation would be negligible and within the scope of analysis for the estimated vehicle trips for drilling, completions, production, and reclamation.

2.6.4.2.1 Drilling Phase

An estimated 326 vehicle trips per day would be required for drilling operations (Table 2-9). For each rig, initial rig-up activities would involve transportation of the drill rig, drill pipe, drilling fluid products, living quarters, and ancillary facilities requiring approximately 19 heavy truck vehicle trips between the new site and previous site. The rig-up process can take between three to five days to complete. Drilling operations would occur 24-hours a day, in 12-hour shifts at each drilling site. While drilling is in progress, workers would drive or be transported up to 17 miles to and from well sites and the workforce facility once per 12-hour shift. An estimated 30 vehicle trips per day for a period of 10.5 days is expected to drill one well, totaling 302 light vehicle trips per day during the 10-year drilling phase. Occasional visits from product vendors would be required to resupply the operation (e.g., fuel and drilling fluid additives).

Table 2-9. Type and Number of Vehicle Trips During Drilling for the Proposed Action (per 24-hour day)

	Rig-Up Trips	Vendor and Supply Trips	Worker Trips	Total
Heavy Vehicle Trips	19	1	0	20
Light Vehicle Trips	-	4	302[1]	306
Total	**19**	**5**	**302**	**326**

Source: See Appendix E (*Transportation Plan*).

[1]Assumes drill time at each well of 10.5 days and 30 vehicle trips per day, equating to 302 trips per day over 10 years (10.5 days X 30 trips = 315 trips per well. 315 trips per well * 3,500 wells = 1,102,500 vehicle trips over 10 years. 1,102,500 vehicle trips / 3,650 days = 302 vehicle trips per day).

Notes: (a) Vehicle trips per day calculated based on the number of wells per year and the vehicle trips per well reported in Appendix E (*Transportation Plan*). (b) Up to two rigs may operate at once at each multi-well pad. (c) Vehicle trip estimates are based on available current information and are subject to revision based on changing conditions.

2.6.4.2.2 Completions

Completions operations would occur at the same time as drilling operations at each multi-well pad location, and would occur 24-hours a day in 12-hour shifts at each completions site. Initial setup of completions equipment at each new multi-well pad would occur as soon as drilling of the first well is completed. During setup, approximately 34 water tanks, two sand-containment vessels (Sand Chiefs), six pump trucks, two mixing vehicles, and one equipment van would be driven or transported to the site, resulting in approximately 45 vehicle trips between the new site and previous site each day.

Completion of each well would involve an average of five stages and an estimated total of 120 vehicle trips per day. At each of the five stages, 21 vehicle trips would be needed to load approximately 4,400 barrels (bbls) of water into the water tanks, totaling approximately 105 round trips per day. Prior to the completion of each of the five stages, approximately 2.5 vehicle trips would be required to load approximately 155,000 pounds of sand into the Sand Chiefs, totaling approximately 13 round trips per day. Completions staff would be transported to the wells by van from the Jonah Energy workforce facility every 12 hours, resulting in approximately two vehicle round trips per day. The distance from the workforce facility to the well sites is estimated to range up to 17 miles.

After stimulation of each well is completed, a coil tubing rig would visit the site and drill out the bridge plugs in the well, requiring one trip from the Jonah Energy work force facility per day. Flow-back would require a crew of three flow testers to monitor the well and conduct measurements and adjustments to flow-back equipment, requiring a total of 15 vehicle trips per day. Flow-back would require five pieces of equipment to be moved to the multi-well pad site, and it is anticipated that flow back-equipment would stay at the site until all wells are completed.

One completions crew would operate at each completions site regardless of the number of drill rigs on site. It is anticipated that water tanks and Sand Chiefs would remain at the site until all wells are completed. Water and sand trucks would be moved from site to site to supply all active completions sites in the development area. Table 2-10 identifies vehicle trips per day during completions.

Table 2-10. Type and Number of Vehicle Trips during Completions for the Proposed Action (per 24-hour day)

	Completions Setup	Completions (5 stages)	Coil Tubing Rig	Flow-back Staff	Flow-back Equipment	Total Trips
Heavy Vehicle Trips	44	118	1	-	2	165
Light Vehicle Trips	1	2	-	15	-	18
Total	45	120[1]	1	15	2[2]	183[3]

Source: See Appendix E (*Transportation Plan*).

[1]Assumes 1.25 days to complete one well to determine completions staff vehicle trips (1 trip every 12 hours = approximately 2 vehicle trips).
[2]Represents trips per multi-well pad location. These five pieces of equipment are moved onto the multi-well pad when flow-back begins on the first well. The equipment is not moved until the last well is completed.
[3]Completions setup only occurs once per multi-well pad location. As a result, these vehicle trips are not included in the total per day.

Notes: (a) Vehicle trips per day calculated based on the number of wells per year and the vehicle trips per well reported in Appendix E (*Transportation Plan*). (b) Vehicle trip estimates are based on available current information and are subject to revision based on changing conditions.

2.6.4.2.3 Production

Production-related staff would travel to and from their assigned CSC and various RGFs, wells, and other sites each day. During production, morning and evening travel to/from the CSCs would result in a maximum of 228 round trips per day between either the Jonah Energy workforce facility or homes outside the Project Area during each 24-hour period (Table 2-11). Staff shuttles and carpooling could reduce these trips. The one or two CSCs and the existing Jonah Energy workforce facility would provide the base of operations for production staff and allow the Project Area to be divided into three service areas (i.e., western, central, and southern regions). Using existing road distances and the expected RGF location scenario, estimated production trips within each region would vary from 0 to 10 miles in length.

Facility Operators would be responsible for maintenance of production equipment and operation of the liquids load-out facilities at one or more RGFs. Travel would be between the base CSC and the RGF assignment for the day. This would equate to a total of 11 (0- to 10-mile) trips per day for the Project Area.

Pumpers would travel each day between CSCs, well sites, and RGFs to perform well maintenance tasks. Estimates indicate that each pumper would visit three sites per day with a variable travel distance of 0 to 10 miles per trip. This would equate to a total of 450 (0- to 10-mile) trips per day within the Project Area.

Production Supervisors could be housed both at the CSCs and at the Jonah Energy workforce facility. Estimates indicate that each supervisor would visit 15 sites per day with a variable travel distance of 0 to 20 miles per trip, depending on the number and location of sites visited in the Project Area. This would equate to a total of 450 (0- to 20-mile) trips per day for the Project Area.

Environmental Specialists would travel each day between the base CSC and well sites, RGFs, and other areas to perform forward-looking infrared camera emission scans, leak tests, and other environmental compliance tasks. Estimates indicate each Environmental Specialist would visit six sites per day with a variable travel distance of 0 to 10 miles per trip. This would equate to a total of 24 (0- to 10-mile) trips per day within the Project Area.

Liquids Haulers would use semi-tractor trailer tankers to haul condensate from each RGF to existing condensate sales points in Rock Springs, or to haul produced water from each RGF to the JIDPA water treatment facility. Estimates indicate that each RGF (11) would require seven condensate runs per day to sales points in Rock Springs[12] to service each RGF, at 70 to 90 miles each way (up to 180 miles round trip), for a total of 77 external vehicle trips. Each RGF (11) would also require an average of four water treatment runs per day, at 5 to 15 miles each way (up to 30 miles round trip) to the JIDPA water treatment facility, for a total of 44 in-field vehicle trips. This would equate to a total of 121 liquids-related trucking runs per day to service all 11 RGFs in the Project Area.

Table 2-11. Type and Number of Vehicle Trips During Production for the Proposed Action (per 24 hour day)

	External Trips[1]			In-Field Trips						Total
	Workforce Travel to Project Area	***Liquid Haulers***	***Total***	***Facility Operators***	***Pumpers***	***Production Supervisors***	***Environmental Specialists***	***Liquid Haulers***	***Total***	
Heavy Vehicle Trips	-	77	77	-	-	-	-	44	44	121
Light Vehicle Trips	228	-	228	11	450	450	24	-	935	1,163
Total	**228**	**77**	**305**	**11**	**450**	**450**	**24**	**44**	**979**	**1,284**

Source: See Appendix E (*Transportation Plan*).

[1]External trips include workforce driving to and from their worksite to their home/lodging. This number represents a high-end scenario, as there may be vans or carpools for transportation to worksites. It is assumed that all staff would operate from a CSC or the workforce facility as their home worksite and conduct in-field trips from there.

Notes: (a) Vehicle trips per day calculated based on the number of wells per year and the vehicle trips per well reported in Appendix E (*Transportation Plan*. (b) Vehicle trip estimates include all trips associated with production and reclamation, are based on available current information, and are subject to revision based on changing conditions.

2.6.5 Surface Disturbance

The Proposed Action would result in an estimated short-term surface disturbance of 6,340 acres in the Project Area (4.5 percent of the Project Area). After interim reclamation, an estimated total of 1,890 acres (or 1.3 percent of the Project Area) would remain disturbed for the life of the project, consisting of permanent facilities (e.g., RGFs), access roads, and equipment areas needed for ongoing production, servicing, and maintenance activities. Table 2-12 presents surface disturbance for the areas with varying density of development for the Proposed Action (Sage-Grouse PHMA and non-PHMA Habitat). Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for more information on assumptions and methods for estimating surface disturbance.

[12]*Depending on a variety of unknown factors, condensate runs may occur to sales points that are closer to the Project Area than Rock Springs. This analysis assumes all condensate runs would be to sales points in Rock Springs.*

Table 2-12. Surface Disturbance Estimates for the Proposed Action

Project Component	Description	Disturbance Calculation Assumption	Estimated Number of Structure Sites or Length of Project Component	Total Short-term Disturbance (acres)			Total Long-term Disturbance (acres)		
				Sage-Grouse PHMA	*Non-PHMA Habitat*	*Total*	*Sage-Grouse PHMA*	*Non-PHMA Habitat*	*Total*
Multi-well Natural Gas Pads	Directionally drilled wells would be included on each well pad, with an average of up to one well pad per 640-acre area in Sage-Grouse PHMA and an average of up to four well pads per 640-acre area in non-PHMA Habitat	Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for information on assumptions and methods for estimating surface disturbance	3,500 directionally drilled natural gas wells	310	2,870	3,180	77	718	795
Pipelines	Includes disturbance for the three-phase pipeline gathering system to transport comingled product from well pads to RGFs and pipelines connecting RGFs to existing sales pipelines	Pipelines and roads would share a common 100-foot ROW corridor	227 miles of new buried pipelines	214	1,851	2,065	0	0	0
Regional Gathering Facilities	RGFs would consist of compressor stations, dehydration units, metering facilities, vapor recovery units, and stock tanks	20 acres per RGF	11 (2 PHMA, 9 non-PHMA)	40	180	220	40	180	220
Powerlines	Electrical distribution lines and substation to power regional gathering facilities and certain emission control technologies to be used at RGFs	Based on estimated locations and number of RGFs using 40-foot disturbance buffer along powerline alignments	38.6 miles of powerline (5.57 PHMA, 33.04, non-PHMA)	27	160	187	27	160	187
Access Roads	Access roads connecting multi-well pads and other locations to established roads	Pipelines and roads would share a common 100-foot ROW corridor	227 miles of new access roads	71	617	688	71	617	688
Total				**663**	**5,677**	**6,340**	**216**	**1,674**	**1,890**

PHMA Priority Habitat Management Area
RGF Regional Gathering Facility
ROW Right-of-Way

Notes: (a) Short-term impacts result in changes to the environment that are stabilized or mitigated rapidly, do not result in any long-term effects, and typically occur for less than five years. Long-term impacts result in lasting effects that typically occur for more than five years. (b) Negligible differences in totals (1-2 acres) are due to rounding. (c) Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for a detailed description of methods and assumptions for calculating surface disturbance.

Table 2-13 identifies estimated surface disturbance by year for the Proposed Action within and outside Sage-Grouse PHMA.

Table 2-13. Estimated Surface Disturbance Accumulating by Year for the Proposed Action

	Short-term Disturbance (acres)			Long-term Disturbance (acres)[1]		
	Sage-Grouse PHMA	*Non-PHMA Habitat*	*Total per Year*	*Sage-Grouse PHMA*	*Non-PHMA Habitat*	*Total*
Development Phase (Years 1–10)						
Year 1	66	568	634	22	167	189
Year 2	133	1,135	1,268	43	335	378
Year 3	199	1,703	1,902	65	502	567
Year 4	265	2,271	2,536	86	670	756
Year 5	331	2,839	3,170	108	837	945
Year 6	398	3,406	3,804	129	1,005	1,134
Year 7	464	3,974	4,438	151	1,172	1,323
Year 8	530	4,542	5,072	173	1,340	1,512
Year 9	596	5,110	5,706	194	1,507	1,701
Year 10	663	5,677	6,340	216	1,674	1,890
Full Production Phase (Years 11-40)						
Years 11–40	0	0	0	216	1,674	1,890

[1]Long-term disturbance numbers provide an accumulated total of long-term surface disturbance.

Notes: (a) Negligible differences in totals are due to rounding. (b) Although actual practice may differ, for estimation purposes the annual disturbance calculations assume exactly 1/10 of the total initial disturbance would be created each year, and exactly 1/10 of the difference between total initial disturbance and total final disturbance would be reclaimed each year. Once a previous year's disturbance has been reclaimed, the difference is then reclassified as long-term and that amount is added to the long-term disturbance accumulated total.

2.6.6 Resource Protection Measures for the Proposed Action

Resource protection measures include BMPs, design features, stipulations, OCPs, and other measures that would reduce potential adverse impacts to resources and resource uses. Appendix B (*Resource Protection Measures*) identifies potential resource protection measures by resource and the alternative to which they would apply. Once exploratory and delineation operations in the Project Area have been completed and Jonah Energy is prepared to enter a development phase, Jonah Energy has voluntarily committed to comply with the OCPs (OCP 2012) included in Appendix B (*Resource Protection Measures*).[13]

[13] *It is important to note that many of the OCPs cannot be effectively or cost-effectively utilized until Jonah Energy completes exploration and delineation and is developing a particular Development Area..*

Resource protection measures that are carried forward in the NPL Project ROD would be applied as COAs during permitting for site-specific development of the NPL Project, as appropriate. Sources of resource protection measures include:

- The BLM PFO Approved RMP and ROD (BLM 2008a) and the BLM Green River Approved RMP and ROD, as amended (BLM 1997a);
- The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e);
- lease stipulations;
- OCPs (OCP 2012);
- standard BMPs identified in the Gold Book (BLM 2007a); and
- other applicable measures from existing laws, ordinances, regulations, guidance, and standards.

2.7 Alternative A

2.7.1 Introduction

Alternative A was developed primarily to address sensitive wildlife resources identified during scoping and the alternatives development process. For Alternative A, the maximum number of wells would be the same as the Proposed Action, but the location, timing, and pattern of development would be different than the Proposed Action with the timing of development occurring sequentially in three geographically defined Phases, or as necessary based on valid existing lease rights. The maximum allowable density of development within identified DAs would be largely driven by the presence or absence of delineated wildlife habitats in a given DA and the expanse of those habitats, if present. The BLM would apply additional resource protection measures for wildlife species within delineated habitats of DAs where species are considered a focus species[14]. The development period would be slightly longer than that of the Proposed Action resulting in slightly fewer new wells drilled per year, on average. Development under Alternative A would occur sequentially within the DAs identified for the three Phases starting with Phase 1, adjacent to the JIDPA.

In order to provide the greatest protection for sensitive wildlife habitat while also providing for development of the Project Area, Alternative A is based on the following primary concepts:

- The Project Area is divided into seven DAs (Map 4);
- The development scenario is designed to incorporate the designated DAs into three different Phases: Phase 1 consists of DA 1 north, DA 2 east, DA 3 north, DA 4 north, DA 5, DA 6 north, and DA 7; Phase 2 consists of DA 2 west and DA 3 central; and Phase 3 consists of DA 1 south, DA 3 south, DA 4 south, and DA 6 south;
- DA 3, which contains all of the Sage-Grouse PHMA in the Project Area, includes a portion of the DA in each of the three Phases so that development in PHMA is phased over the development period and does not all occur at the same time;
- Development of the three Phases would occur sequentially starting with development of Phase 1 adjacent to the JIDPA (Map 4);

[14]*Focus species are species with existing delineated habitats that warrant additional management focus due to species status, quantity and quality of habitat, issues identified during scoping, or other factors. Refer to Section 2.7.6 (Resource Protection Measures for Alternative A) for more information.*

- Each of the three existing oil and gas units (Sol, Hacienda, Crimson) are entirely included in a phase to allow development consistent with existing unit obligations (Map 4); and;
- The BLM would implement resource protection and conservation measures unique to the DAs not only based upon but in addition to measures included in the current RMPs that govern the RSFO (BLM 1997a) and PFO (BLM 2008a). Measures additional to the RMPs are considered in this EIS at a programmatic level and would also be considered during site-specific permitting, subject to valid existing lease rights. The BLM included resource protection measures additional to those in the RMPs to: (1) reflect new site-specific information and knowledge for resources in the Project Area since the approvals of the RMPs; (2) incorporate lessons learned from implementing measures from the existing RMPs for other oil and gas development; and (3) address potential impacts to sensitive wildlife resources identified during scoping.

DA boundaries are based on the spatial distribution of sensitive wildlife habitats found throughout the Project Area (Map 5), the location of existing oil and gas units (Map 4), and other existing resources (e.g., cultural, visual) and landscape features (e.g., consideration of existing roads and pipelines in relation to important biological resources). The BLM identified focus wildlife species within each of the seven DAs. The BLM identified more stringent conservation measures that would be applied within the delineated habitats for focus species. Delineated habitats for focus species are presented and explained in Section 2.7.6.2 (*Development and Resource Protection Measures in Delineated Habitats for Focus Species*) and depicted on Map 5. Focus species in each DA are presented and explained in Section 2.7.6.1 (*Resource Protection Measures by Development Area*).

Species not afforded focused management status within a DA would receive general protection through either the BLM PFO Approved RMP and ROD (BLM 2008a), or the BLM Green River Approved RMP and ROD (BLM 1997a). Refer to Appendix B (*Resource Protection Measures*) for a description of resource protection measures. Development receiving relief from protective COAs (e.g., waivers for timing stipulations) will not be analyzed in this alternative. Exceptions meeting criteria found in either the BLM PFO Approved RMP and ROD (BLM 2008a), or the BLM Green River Approved RMP and ROD (BLM 1997a) could be granted for circumstances that merit an exceptional need.

A variety of project components, equipment, actions, and other aspects of Alternative A would be similar to the Proposed Action. Only those subsections and details that would differ substantively between Alternative A and the Proposed Action are discussed below. The alternatives are compared in Section 2.10 (*Comparison of Alternatives*) and Section 2.11 (*Summary of Impacts*). Refer to Table 2-28 for a comparison of the key features of the alternatives.

2.7.2 Project Components

Project components would generally be similar to the Proposed Action and include directionally drilled natural gas wells from multi-well pads, water disposal wells, existing and new pipelines, powerlines, access roads, and RGFs. Though the project components would be similar to the Proposed Action, a lower density of development and additional resource protection measures in delineated focus wildlife habitats would limit the timing and extent of development in these areas compared to the Proposed Action. Within these sensitive wildlife habitats, the distance between clusters of development would be greater than the more uniformly distributed clusters of development for the Proposed Action.

The sections below describe differences in project components and their locations compared to the Proposed Action.

2.7.2.1 Regional Gathering Facilities and Powerlines

For Alternative A, RGFs, compressor facilities, and powerlines would be prohibited within delineated mountain plover habitat in DA 3 and DA 6 (a focus species in these DAs), within raptor nest buffers in DA 1, DA 3, and DA 5, and within burrowing owl nest buffers in DA 6.[15] RGFs would be allowed within Sage-Grouse PHMA (DA 3) as long as disturbance would not exceed the 5 percent disturbance threshold described in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e)[16]. Within Sage-Grouse PHMA, powerlines would be authorized in accordance with the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e), including the authorization of electric distribution lines (less than 115 kV), as noted below:

- New electric distribution lines will be buried where feasible and economically feasible. If not economically feasible, distribution lines may be authorized when effectively designed/mitigated to protect Sage-Grouse and the AO determines that overhead installation is the action alternative with the fewest adverse impacts while still meeting the project need.[17]
- Power lines (distribution and transmission) will be designed to minimize wildlife related impacts and constructed to the latest Avian Power Line Interaction Committee (APLIC) standards.

2.7.2.2 Pipelines

For Alternative A, pipelines and roads would share a common 100-foot ROW corridor. In contrast to the Proposed Action which would rely on trucking produced water and condensate from RGFs to offsite facilities, Alternative A would utilize two separate buried pipelines to transport produced water and condensate from RGFs to existing water treatment plants or condensate sales points, as described below. The transport pipelines would extend from each RGF to a central pipeline network connecting to offsite facilities for treatment and disposal of produced water and sales of condensate. Whenever possible, these pipelines would be located adjacent to new or existing access roads, be within a 100-foot combined ROW corridor, and be buried in the same trench and at a minimum depth of six feet to protect pipelines from surface freeze conditions. The pipeline for transport of produced water and condensate may also require additional pumping stations. At this time, the only planned use of the pipeline system would be to transport produced water and condensate from within the Project Area to

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[15]*Includes raptor buffers for Alternative A identified as delineated habitats for focus species in DAs. Includes one-mile buffer of documented Ferruginous hawk and Bald Eagle nests, regardless of occupancy or current presence of nest; and 1/2-mile buffers of documented Burrowing Owl, American Kestrel, Prairie Falcon and/or unknown raptor nests regardless of occupancy or current presence of nest.*

[16]*The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) indicate that liquids gathering facilities should be centralized/clustered and placed outside of Sage-Grouse priority areas. Jonah Energy has proposed the use of centralized RGFs within three-miles of well pad clusters. However, due to the contiguous acreage of Sage-Grouse PHMA (Map 40) in the Project Area, it may not be technically feasible to develop the NPL Project without placing RGFs in PHMA. For purposes of analysis, this EIS assumes that up to two RGFs would be located in PHMA. During site-specific permitting, placement of RGFs in priority habitats would be avoided, if possible. If RGFs in priority habitats are technically necessary to develop the NPL Project, appropriate mitigation (including appropriate additional mitigation) would be applied during site-specific permitting.*

[17]*At this programmatic level, it is not possible to determine with any degree of certainty which powerlines would be feasible to bury. Determinations on the feasibility to bury powerlines would be conducted during site-specific permitting. As a result, and for purposes of analysis, the NPL EIS assumes and analyzes the potential impacts of all powerlines being overhead. Appropriate design features and mitigation measures for powerlines would be considered and applied at a site-specific level during the processing of APDs or ROW applications.*

areas outside the Project Area. Potential future uses of the pipelines, including the portion of the pipeline outside of the Project Area, are unknown and are not analyzed in this EIS.

Surface disturbance associated with this buried pipeline network is included in Table 2-18 and is based on the following assumptions:

- The pipeline network would extend from 11 new RGFs in the Project Area to existing offsite facilities, as described below.
- Buried condensate and produced water pipelines leaving the 11 RGFs would connect to a central pipeline system to transport condensate and produced water to existing offsite facilities.[18]
- Condensate for sales would be transported by buried pipeline from RGFs to existing sales point facilities, to be determined by Jonah Energy.[19] Sales points for condensate could include, but not be limited to, the following locations outside the Project Area (Map 2).
  - Plains Facility in Township (T) 30N, Range (R) 108W, Section (Sec.) 36, 31 (transport from northeastern side of Project Area);
  - Plains Facility in LaBarge T26N, R113W, Sec. 11, 24 (transport from southwestern side of NPL Project); and
  - Granger Facility in T18N, R111W, Sec. 16 (transport from southern side of Project Area).
- The buried condensate and produced water pipeline would result in 50 miles of new pipeline in the Project Area and 70 miles of new pipeline outside the Project Area, for a total of 120 miles of new pipeline.
- Produced water requiring treatment that would not be injected underground at RGFs (approximately 10 percent of the produced water) would be transported by buried pipeline to the JIDPA water treatment facility in T29N, R108W, Sec. 36 (Map 2).
- Up to 120 miles of additional pipelines would require increased groundwater use for hydrostatic testing of the pipelines. Refer to Section 2.7.3.2 (*Water Use*) for more information on water use for Alternative A.

2.7.2.3 Roads and Access

Similar to the Proposed Action, roads and pipelines would share a common 100-foot wide ROW corridor. For Alternative A, project-related traffic could utilize North Burma Road north of the project boundary. All other components of roads and access would be the same as the Proposed Action.

2.7.3 Description of Drilling and Operations

Similar pre-construction activities, construction, drilling, completion, production, maintenance, abandonment, and reclamation would occur as described under the Proposed Action. However, the drilling and operations activities would occur sequentially over time in three geographically defined Phases, as described below. For Alternative A, drilling and production activities would operate under tighter controls than the Proposed Action due to additional BMPs and other resource protection

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[18]*If this option moves forward as part of the Preferred Alternative, the BLM would further define and analyze the route and corridor during site-specific permitting.*

[19]*The identified sales points provide examples of where condensate could be transported via pipeline for analysis purposes only. Actual condensate sales points would be determined by Jonah Energy and would not be directed by the BLM.*

measures in certain delineated wildlife habitats, as described in Section 2.7.6 (*Resource Protection Measures for Alternative A*).

2.7.3.1 Description of Development

The Project Area would be developed sequentially in three geographically defined Phases (Map 4) within DAs delineated based on sensitive wildlife habitats and existing oil and gas units, subject to valid existing rights. The sensitive wildlife habitats are located across the Project Area, with sensitive spring and summer habitats found primarily, but not exclusively, along the eastern portion of the Project Area and sensitive winter habitats found primarily but not exclusively along the western portion of the Project Area. Each of the three Phases are designed so that development could be permitted in the eastern portion of the Project Area during the winter, and in the western portion during the summer. As a result, each Phase could be fully developed while abiding by all recognized COAs and Timing Limitation Stipulations (TLSs).

The BLM designed the phasing scheme to take advantage of existing infrastructure from previous field development in the JIDPA. DAs in Phase 1 would be adjacent to existing infrastructure of the JIDPA and consists of DA 1 north, DA 2 east, DA 3 north, DA 4 north, DA 5, DA 6 north, and DA 7. Phase 2, consisting of DA 2 west and DA 3 central, would be geographically situated adjacent to Phase 1 to allow for construction to connect with the infrastructure of Phase 1. While Phase 1 is being implemented, Phases 2 and 3 would be deferred. Upon completion of Phase 1, Phase 2 would be developed while Phase 3 would be deferred. Phase 3, consisting of DA 1 south, DA 3 south, DA 4 south, and DA 6 south, would then be developed upon completion of Phase 2.

A key concept in Alternative A is the deferment of DA 4 south until the final Phase (Phase 3). DA 4 south is one of the least restrictive areas, with no focus species identified. Previous development in the UGRB has typically occurred by first developing areas without protective COAs (e.g., developing areas that do not have timing stipulations), followed by development in areas with COAs. While avoidance of more sensitive areas until later in development would benefit wildlife species, this approach usually results in a scenario in which operators have no other options but to drill in those sensitive areas once the less restrictive areas have been drilled out. Exceptions to lease stipulations or COAs are routinely requested by operators when development is not able to be completed within the timeframe not protected by COAs. By deferring an area that maintains less restriction until the later stages of the development phase, Jonah Energy would have a location to drill when protections in other areas (e.g., Sage-Grouse Winter Concentration Areas in DA 1 south) may be limiting, thus reducing the potential for exception requests.

Table 2-14 below identifies the Phases of development, the DAs associated with each Phase, and the rationale for development in each Phase and location. Map 4 depicts the Phases of development and the DAs for Alternative A.

Table 2-14. Description of Phased Development

Phase	Location (Development Area)	Development Rationale
Phase 1	DA 1 north DA 2 east DA 3 north DA 4 north DA 5 DA 6 north DA 7	• Development in Phase 1 is designed to radiate out from the JIDPA, taking advantage of existing infrastructure. As a result, DAs bordering the JIDPA are included in Phase 1 (i.e., DA 1 north, DA 2 east, DA 6 north, DA 5, DA 7). • DA 1 north and DA 2 east are included so that the entirety of the Sol Unit is included in a single Phase. • The development of DA 2 east, while deferring development of DA 2 west until Phase 2, is designed to reduce impacts to wintering pronghorn by allowing for displacement from DA 2 east into DA 2 west. • DA 3 north, DA 4 north, DA 5, and DA 7 are included so that the entirety of the Hacienda Unit is included in a single Phase. • DA 3 north is also included to provide for a phased approach to development in Sage-Grouse PHMA (DA 3) so that development in PHMA is phased over the development period for the NPL Project and does not all occur at the same time.
Phase 2	DA 2 west DA 3 central	• The inclusion of DA 2 west and DA 3 central continues the eastern and western development of the Project Area out from Phase 1. • Development is designed to radiate out from DA 2 east into DA 2 west and could radiate from the southern portion of DA 3 north (Phase 1) toward the south (into DA 3 central). • DA 3 central is included to provide for a phased approach to development in PHMA (DA 3) so that development in PHMA is phased over the development period for the NPL Project and does not all occur at the same time.
Phase 3	DA 1 south DA 3 south DA 4 south DA 6 south	• Including DA 1 south and DA 4 south in Phase 3 alleviates difficulties of development due to wildlife protections in DA 1 south since no focus species have been identified in DA 4 south. • DA 6 south, DA 3 south, and DA 4 south are included so that the entirety of the Crimson Unit is included in a single Phase. • DA 3 south is included to provide for a phased approach to development in PHMA (DA 3) so that development in PHMA is phased over the development period for the NPL Project and does not all occur at the same time.

DA Development Area

Density of development would be based, in part, on delineated habitats for focus species within a given DA, as described below. These delineated habitats are depicted on Map 5. Development inside Sage-Grouse PHMA (DA 3) would abide by all policies governing the management of Sage-Grouse and Sage-Grouse habitats in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and newer guidance as it is developed, subject to valid existing lease rights.

- In Sage-Grouse PHMA, 48,036 acres, 34 percent of the Project Area), development would occur at a density averaging up to more than one disturbance location[20] per 640 acres and not to exceed 32 acres (5 percent) surface disturbance per 640 acres, inclusive of existing disturbances.
- In delineated Sage-Grouse Winter Concentration Areas (27,292 acres, 19 percent of the Project Area), development would occur at a density averaging no more than one disturbance location per 640 acres. Within WCAs in DA 1, surface disturbance would not exceed 20 acres (3 percent) surface disturbance per 640 acres, inclusive of existing disturbances.[21]
- In delineated habitats for all other focus wildlife species within a given DA (besides Sage-Grouse) (22,918 acres, 16 percent of the Project Area), development would occur at a density of up to four disturbance locations (of up to 19 acres per pad) per 640 acres, not to exceed 20 acres (3 percent) surface disturbance per 640 acres, inclusive of existing disturbances.[12] Refer to Section 2.7.6.1 (*Resource Protection Measures by Development Area*) and Section 2.7.6.2 (*Development and Resource Protection Measures in Delineated Habitats for Focus Species*) for more information on delineated habitats and associated resource protection measures.
- In general habitat areas (i.e., all areas excluding Sage-Grouse PHMA, Winter Concentration Areas, and delineated habitats for focus species in the DAs) (42,617 acres, 30 percent of the Project Area), development would occur at a density of up to four disturbance locations per 640 acres.

In areas with overlapping habitat types the more restrictive density of development would be applied. For example, in delineated mountain plover habitat in DA 3, which overlaps Sage-Grouse PHMA, the density of development for Sage-Grouse PHMA would be applied.

Average well pad density in delineated wildlife habitats would be calculated based on the total acreage of the delineated habitat area within a DA (e.g., mountain plover delineated habitat in DA 3) divided by 640 acres. Average well pad density and allowable maximum disturbance in Sage-Grouse PHMA (e.g., not to exceed 5 percent disturbance per 640 acres) would be calculated based on the DDCT process described in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e). Allowable maximum disturbance in DA 1 and other delineated habitats (i.e., not to exceed 3 percent disturbance per 640 acres) would be calculated based on the total acreage of the delineated habitat in the DA where restrictions apply. For example, maximum allowable disturbance within a given DA would be calculated based on the total acreage of the Winter Concentration Area in the DA divided by 640 acres (i.e., not calculated by section or by total acreage of Winter Concentration Areas in the Project Area). Maximum allowable disturbance within protective buffers for raptors would be calculated based on the total acreage of the nest buffer around each individual nest divided by 640 acres.

Refer to Section 2.7.6.2 (*Development and Resource Protection Measures in Delineated Habitats for Focus Species*) for more information on development for Alternative A in sensitive wildlife habitats.

Table 2-15 provides the estimated development summary for Alternative A.

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[20] *A "disturbance location" is defined as one well pad, RGF, compressor station, or other project-related facility and its ancillary infrastructure (e.g., roads, pipelines, powerlines).*

[21] *The disturbance threshold of 3 percent (20 acres per square mile) is based on the WGFD Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats (WGFD 2010c)*

Table 2-15. Estimated Development Summary for Alternative A

Type of Development	Amount
Estimated Number of New Directionally Drilled Wells from Multi-well Pads	3,500
Estimated Number of New Wells (per year)[1]	336
Estimated Duration of Development (years)[2]	10.4
Development Timeframe (years)[3]	1-10.4
Field Production Duration (years)	40.4
Field Production Timeframe (years)[3]	1-40.4
Full Production Phase Duration (years)	30
Full Production Timeframe (years)[3,4]	10.4-40.4
Total Life of Project (years)	**40.4**

[1]Assumes the same maximum number of wells as the Proposed Action (3,500). However, since the duration of development is slightly longer than the Proposed Action, the maximum number of new wells per year would be less than the Proposed Action.
[2]Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for more information on estimated duration of development.
[3]Timeframes identify the years in which a certain project phase would occur. For example, the development timeframe would occur in years 1 through 10.4 and full production would occur in years 10.4 through 40.
[4]Full production phase and timeframe includes initiation of final reclamation of production wells and facilities.

2.7.3.2 Water Use

Similar to the Proposed Action, Alternative A would require an estimated 35,000 bbls of water for drilling and completions of each well with all water for completions (71 percent of total water use for drilling and completions, 25,000 bbls per well) coming from recycled sources and water for drilling (29 percent of total water use for drilling and completions, 10,000 bbls per well) coming from shallow groundwater wells in the top 1,000 feet of the Wasatch Aquifer. Alternative A would require an estimated 12,404 bbls of groundwater per year for new road construction dust control during the development phase and an estimated 78,001 bbls of groundwater per year for road maintenance dust control during the development phase. Alternative A would require an estimated 60,480 bbls of groundwater per year for well pad construction dust control. Water used for well drilling would be trucked from groundwater well locations to well pads and stored in water tanks on site, and would not be transported by pipeline.

Due to an estimated 88 more miles of pipelines (including the buried produced water and condensate pipeline) Alternative A would require additional water for hydrostatic testing, compared to the Proposed Action. Alternative A would require an estimated 34,692 bbls of groundwater for hydrostatic testing each year during the 10.4 year development phase.

Alternative A would result in a total estimated groundwater use of 3,545,577 bbls per year during the 10.4 year development period (457.0 acre-feet per year) for a total estimated groundwater use of 36,874,001 bbls during the 10.4 year development phase (4,752.8 acre-feet). Alternative A would result in an estimated groundwater use of 129,000 bbls per year (16.6 acre-feet per year) for road maintenance dust control during the full production phase (years 11-40) for a total estimated groundwater use of 498.0 acre-feet during the 30-year full production phase.

Refer to Table 2-28 for a description and comparison of water use and other key features of the Proposed Action and alternatives and refer to Appendix K (*Water Resource Support Appendix*) for additional information on water use and potential impacts for the Proposed Action and alternatives. For the Proposed Action and all alternatives, in advance of development, Jonah Energy would work with appropriate federal, state, and local agencies to implement an acceptable groundwater monitoring program for the NPL Project consistent with WOGCC rules to establish and monitor the quality of groundwater around sites prior to, during, and after development.

2.7.3.3 Reclamation and Monitoring

Similar to the Proposed Action, Jonah Energy would conduct reclamation, monitoring, and abandonment in accordance with Appendix C (*Reclamation, Monitoring, and Weed Management Plan*). However, for Alternative A, progression from one Phase to another would not occur until Jonah Energy has initiated interim reclamation on all surface disturbance which occurred prior to the previous growing season. In addition, older interim reclamation areas must provide sufficient soil stability, noxious and invasive weed prevention, and appropriate vegetative response given the age of the reclamation, in accordance with the reclamation objectives and standards in Appendix C (*Reclamation, Monitoring, and Weed Management Plan*).

2.7.4 Development and Production Workforce and Transportation

2.7.4.1 Development and Production Jobs

Similar to the Proposed Action, the existing Jonah Energy workforce facility would be utilized to house workers to the extent possible. For Alternative A, a pipeline network to transport condensate and produced water to offsite facilities would reduce the production workforce by 33 jobs (eliminating liquids haulers). In general, all jobs would be full-time, year-round during the respective phase. However, the number of jobs at any given time could fluctuate more than the Proposed Action during development depending on the Phase and DA being developed. Table 2-16 identifies estimated jobs during the development and full production phases for Alternative A.

Table 2-16. Type and Number of Jobs During Development and Production for Alternative A

Type of Job	Development Phase (Years 1–10)[1]	Full Production (Years 11–40)[2]
Drilling and Completions: 16 Production Staff 9 Drilling Supervisors 24 Completions Supervisors 12 Regulatory/Reclamation Staff 15 Construction Supervisors 150 Construction and Maintenance Staff (50 completions hands and supervisors per rig X 10 rigs) = 500 total completions hands	726	-
Production: 150 Pumpers 30 Supervisors 11 Facility Operators 4 Environmental Specialists	195	195[2]
Total	**921**	**195[2]**

[1]The range of estimates assumes that development and associated jobs would be 100 percent of that of the Proposed Action.
[2]Actual number of production jobs at any one time may vary throughout the life of the project, depending on project phase.

Notes: (a) Job estimates are based on existing information and are subject to revision based on changing conditions.
Note: The job numbers presented in the table above represent total jobs during the respective phase (i.e., jobs are not reported for each year, but the total number of jobs during the respective phase). (b) For purposes of analysis, the EIS assumes that for Alternative A, all jobs would be full-time, year-round, throughout the duration of the respective phase. (c) Due to the nature of jobs associated with decommissioning and reclamation activities (not occurring every day or year round) and the relatively low levels of jobs for these activities it is assumed that jobs associated with decommissioning and reclamation would be negligible and within the scope of analysis for the estimated jobs for drilling, completions, and production.

2.7.4.2 Development and Production Transportation

Transportation and traffic associated with the NPL Project would occur during all phases of the project, including drilling, completion, production, and reclamation. Vehicle trips during the drilling and completion phases of Alternative A would be the same as under the Proposed Action. However, a pipeline network to transport condensate and produced water to offsite facilities would reduce the number of heavy vehicle trips during the production phase by 121 compared to the Proposed Action. In addition, the number of vehicle trips per day may fluctuate more than the Proposed Action depending on the Phase and DAs being developed. Table 2-17 identifies heavy and light vehicle trips per day for Alternative A.

Table 2-17. Type and Number of Vehicle Trips for Alternative A (per 24-hour day)

	Heavy Vehicle Trips	Light Vehicle Trips	Total Vehicle Trips
Drilling	20	306	326
Completion	165	18	183
Production	0[1]	1,163	1,163

Source: See Appendix E (*Transportation Plan*).

[1]For Alternative A, produced water and condensate would be transported via pipeline, not truck.

Notes: (a) Vehicle trips per day are calculated based on the number of wells per year and the vehicle trips per well reported in Appendix E (*Transportation Plan*). (b) Vehicle trip estimates are based on available information and are subject to revision based on changing conditions. It is assumed that these vehicle trip estimates include reclamation-related vehicle trips. (c) Due to the nature of workforce associated with decommissioning and reclamation activities (not occurring every day or year round) and the relatively low levels of workforce and vehicle trips for these activities it is assumed that vehicle trips associated with decommissioning and reclamation would be negligible and within the scope of analysis for the estimated vehicle trips for drilling, completions, and production.

2.7.5 Surface Disturbance

Alternative A would result in an estimated short-term surface disturbance of 6,324 acres in the Project Area (4.5 percent of the Project Area). Due to the condensate and produced water pipeline outside of the Project Area, Alternative A would result in a total short-term disturbance of 6,748 acres, including 424 acres of disturbance outside the Project Area. After interim reclamation, an estimated total of 1,811 acres, or 1.3 percent of the Project Area, would remain disturbed for the life of the project, consisting of permanent facilities (e.g., RGFs), access roads, and equipment areas needed for ongoing production, servicing, and maintenance activities. Table 2-18 presents surface disturbance for the areas with varying density of development in Alternative A (general habitat, delineated habitats for focus species in Alternative A, Sage-Grouse PHMA, and Sage-Grouse Winter Concentration Areas). Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for more information on assumptions and methods for estimating surface disturbance.

Table 2-18. Surface Disturbance Estimates for Alternative A

Project Component	Description	Disturbance Calculation Assumption	Estimated Number of Structure Sites or Length of Project Component	Total Short-Term Disturbance (acres)					Total Long-Term Disturbance (acres)				
				General Habitat	*Delineated Habitats for Focus Species*	*Sage-Grouse PHMA*	*Sage-Grouse Winter Concentration Areas*	*Total*	*General Habitat*	*Delineated Habitats for Focus Species*	*Sage-Grouse PHMA*	*Sage-Grouse Winter Concentratio n Areas*	*Total*
Multi-well Natural Gas Pads	Directionally drilled wells would be included on each well pad, with varying density of development based on habitat types[1]	Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for information on assumptions and methods for estimating surface disturbance	3,500 directionally drilled natural gas wells	2,167	395	310	133	3,004	542	99	77	33	751
Pipelines	Includes disturbance for three-phase pipeline gathering system to transport comingled product from well pads to RGFs and pipelines connecting RGFs to existing sales pipelines	Pipelines and roads would share a common 100-foot ROW corridor with access roads	195 miles of new buried pipelines	1,397	254	214	92	1,958	0	0	0	0	0
Condensate and Produced Water Pipelines in Project Area (share same trench)	Condensate and produced water pipelines from RGFs to the edge of the Project Area	Assumes a 100-foot combined ROW corridor with existing roads/pipelines (50-foot ROW shared trench for the condensate and produced water pipelines in the Project Area and 50-foot existing corridor)	50 miles of shared trench in the Project Area	165	28	55	55	302	0	0	0	0	0
Condensate Pipeline (outside Project Area)[2]	Buried pipeline from the edge of the Project Area to condensate sales points outside the Project Area	Assumes a 100-foot combined ROW corridor with existing roads/pipelines (50-foot ROW shared trench for the condensate and produced water pipelines in the Project Area and 50-foot existing corridor)	70 miles from the edge of the Project Area to the farthest potential condensate sales point (Granger Facility)	-	-	-	-	424	-	-	-	-	0
Regional Gathering Facilities	RGFs would consist of compressor stations, dehydration units, metering facilities, vapor recovery units, and stock tanks	Assumes 20 acres per RGF	11 (2 in PHMA, 1 in Delineated Habitat, 6 in non-PHMA Habitat, 2 in Winter Concentrations Areas within DA 1)	120	20	40	40	220	120	20	40	40	220
Powerlines	Electrical distribution lines to power compressor stations and certain emission control technologies to be used at RGFs	Based on estimated locations and number of RGFs using 40-foot disturbance buffer along powerline alignments	38.6 miles of powerlines	102	17	34	34	187	102	17	34	34	187
Access Roads	Access roads connecting multi-well pads and other locations to established roads	Pipelines and roads would share a common 100-foot ROW corridor with pipelines	215 miles of new access roads	466	85	71	31	653	466	85	71	31	653
Total Disturbance in Project Area				**4,417**	**798**	**725**	**384**	**6,324**	**1,230**	**221**	**223**	**138**	**1,811**
Total Disturbance, including outside Project Area				**4,417**	**798**	**725**	**384**	**6,748[3]**	**1,230**	**221**	**223**	**138**	**1,811**

[1]Alternative A includes varying densities of development based on habitat type as described below:

General Habitat: Average of up to four well pads per 640 acres (areas not included under the habitat types below).
Delineated Habitats for Focus Species in Alternative A: Average of up to four well pads per 640 acres, not to exceed 3 percent disturbance per 640 acres.
Sage-Grouse PHMA: Average of no more than one well pad per 640 acres, not to exceed 5 percent disturbance per 640 acres.
Sage-Grouse Winter Concentration Areas: Average of no more than one well pad per 640 acres. Within DA 1 (including the Alkali Draw and Alkali Creek Winter Concentration Areas) surface disturbance would not to exceed 3 percent disturbance per 640 acres.

[2]Represents surface disturbance outside of the Project Area for the buried condensate pipeline from the edge of the Project Area to the farthest potential condensate sales point (Granger Facility). If this option moves forward as part of the Preferred Alternative, the BLM would further define and analyze the route and corridor as part of the Project Area.
[3]Includes the 424 acres of disturbance outside of the Project Area for the buried condensate pipeline from the edge of the Project Area to the farthest potential condensate sales point (Granger Facility). Total short-term disturbance in the Project Area is estimated at 6,324 acres.

PHMA Priority Habitat Management Area
RGF Regional Gathering Facility
ROW Right-of-way

Notes: (a) Short-term impacts result in changes to the environment that are stabilized or mitigated rapidly, do not result in any long-term effects, and typically occur for less than five years. Long-term impacts result in lasting effects that typically occur for more than five years. (b) Negligible differences in totals (1-2 acres) are due to rounding. (c) Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for a detailed description of methods and assumptions for calculating surface disturbance.

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2.7.6 Resource Protection Measures for Alternative A

Resource protection measures include BMPs, design features, RMP-designated stipulations, OCPs, and other measures that would reduce potential adverse impacts to resources and resource uses. Appendix B (*Resource Protection Measures*) identifies potential resource protection measures by resource and the alternative to which they would apply. Resource protection measures that are carried forward in the NPL Project ROD would be applied as COAs during permitting for site-specific development of the NPL Project, as appropriate. Sources of resource protection measures include:

- The BLM PFO Approved RMP and ROD (BLM 2008a) and the BLM Green River Approved RMP and ROD, as amended (BLM 1997a);
- The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e);
- lease stipulations;
- OCPs (OCP 2012);
- Standard BMPs identified in the Gold Book (BLM 2007a); and
- other applicable sources.

For Alternative A, the BLM would implement resource protection and conservation measures unique to the DAs not only based upon, but in addition to, measures included in the current RMPs that govern the BLM RSFO and PFO. Measures additional to the RMPs are considered in this EIS at a programmatic level and would also be considered during site-specific permitting, subject to valid existing lease rights. For Alternative A, the BLM included supplementary resource protection measures in addition to the RMPs in order to: (1) reflect new site-specific information and knowledge for resources in the Project Area since the RMPs were approved; (2) incorporate lessons learned from implementing measures from the existing RMPs for other oil and gas development; and (3) address potential impacts to sensitive wildlife resources identified during scoping. The sections below describe resource protection measures by DA for Alternative A.

2.7.6.1 Resource Protection Measures by Development Area

Resource protection measures would vary depending on the DA being developed and whether or not a species is considered a focus in that DA (Table 2-19). For example, raptors may be considered a focus species in one DA and be considered a non-focus species in another, based on quality and quantity of habitat, identified nest locations, and other information. Stricter resource protection measures would be implemented for the focus species within a DA, whereas protection measures established in the BLM PFO Approved RMP and ROD (BLM 2008a) and BLM Green River Approved RMP and ROD (BLM 1997a) would be applied for non-focus species within a DA. Greater protection for focus species would be applied within certain delineated wildlife habitats. If there are any areas within a DA that are devoid of delineated wildlife habitats, those areas would not be subject to any greater restrictions than are found in the BLM PFO Approved RMP and ROD (BLM 2008a) or the BLM Green River Approved RMP and ROD (BLM 1997a).

Table 2-19. Delineated Habitats for Focus Species by Development Area for Alternative A

Development Area	Delineated Habitats for Focus Species
1	Greater Sage-Grouse, Raptors
2	Pronghorn
3	Greater Sage-Grouse, Raptor, Mountain Plover
4	No focus species identified
5	Raptors
6	Pronghorn, Burrowing Owl, Mountain Plover
7	Prairie Dog

2.7.6.2 Development and Resource Protection Measures in Delineated Habitats for Focus Species

The BLM considered the spatial distribution of various delineated areas and wildlife habitats throughout the Project Area; Alternative A would allow portions of each Phase to be developed seasonally in accordance with applicable TLSs or COAs. Wildlife habitats that have been delineated across the Project Area would be subject to specific conservation measures for each species. Table 2-19 summarizes the presence of focus wildlife species habitat in each DA, and Section 2.7.6.3 (*Resource Protection Measures in Delineated Habitats for Focus Species*) summarizes wildlife-related resource protection measures that would be implemented for each DA. Refer to Section 2.7.3.1 (*Description of Development*) for a description of average well pad density and maximum allowable disturbance in delineated habitats for Alternative A.

Delineated habitats identified in this alternative would be used as the spatial area in which density restrictions and surface disturbance would be calculated and enforced (Map 5). Timing restrictions associated with these delineated habitats would not vary from those afforded in the applicable resource protection measures found in the field offices' RMPs and in Appendix B (*Resource Protection Measures*). The BLM identified raptor nest locations and buffers based on existing data and applicable protective buffers in the Pinedale and Green River RMPs.

Delineated habitats for focus wildlife species within a given DA include:

- Sage-Grouse PHMA (DA 3);
- Sage-Grouse Winter Concentration Areas (DA 1);
- 1-mile buffers of documented Ferruginous Hawk and Bald Eagle nests, regardless of occupancy or current presence of nest (DA 1, DA 3, DA 5);
- 1/2-mile buffers of documented Burrowing Owl, American Kestrel, Prairie Falcon and/or uncharacterized raptor nests, regardless of occupancy or current presence of nest (DA 1, DA 3, DA 5, DA 6);
- Big game crucial winter range (DA 2, DA 6);
- Delineated potential mountain plover habitat (DA 3, DA 6); and
- Delineated white tailed prairie dog towns (DA 7).

2.7.6.3 Resource Protection Measures in Delineated Habitat for Focus Species

In addition to the resource protection measures identified in Appendix B (*Resource Protection Measures*), Table 2-20 identifies resource protection measures that would be applied to delineated habitats for focus wildlife species in the DAs under Alternative A.

Table 2-20. Summary of Resource Protection Measures in Delineated Habitat for Focus Species for Alternative A

Raptors	
Focus Species Habitat Management Development Areas 1, 3, and 5	**Standard Habitat Management Development Areas 2, 4, and 7**
• The Timing Limitation Stipulations for raptor nests and their protective buffers as described in existing NPL federal oil and gas leases as well as in the BLM Pinedale and Green River RMPs and Appendix B (*Resource Protection Measures*). • Development would occur at a density of up to an average of four disturbance locations and less than 20 acres (3 percent) disturbance per 640-acre area in delineated raptor nest buffers, regardless of occupancy or activity.[1,2] • RGFs, compressor stations, other production facilities[3], and powerlines would be prohibited within delineated raptor habitat buffers in DAs 1, 3, and 5.[2] • Refer to Section 2.7.6.2 (*Development and Resource Protection Measures in Delineated Habitats for Focus Species*) for a description of delineated raptor habitat buffers for raptors in Alternative A.[4]	• The Timing Limitation Stipulations for raptor nests and their protective buffers as described in existing NPL federal oil and gas leases as well as in the BLM Pinedale and Green River RMPs and Appendix B (*Resource Protection Measures*). • Production facilities[3] would be permitted in raptor buffers but not within the line of sight from the nest. • No well heads would be visible within the line of sight from the nest within raptor buffers.
Burrowing Owl	
Focus Species Habitat Management Development Area 6	**Standard Habitat Management Development Areas 1, 2, 3, 4, 5 and 7**
Standard raptor protection buffers and timing limitations from the BLM Pinedale and Green River RMPs would apply, as described in Appendix B (*Resource Protection Measures*). In addition, the following measures would apply to delineated burrowing owl habitat in DA 6. • Development would occur at a density of up to an average of four disturbance locations and less than 20 acres (3 percent) disturbance per 640-acre area in delineated burrowing owl nest buffers in DA 6, regardless of occupancy or activity.[1,2] • RGFs, compressor stations, other production facilities[3], and powerlines would be prohibited within delineated burrowing owl habitat buffers in DA 6. • Delineated burrowing owl habitat includes 1/2-mile buffers of documented burrowing owl nests, regardless of occupancy or current presence of nest.	• Within burrowing owl nest buffers in DAs other than DA 6, the standard measures from the BLM Pinedale and Green River RMPs would apply, as described in Appendix B (*Resource Protection Measures*).

Table 2-20. Summary of Resource Protection Measures in Delineated Habitat for Focus Species for Alternative A

<table>
<tr><td colspan="2">White Tailed Prairie Dog</td></tr>
<tr><td>Focus Species Habitat Management
Development Area 7</td><td>Standard Habitat Management
Development Areas 1, 2, 3, 4, 5, and 6</td></tr>
<tr><td>Development would occur at a density of an average of four disturbance locations and less than 20 acres (3 percent) disturbance per 640-acre area in delineated white-tailed prairie dog habitat in DA 7.[2,5]</td><td>In DAs other than DA 7, prairie dogs are considered a focus species within raptor nest buffers in DAs where raptors are a focus species.
• Maximum allowable disturbance of 3 percent of delineated habitat within raptor buffers.[1]</td></tr>
<tr><td colspan="2">Mountain Plover</td></tr>
<tr><td>Focus Species Habitat Management
Development Areas 3 and 6</td><td>Standard Habitat Management
Development Areas 1, 2, 4, 5, and 7</td></tr>
<tr><td>• Development would occur at a density of an average of four disturbance locations and less than 20 acres (3 percent) disturbance per 640-acre area in delineated mountain plover habitat in DA 3 and DA 6.[2,5]
• RGFs, compressor stations, other production facilities[3], and powerlines would be prohibited within delineated mountain plover habitat.</td><td>In DAs other than DAs 3 and 6, mountain plover is considered a focus management species within respective raptor nest buffers in DAs where raptors are a focus species.
• Maximum allowable disturbance of 3 percent of delineated habitat within respective raptor buffers.[1,2]</td></tr>
<tr><td colspan="2">Big Game</td></tr>
<tr><td>Focus Species Habitat Management
Development Areas 1, 2, 3, and 6</td><td>Standard Habitat Management
Development Areas 4, 5, and 7</td></tr>
<tr><td>• Development would occur at a density of an average of four disturbance locations (of up to 19 acres per well pad) and less than 20 acres (3 percent) disturbance per 640 acres in crucial winter ranges in DA 1, DA 2, DA 3, and DA 6.[2,5]</td><td>• Management of big game habitats would comply with the BLM PFO Approved RMP and ROD, the BLM Green River Approved RMP and ROD.</td></tr>
<tr><td colspan="2">Herpetological Species</td></tr>
<tr><td>Focus Species Habitat Management
No Development Areas Identified</td><td>Standard Habitat Management
Development Areas 1, 2, 3, 4, 5, 6, and 7</td></tr>
<tr><td>-</td><td>• To maintain habitat connectivity for herpetological species and to reduce herpetological mortality on roadways, during site-specific permitting, the BLM would assess the potential for construction of bottomless culverts at certain intervals under roadways and the potential for silt fences, which would act as a funnel to guide herpetological passage under roadways.</td></tr>
</table>

Table 2-20. Summary of Resource Protection Measures in Delineated Habitat for Focus Species for Alternative A

<table>
<tr><th colspan="2">Sage-Grouse</th></tr>
<tr><th>Focus Species Habitat Management
Development Areas 1 and 3</th><th>Standard Habitat Management
Development Areas 2, 4, 5, 6, and 7</th></tr>
<tr><td>Management of Sage-Grouse habitats in the Project Area would comply with the BLM PFO Approved RMP and ROD and the BLM Green River Approved RMP and ROD, as amended by the BLM Wyoming Sage-Groups RMP Amendments (BLM 2015e), (see Section 2.4.3 – Greater Sage-Grouse Habitat Management), with the following additions:

Surface-disturbing and disruptive activities in sage-grouse Winter Concentration Areas (all DAs) would be prohibited from December 1 – March 14.
Within DA 1, development would be prohibited in areas containing greater than 5 percent sagebrush canopy cover, except when technically and economically infeasible.
Within DA 1, surface disturbance would not exceed 20 acres (3 percent) surface disturbance per 640 acres, inclusive of existing disturbances.[2,5]
Within DA 1, above-ground facilities would be centralized to locations outside of DA 1, where technically and economically feasible.
Within DA 1, Reardon, Chapel, Alkali Creek, and Burma Road travel routes would not be used during the winter stipulation period (12/1 – 3/14), unless development activity has been authorized within DA 1.
Within PHMA, RGFs and compressor stations would be allowed as long as disturbance does not exceed the 5 percent disturbance threshold described in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e).
Within PHMA, powerlines would be authorized in accordance with the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e), including the authorization of electric distribution lines (lines less than 115 kV) as noted below.

New electric distribution lines will be buried where feasible and economically feasible. If not economically feasible, distribution lines may be authorized when effectively designed/mitigated to protect Sage-Grouse and the AO determines that overhead installation is the action alternative with the fewest adverse impacts while still meeting the project need.
Power lines (distribution and transmission) will be designed to minimize wildlife related impacts and constructed to the latest APLIC standards.

</td>
<td>Management of Sage-Grouse habitats would comply with the BLM PFO Approved RMP and ROD, the BLM Green River Approved RMP and ROD, and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e), including:

Surface-disturbing and disruptive activities in sage-grouse Winter Concentration Areas (all DAs) would be prohibited from December 1 – March 14.
Utilize existing roads and two tracks where feasible and where resource conditions are conducive to use of the two tracks (i.e., where two track roads better respond to soil conditions, where all weather roads are not needed and two tracks can accommodate anticipated traffic loads).
Use areas with less than 5 percent sage-brush canopy where feasible.

If impacts are identified, mitigation practices may be considered to reduce disturbance from drilling and production, such as having centralized facilities, maximizing reclamation efforts, and specifying pad size limits based on the number of pads per acre in each DA.

In DAs other than DA 1 and DA 3, Sage-Grouse are considered focus management species within respective raptor nest buffers in DAs where raptors are a focus species.

Maximum allowable disturbance of 3 percent of delineated habitat within respective raptor buffers.

Exceptions and modifications may be considered, based on current guidance in the BLM PFO Approved RMP and ROD and the BLM Green River Approved RMP and ROD, as amended by the BLM Wyoming Sage-Grouse RMP Amendments, and other applicable decision documents and guidance.</td></tr>
</table>

Table 2-20. Summary of Resource Protection Measures in Delineated Habitat for Focus Species for Alternative A

Focus Species Habitat Management Development Areas 1 and 3	Standard Habitat Management Development Areas 2, 4, 5, 6, and 7
• Above-ground facilities would be centralized outside delineated Sage-Grouse Winter Concentration Areas, where technically and economically feasible. If it is determined to not be technically or economically feasible to locate facilities outside delineated Winter Concentration Areas, facilities would be located on the periphery of Winter Concentration Areas. If impacts are identified, BLM may consider mitigation measures to reduce disturbance from drilling and production, such as further centralizing facilities, maximizing reclamation efforts, and adjusting pad size limits based on the number of pads per acre in DA 1. Exceptions and modifications may be considered, based on current guidance in the BLM PFO Approved RMP and ROD and the BLM Green River Approved RMP and ROD, as amended by the BLM Wyoming Sage-Grouse RMP Amendments, and other applicable decision documents and guidance.	

[1]Maximum allowable disturbance within protective buffers for raptors would be calculated based on the total acreage of the nest buffer around each individual nest divided by 640.
[2]The disturbance threshold of 3 percent (20 acres per square mile) is based on the WGFD Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats (WGFD 2010c)
[3]Production facilities may typically include RGFs, compressor stations, production units, separators, storage tanks, water/methanol tanks, pumps, line heaters, and meter runs.
[4]Protection measure includes all raptors identified in Section 2.7.6.2 (*Development and Resource Protection Measures in Delineated Habitat for Focus Species*), including burrowing owls.
[5]Allowable maximum disturbance for delineated habitats would be calculated based on the total acreage of the delineated habitat in the DA where restrictions apply. Average well pad density in delineated habitats would be calculated based on the total contiguous acreage of the area divided by 640 acres.

AO	BLM Authorizing Officer
BLM	Bureau of Land Management
DA	Development Area
kV	Kilovolt
PHMA	Priority Habitat Management Area
RGF	Regional Gathering Facilities
RMP	Resource Management Plan

Note: The above measures are an extension to what is prescribed in the BLM PFO Approved RMP and ROD and the BLM Green River Approved RMP and ROD; these measures were developed specifically for Alternative A.

2.8 Alternative B (Preferred Alternative)

2.8.1 Introduction

Alternative B is the BLM Preferred Alternative and was developed to address concerns expressed during scoping associated with conserving a broad range of resource values and focusing development in the least environmentally sensitive areas. In contrast to Alternative A, where the density of development and development limitations would be based primarily on wildlife habitat for focus species, development for Alternative B would be based on a broader range of resources including visual resources, paleontological resources, surface water features, identified lands with wilderness characteristics, and other resources (including wildlife habitat). Under Alternative B, the maximum number of wells would be the same as for the Proposed Action, but the DA 1 area (Map 6) would have a reduced density of development, reduced surface disturbance, and more clustering of disturbance locations to reduce impacts to a range of sensitive resources in this area. For Alternative B, the development period would be slightly longer than that of the Proposed Action resulting in slightly fewer new wells drilled per year (on average).

In addition to the Alternative B development prescriptions in the identified DAs (e.g., an average of up to 1 disturbance location per 640 acres in DA 1), Alternative B includes two potential development scenarios for Sage-Grouse Winter Concentration Areas: 1.) Winter Concentration Area development scenario 1 applies a seasonal timing limitation on development during the wintering period as identified in the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e), and 2.) Winter Concentration Area development scenario 2 applies the seasonal timing limitation as well as additional resource protection measures in Winter Concentration Areas including a disturbance threshold and other measures to reduce potential impacts. Under both scenarios, development would be allowed on a limited scale in Winter Concentration Areas. A study would be conducted concurrently with development activities to better understand the impacts of developing in Winter Concentration Areas. The objectives and details of the study will be coordinated with the BLM, WGFD, and other appropriate parties. The results of the study, current information available at the time of site-specific permitting, and current guidance at the time of site-specific permitting would inform BLM understanding of impacts and subsequent development in Winter Concentration Areas, which would inform analysis during site-specific NEPA reviews.

Inclusion of two Sage-Grouse Winter Concentration Area development scenarios provides for a range of development scenarios in the NPL EIS. Winter Concentration Area development scenario 1 reflects current guidance in Wyoming EO 2015-4 and the BLM Wyoming Sage-Grouse Amendments (BLM 2015e). Winter Concentration Area development scenario 2 provides additional protection measures based on issues identified during scoping and other rationale as described in Section 2.8.6 (*Resource Protection Measures for Alternative B)*. Both development scenarios would recognize and be consistent with valid existing rights and guidance at the time of site-specific permitting.

Alternative B is based on the following concepts:

- The Project Area would be divided into three DAs (Map 6). The boundaries of the DAs are based on a range of resource features including visual resources (i.e., Visual Resource Management [VRM] Class III areas), lands with wilderness characteristics, cultural resources, paleontological resources, surface water features, Sage-Grouse PHMA and Winter Concentration Areas, and other resources, as well as on the ground features that allow for identification of DA boundaries on the ground (e.g., existing roads). The average number of disturbance locations per 640 acres would be based on a range of resources resulting in the density of development for each DA as described in Section 2.8.3.1 (*Description of Development*). DAs with a range of sensitive resources (DA 1 and DA 3) would have a lower density of development (an average of up to 1 disturbance location per 640 acres) and the remaining area (DA 2), that has a higher degree of existing development and generally fewer sensitive resources, would have a higher density of development (an average of up to 4 disturbance locations per 640 acres).
- In contrast to Alternative A, development could occur in all DAs simultaneously (i.e., development in the DAs would not be sequential or phased over time).
- A lower density of development in DA 1 (an average of up to 1 disturbance location per 640 acres), compared to the Proposed Action (an average of up to 4 disturbance locations per 640 acres in this area), would result in clusters of development in the least sensitive areas in DA 1. This pattern

of development would conserve larger areas of uninterrupted open space in DA 1 to benefit Sage-Grouse Winter concentration Areas, visual resources, lands with wilderness characteristics, paleontological resources, and other resources that are either within DA 1 or within view of DA 1.

For Alternative B, the BLM would consider limited development in Sage-Grouse Winter Concentration Areas. For purposes of analysis, Alternative B includes two potential development scenarios for Winter Concentration Areas, as described below in Table 2-21. Besides the varying Winter Concentration Area development scenarios, all other components of Alternative B would be the same for both development scenarios.

Table 2-21. Alternative B Sage-Grouse Winter Concentration Area Development Scenarios

Winter Concentration Area Development Scenario 1	Winter Concentration Area Development Scenario 2
Surface disturbing and/or disruptive activities in Sage-Grouse Winter Concentration Areas would be prohibited from December 1 – March 14 (BLM 2015e).	Surface disturbing and/or disruptive activities in Sage-Grouse Winter Concentration Areas would be prohibited from December 1 – March 14 (BLM 2015e).
The DA 1 area (Map 6) would have a density of development averaging up to 1 disturbance location per 640 acres.	The DA 1 area (Map 6) would have a density of development averaging up to 1 disturbance location per 640 acres.
Not included in Winter Concentration Area Development Scenario 1	Within Winter Concentration Areas, surface disturbance would not exceed 32 acres (5 percent) of surface disturbance per 640 acres, inclusive of existing disturbance.
Not included in Winter Concentration Area Development Scenario 1	Above-ground facilities would be centralized to locations outside of Winter Concentration Areas, where technically and economically feasible. For purposes of analysis, Alternative B assumes that two RGFs would be centrally located in Winter Concentration Areas and two RGFs would be centrally located in PHMA.
Not included in Winter Concentration Area Development Scenario 1	Within Winter Concentration Areas, development would be phased from east to west.
Not included in Winter Concentration Area Development Scenario 1	Buried pipelines would be constructed to transport produced water and condensate from RGFs within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas. Produced water that is not injected at RGF locations and condensate would then be trucked from RGFs outside of Winter Concentration Areas and PHMA to treatment locations (produced water) and sales points (condensate).
Not included in Winter Concentration Area Development Scenario 1	Powerlines in Sage-Grouse PHMA and Winter Concentration Areas would be buried, where feasible.

Note: Besides the differences in Sage-Grouse Winter Concentration Area development noted above, all other components of Alternative B development would be the same under the two Winter Concentration Area development scenarios.

A variety of project components, equipment, and other aspects of Alternative B would be similar to the Proposed Action. Only those subsections and details that would differ substantively from the Proposed Action are discussed below. The alternatives are compared in Section 2.10 (*Comparison of Alternatives*) and Section 2.11 (*Summary of Impacts*). Refer to Table 2-28 (*Comparison of Key Features of the Alternatives*) for a comparison of the key features of the alternatives.

2.8.2 Project Components

Project components would generally be similar to the Proposed Action and include directionally drilled natural gas wells on multi-well pads, water disposal wells, existing and new pipelines, powerlines, access roads, and RGFs. Though the project components would be similar to the Proposed Action, the lower density of development in DA 1 for Alternative B would result in fewer well pads, with a generally greater number of wells per pad in DA 1 compared to the Proposed Action. Clusters of development would be focused in areas with lower resource sensitivity (DA 2). Within the DA 1, a lower density of development may result in a more clustered pattern of development in this area, compared to the Proposed Action.

The sections below identify differences in project components and their locations compared to the Proposed Action.

2.8.2.1 Regional Gathering Facilities and Powerlines

Similar to the Proposed Action, RGFs would be allowed in Sage-Grouse PHMA and Sage-Grouse Winter Concentration Areas and development of powerlines in PHMA would comply with the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e). For purposes of analysis, Alternative B assumes that two RGFs would be centrally located in Winter Concentration Areas and two RGFs would be centrally located in PHMA[22]. For Winter Concentration Area Development Scenario 2, within Winter Concentration Areas and PHMA buried pipelines would be developed within a 75-foot wide construction ROW to transport produced water and condensate from RGFs within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas.

[22]*The BLM Wyoming Sage-Grouse RMP Amendments* (*BLM 2015e*) *indicate that liquids gathering facilities should be centralized/clustered and placed outside of Sage-Grouse priority areas. Jonah Energy has proposed the use of centralized RGFs within three-miles of well pad clusters. However, due to the contiguous acreage of Sage-Grouse PHMA (Map 40) in the Project Area, it may not be technically feasible to develop the NPL Project without placing RGFs in PHMA. For purposes of analysis, this EIS assumes that up to two RGFs would be located in PHMA. During site-specific permitting, placement of RGFs in priority habitats would be avoided, if possible. If RGFs in priority habitats are technically necessary to develop the NPL Project, appropriate mitigation (including appropriate additional mitigation) would be applied during site-specific permitting.*

Within Sage-Grouse PHMA, powerlines would be authorized in accordance with the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e), including the authorization of electric distribution lines (less than 115 kV), as noted below:

- New electric distribution lines will be buried where feasible and economically feasible. If not economically feasible, distribution lines may be authorized when effectively designed/mitigated to protect Sage-Grouse and the AO determines that overhead installation is the action alternative with the fewest adverse impacts while still meeting the project need.[23]
- Power lines (distribution and transmission) will be designed to minimize wildlife related impacts and constructed to the latest Avian Power Line Interaction Committee (APLIC) standards.

For Alternative B, Winter Concentration Area development scenario 2, powerlines in Winter Concentration Areas (Map 40b) would be buried, where feasible.

2.8.2.2 Pipelines

Similar to the Proposed Action, for Alternative B pipelines and roads would share a common 100-foot ROW corridor.

Alternative B includes a lower density of development in the DA 1 area which would result in fewer well pads, a generally greater number of wells per pad in DA 1, and fewer miles of pipelines in the DA 1 area compared to the Proposed Action. As a result, Alternative B would have an estimated 22 fewer miles of pipelines, compared to the Proposed Action. Refer to Tables 2-25 and 2-26 and Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for more information on estimated mileage and surface disturbance for pipelines.

For the Alternative B Winter Concentration Area development scenario 1, produced water and condensate would be transported from RGFs in Winter Concentration Areas and PHMA via truck, similar to the Proposed Action. As indicated in Table 2-26, for the Alternative B Winter Concentration Area development scenario 2, buried pipelines would be developed within a 75-foot wide construction ROW to transport produced water and condensate from RGFs within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas. Produced water that is not injected at RGF locations and condensate would then be trucked from RGFs outside of Sage-Grouse Winter Concentration Areas and PHMA to treatment locations (produced water) and sales points (condensate). This development approach would increase short-term surface disturbance but would reduce vehicle traffic, noise, and other project-related activity in Sage-Grouse PHMA and Winter Concentration Areas over the life of the project, compared to the Proposed Action.

To estimate the potential miles of pipelines and surface disturbance associated with these buried produced water and condensate pipelines under Winter Concentration Area development scenario 2, the BLM identified conceptual locations of the RGFs based on the methodology as described in Appendix D (*Surface Disturbance and Duration of Development Worksheets*). For purposes of analysis, Alternative B assumes that these pipelines would result in up to 15 miles of construction ROW for the buried pipelines between RGFs in Sage-Grouse Winter Concentration Areas and PHMA and RGFs outside of

[23] *At this programmatic level, it is not possible to determine with any degree of certainty which powerlines would be feasible to bury. Determinations on the feasibility to bury powerlines would be conducted during site-specific permitting. As a result, and for purposes of analysis, the NPL EIS assumes and analyzes the potential impacts of all powerlines being overhead. Appropriate design features and mitigation measures for powerlines would be considered and applied at a site-specific level during the processing of APDs or ROW applications.*

these areas, constituting an estimated 132 acres of short-term surface disturbance. Construction practices, equipment, and components for the pipelines would be based on industry standard practices and construction, operation, and maintenance would be in accordance with all governing regulations and standards. The ultimate size and location of the pipelines would be based on the final placement of the RGFs during site-specific permitting.

2.8.2.3 Roads and Access

Similar to the Proposed Action, roads and pipelines would share a common 100-foot wide ROW corridor.

Alternative B includes a lower density of development in the DA 1 area (average of up to 1 disturbance location per 640 acres), compared to the Proposed Action. This development approach would result in fewer well pads, a generally greater number of wells per pad in DA 1, and fewer miles of access roads in the DA 1 area compared to the Proposed Action. As a result, Alternative B would have an estimated 22 fewer miles of access roads, compared to the Proposed Action. Refer to Table 2-25, Table 2-26, and Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for more information on estimated mileage and surface disturbance for access roads.

In contrast to the Proposed Action, for Alternative B project-related traffic could utilize North Burma Road north of the project boundary. All other components of roads and access would be the same as the Proposed Action.

2.8.3 Description of Drilling and Operations

In general, Alternative B would include similar pre-construction activities, construction, drilling and completion operations, and production and maintenance operations as those described under the Proposed Action, unless otherwise noted. Though the project components would be similar to those of the Proposed Action, the density of development would be reduced in DA 1, there would generally be more wells per pad in DA 1 due to the lower density of well pads (average of up to 1 disturbance location per 640 acres), and the development approach in Sage-Grouse Winter Concentration Areas would vary from the Proposed Action.

2.8.3.1 Description of Development

The Project Area would be divided into three DAs with DA boundaries based on a range of resource features including visual resources (i.e., VRM Class III areas), lands with wilderness characteristics, Sage-Grouse PHMA, Winter Concentration Areas, and other resources, as well as on the ground features that allow for identification of DA boundaries on the ground (e.g., existing roads).

DA 1 covers approximately 38,384 acres (27 percent of the Project Area) and is located along the western and northern borders of the Project Area (Map 6). The boundaries of DA 1 and the density of development consider a range of resources in the area including VRM Class III areas (Map 27), lands with wilderness characteristics (Map 12), Alkali Creek and Alkali Draw surface water features and watersheds (Map 29), portions of the Wasatch Formation with high potential for paleontological resources (Map 9), Sage-Grouse Winter Concentration Areas (Map 40b), portions of Big Game crucial winter range and migration routes (Map 37b), and raptor nests and protective buffers (Map 39b). Within DA 1, development would occur at a density averaging no more than one disturbance location per 640 acres.

For Alternative B, the BLM would consider limited development in Sage-Grouse Winter Concentration Areas, which primarily occur in DA 1 (Map 40b). For purposes of analysis, Alternative B includes two potential development scenarios for Winter Concentration Areas, as described in Table 2-21.

DA 2 covers approximately 54,441 acres (39 percent of the Project Area) in the central portion of the Project Area, mostly adjacent to the JIDPA (Map 6). Based on the identified resources in DA 2, the proximity to the JIDPA, and existing development and infrastructure already in DA 2 (Map 3), this area would have a higher density of development compared to the other DAs. Within DA 2, development would occur at a density averaging no more than 4 disturbance locations per 640 acres.

DA 3 covers approximately 48,034 acres (34 percent of the Project Area) in the southeastern portion of the Project Area and is defined by Sage-Grouse PHMA (Map 6). DA 3 also contains the North Sublette Meadow Spring Variant of the Sublette Cutoff and the associated three-mile viewshed (Map 8) as well as raptor nests and protective buffers, prairie dog habitat, and mountain plover habitat (Map 38b). Development in DA 3 would be consistent with State of Wyoming EO 2015-4 and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) with density of development averaging no more than one disturbance location per 640 acres and not to exceed 32 acres (5 percent) surface disturbance per 640 acres, inclusive of existing disturbances, calculated using the DDCT process.

Average disturbance location density would be calculated based on the total contiguous acreage of the DA divided by 640 acres.

Table 2-22 provides the estimated development summary for Alternative B.

Table 2-22. Estimated Development Summary for Alternative B

Type of Development	Amount
Estimated Number of New Directionally Drilled Wells from Multi-well Pads	3,500
Estimated Number of New Wells (per year)[1]	336
Estimated Duration of Development (years)[2]	10.4
Development Timeframe (years)[3]	1-10.4
Field Production Duration (years)	40.4
Field Production Timeframe (years)[3]	1-40.4
Full Production Phase Duration (years)	30
Full Production Timeframe (years)[3,4]	10.4-40.4
Total Life of Project (years)	**40.4**

[1]Assumes the same maximum number of wells as the Proposed Action (3,500). However, since the duration of development is slightly longer than the Proposed Action, the maximum number of new wells per year would be less than the Proposed Action.
[2]Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for more information on estimated duration of development.
[3]Timeframes identify the years in which a certain project phase would occur. For example, the development timeframe would occur in years 1 through 10.4 and full production would occur in years 10.4 through 40.
[4]Full production phase and timeframe includes initiation of final reclamation of production wells and facilities.

2.8.3.2 Water Use

Similar to the Proposed Action, Alternative B would require an estimated 35,000 bbls of water for drilling and completions of each well with all water for completions (71 percent of total water use for drilling and completions, 25,000 bbls per well) coming from recycled sources and all water for drilling (29 percent of total water use for drilling and completions, 10,000 bbls per well) coming from shallow groundwater wells in the top 1,000 feet of the Wasatch Aquifer. Alternative B would require an estimated 11,827 bbls of groundwater per year for new road construction dust control during the development phase and an estimated 74,950 bbls of groundwater per year for road maintenance dust control during the development phase. Alternative B would require an estimated 60,480 bbls of groundwater per year for well pad construction dust control. Water used for well drilling would be trucked from groundwater well locations to well pads and stored in water tanks on site, and would not be transported by pipeline.

Due to fewer miles of pipelines than the Proposed Action, Alternative B would require less water for hydrostatic testing of pipelines, compared to the Proposed Action. Alternative B would require an estimated 24,174 bbls of groundwater per year for hydrostatic testing of pipelines during the 10.4 year development period.

Alternative B would result in a total estimated groundwater use of 3,531,431 bbls per year during the 10.4 year development phase (455.2 acre-feet per year) for a total estimated groundwater use of 36,726,882 bbls during the 10.4 year development phase (4,734.1 acre-feet). Alternative B would result in an estimated groundwater use of 123,000 bbls per year (15.9 acre-feet per year) for road maintenance dust control during the full production phase (years 11-40) for a total estimated groundwater use of 477.0 acre-feet during the 30-year full production phase.

Refer to Table 2-28 for a description and comparison of water use and other key features of the Proposed Action and alternatives and refer to Appendix K (*Water Resource Support Appendix*) for additional information on water use and potential impacts for the Proposed Action and alternatives. For the Proposed Action and all alternatives, in advance of development, Jonah Energy would work with appropriate federal, state, and local agencies to implement an acceptable groundwater monitoring program for the NPL Project consistent with WOGCC rules to establish and monitor the quality of groundwater around sites prior to, during, and after development.

2.8.3.3 Reclamation and Monitoring

For Alternative B, reclamation, monitoring, and final abandonment would follow the standards described in Appendix C (*Reclamation, Monitoring, and Weed Management Plan*).

2.8.4 Development and Production Workforce and Transportation

2.8.4.1 Development and Production Jobs

Similar to the Proposed Action, under Alternative B the existing Jonah Energy workforce facility would be utilized to house workers to the extent possible. The total estimated number of jobs would be the same as for the Proposed Action and all jobs would be full-time, year-round during the respective phase. Table 2-23 identifies the estimated number of development and production jobs for Alternative B.

Table 2-23. Type and Number of Jobs During Development and Production for Alternative B

Type of Job	Development Phase (Years 0-10)	Full Production (Years 11-40)[1]
Drilling and Completions: 16 Production Staff 9 Drilling Supervisors 24 Completions Supervisors 12 Regulatory/Reclamation Staff 15 Construction Supervisors 150 Construction and Maintenance Staff (50 completions hands and supervisors per rig X 10 rigs) = 500 total completions hands	726	-
Production: 150 Pumpers 30 Supervisors 11 Facility Operators 33 Liquids Haulers[2] 4 Environmental Specialists	228	228
Total	**954**	**228[1]**

[1]Actual number of production jobs at any one time will vary throughout the life of the project, depending on the project phase.
[2]While Alternative B-2 would include a buried pipeline network to transport produced water and condensate from RGFs inside Sage-Grouse PHMA and Winter Concentration Areas to RGFs outside these areas, the overall number of liquid hauler jobs are not expected to change. However, the location of where these liquids haulers would travel would change between the Proposed Action and Alternative B-2 (i.e., less hauler traffic in PHMA and Winter Concentration Areas and more hauler traffic outside these areas).

Notes: (a) Job estimates are based on best available information and are subject to revision based on changing conditions.
Note: The job numbers presented in the table above represent total jobs during the respective phase (i.e., jobs are not reported for each year, but the total number of jobs during the respective phase). (b) For purposes of analysis, the EIS assumes that for Alternatives B, all jobs would be full-time, year-round, throughout the duration of the respective phase. (c) Due to the nature of jobs associated with decommissioning and reclamation activities (not occurring every day or year round) and the relatively low levels of jobs for these activities it is assumed that jobs associated with decommissioning and reclamation would be negligible and within the scope of analysis for the estimated jobs for drilling, completions, and production.

2.8.4.2 Development and Production Transportation

Transportation associated with the NPL Project under Alternative B would occur during all phases of the project including drilling, completion, production, and reclamation. The total estimated number of vehicle trips per day would be the same as for the Proposed Action. Table 2-24 identifies the estimated daily number of heavy, light, and total vehicle trips during drilling, completion, production, and reclamation. However, for Alternative B, the location of vehicle traffic within the Project Area would vary from the Proposed Action. For Alternative B, buried pipelines would be developed to transport produced water and condensate from RGFs within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas. Produced water that is not injected at RGF locations and condensate would then be trucked from RGFs outside of Winter Concentration Areas and PHMA to treatment locations (produced water) and sales points (condensate). This development approach would reduce vehicle traffic to and from RGFs within PHMA and Winter Concentration Areas during production, but would increase vehicle traffic to and from RGFs outside of these areas during production.

Table 2-24. Type and Number of Vehicle Trips for Alternative B (per 24-hour day)

	Heavy Vehicle Trips	Light Vehicle Trips	Total Vehicle Trips by Phase
Drilling	20	306	326
Completion	165	18	183
Production	121	1,163	1,284

Source: See Appendix E (*Transportation Plan*).

Note: (a) Vehicle trips per day are calculated based on the number of wells per year and the vehicle trips per well reported in Appendix E (*Transportation Plan*). (b) Vehicle trip estimates are based on existing information and are subject to revision based on changing conditions. It is assumed that these vehicle trip estimates include reclamation-related vehicle trips. (c) Due to the nature of jobs associated with decommissioning and reclamation activities (not occurring every day or year round) and the relatively low levels of jobs and vehicle trips for these activities it is assumed that vehicle trips associated with decommissioning and reclamation would be negligible and within the scope of analysis for the estimated vehicle trips for drilling, completions, and production.

2.8.5 Surface Disturbance

Alternative B, Winter Concentration Area development scenario 1 would result in an estimated short-term surface disturbance of 5,742 acres in the Project Area (4.1 percent of the Project Area). After interim reclamation, an estimated 1,741 acres, or 1.2 percent of the Project Area, would remain disturbed for the life of the project, consisting of permanent facilities (e.g., RGFs), access roads, and equipment areas needed for ongoing production, servicing, and maintenance activities. Table 2-25 presents surface disturbance for the areas with varying density of development (varies by DA).

Alternative B, Winter Concentration Area development scenario 2 would result in an estimated short-term surface disturbance of 5,874 acres in the Project Area (4.2 percent of the Project Area). After interim reclamation, an estimated 1,741 acres, or 1.2 percent of the Project Area, would remain disturbed for the life of the project, consisting of permanent facilities (e.g., RGFs), access roads, and equipment areas needed for ongoing production, servicing, and maintenance activities. Table 2-26 presents surface disturbance for the areas with varying density of development (varies by DA). Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for more information on assumptions and methods for estimating surface disturbance.

Table 2-25. Surface Disturbance Estimates for Alternative B, Winter Concentration Area Development Scenario 1

Project Component	Description	Disturbance Calculation Assumption	Estimated Number of Structure Sites or Length of Project Component	Total Short-Term Disturbance (acres)			*Total*	Total Long-Term Disturbance (acres)			*Total*
				DA 1	*DA 2*	*DA 3*		*DA 1*	*DA 2*	*DA 3*	
Multi-well Natural Gas Pads	Directionally drilled wells would be included on each well pad, assuming varying density of development based on DA[1]	Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for information on assumptions and methods for estimating surface disturbance	3,500 directionally drilled natural gas wells	251	2,289	310	2,849	63	572	77	712
Pipelines	Includes disturbance for the three-phase pipeline gathering system to transport comingled product from well pads to RGFs and pipelines connecting RGFs to existing sales pipelines	Pipelines and roads would share a common 100-foot ROW corridor with access roads	205 miles of new buried pipelines	174	1,476	214	1,864	0	0	0	0
Regional Gathering Facilities	RGFs would consist of compressor stations, dehydration units, metering facilities, vapor recovery units, and stock tanks	Assumes 20 acres per RGF	11 (2 in DA 1, 7 in DA 2, 2 in DA 3,)	40	140	40	220	40	140	40	220
Powerlines	Electrical distribution lines to power compressor stations and certain emission control technologies to be used at RGFs	Based on estimated locations and number of RGFs using 40-foot disturbance buffer along powerline alignments	38.6 miles of powerlines	34	120	34	188	34	120	34	188
Access Roads	Access roads connecting multi-well pads and other locations to established roads	Pipelines and roads would share a common 100-foot ROW corridor with pipelines	205 miles of new access roads	58	492	71	621	58	492	71	621
Total				**556**	**4,516**	**670**	**5,742**	**195**	**1,324**	**223**	**1,741**

[1]Alternative B includes varying densities of development based on the DAs as described below:

DA 1: Average of up to one well pad per 640 acres
DA 2: Average of up to four well pads per 640 acres
DA 3: Average of up to one well pad per 640 acres and no more than 5 percent disturbance per 640 acres

DA Development Area
RGF Regional Gathering Facilities
ROW right-of-way

Notes: (a) Short-term impacts result in changes to the environment that are stabilized or mitigated rapidly, do not result in any long-term effects, and typically occur for less than five years. Long-term impacts result in lasting effects that typically occur for more than five years. (b) Negligible differences in totals (1-2 acres) are due to rounding. (c) Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for a detailed description of methods and assumptions for calculating surface disturbance.

Table 2-26. Surface Disturbance Estimates for Alternative B, Winter Concentration Area Development Scenario 2

Project Component	Description	Disturbance Calculation Assumption	Estimated Number of Structure Sites or Length of Project Component	Total Short-Term Disturbance (acres)			*Total*	Total Long-Term Disturbance (acres)			*Total*
				DA 1	*DA 2*	*DA 3*		*DA 1*	*DA 2*	*DA 3*	
Multi-well Natural Gas Pads	Directionally drilled wells would be included on each well pad, assuming varying density of development based on DA[1]	Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for information on assumptions and methods for estimating surface disturbance	3,500 directionally drilled natural gas wells	251	2,289	310	2,849	63	572	77	712
Pipelines	Includes disturbance for the three-phase pipeline gathering system to transport comingled product from well pads to RGFs and pipelines connecting RGFs to existing sales pipelines	Pipelines and roads would share a common 100-foot ROW corridor with access roads	205 miles of new buried pipelines	174	1,476	214	1,864	0	0	0	0
Pipelines	Includes disturbance for buried pipelines to transport condensate and produced water from RGFs in Winter Concentration Area and PHMA to RGFs outside these areas	Assumes a 75-foot wide construction ROW corridor. Condensate and produced water lines would be buried in the same trench in the corridor	15 miles of new buried pipelines	38	30	64	132	0	0	0	0
Regional Gathering Facilities	RGFs would consist of compressor stations, dehydration units, metering facilities, vapor recovery units, and stock tanks	Assumes 20 acres per RGF	11 (2 in DA 1, 7 in DA 2, 2 in DA 3,)	40	140	40	220	40	140	40	220
Powerlines	Electrical distribution lines to power compressor stations and certain emission control technologies to be used at RGFs	Based on estimated locations and number of RGFs using 40-foot disturbance buffer along powerline alignments	38.6 miles of powerlines	34	120	34	188	34	120	34	188
Access Roads	Access roads connecting multi-well pads and other locations to established roads	Pipelines and roads would share a common 100-foot ROW corridor with pipelines	205 miles of new access roads	58	492	71	621	58	492	71	621
Total				**594**	**4,546**	**734**	**5,874**	**195**	**1,324**	**223**	**1,741**

[1]Alternative B includes varying densities of development based on the DAs as described below:

DA 1: Average of up to one well pad per 640 acres
DA 2: Average of up to four well pads per 640 acres
DA 3: Average of up to one well pad per 640 acres and no more than 5 percent disturbance per 640 acres

DA Development Area
RGF Regional Gathering Facilities
ROW right-of-way

Notes: (a) Short-term impacts result in changes to the environment that are stabilized or mitigated rapidly, do not result in any long-term effects, and typically occur for less than five years. Long-term impacts result in lasting effects that typically occur for more than five years. (b) Negligible differences in totals (1-2 acres) are due to rounding. (c) Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for a detailed description of methods and assumptions for calculating surface disturbance.

2.8.6 Resource Protection Measures for Alternative B

Resource protection measures include BMPs, design features, stipulations, OCPs, and other measures that would reduce potential adverse impacts to resources and resource uses. Appendix B (*Resource Protection Measures*) identifies potential resource protection measures by resource and the alternative to which they would apply. Resource protection measures that are carried forward in the NPL Project ROD would be applied as COAs during permitting for site-specific development of the NPL Project, as appropriate. Sources of resource protection measures include:

- The BLM PFO Approved RMP and ROD (BLM 2008a) and the BLM Green River Approved RMP and ROD, as amended (BLM 1997a);
- The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e);
- lease stipulations;
- OCPs (OCP 2012);
- standard BMPs identified in the Gold Book (BLM 2007a);
- measures identified by cooperating agencies, the BLM ID Team, and other entities as part of the EIS process; and
- other applicable sources.

For Alternative B, the BLM would implement resource protection and conservation measures unique to the DAs not only based upon, but in addition to, measures included in the current RMPs that govern the BLM RSFO and PFO. Measures additional to the RMPs are considered in this EIS at a programmatic level and would also be considered during site-specific permitting, subject to valid existing lease rights. For Alternative B, the BLM included supplementary resource protection measures in addition to the RMPs in order to: (1) reflect new site-specific information and knowledge for resources in the Project Area since the RMPs were approved; (2) incorporate BLM experience from implementing measures from the existing RMPs for other oil and gas development; and (3) address potential impacts to sensitive wildlife resources identified during scoping.

2.9 Alternatives Considered but Eliminated from Detailed Analysis

During the NPL Project EIS process, the BLM considered several alternatives and alternative components that were eventually eliminated from detailed analysis in this EIS. In accordance with 40 CFR 1502.14 and the BLM NEPA Handbook (H-1790-1), this section identifies alternatives considered and briefly describes why they were eliminated from further detailed analysis. In general, alternatives are eliminated from further detailed analysis if they meet any of the following criteria:

- The alternative is ineffective (it would not respond to the purpose and need);
- the alternative is technically or economically infeasible (consider whether implementation of the alternative is likely given past and current practice and technology; this does not require information about an applicant's costs and profits);
- the alternative is inconsistent with the basic policy objectives for the management of the area;
- implementation of the alternative is remote or speculative;
- the alternative is substantially similar in design to an alternative that is analyzed; and
- the alternative would have substantially similar effects to an alternative that is analyzed.

2.9.1 Wildlife and Resource Protection Alternative

During the July 2011 alternatives development workshop, attendees discussed the potential for a wildlife and resource protection alternative that would guide development in response to sensitive wildlife resources as well as other issues identified during scoping. The BLM determined that many of the initial elements of a resource protection alternative would be more effective as resource protection measures under other alternatives; furthermore, the concept was similar to Alternative A. This alternative was eliminated from further detailed analysis because it would be substantially similar to, and result in similar effects as, other action alternatives being analyzed in this EIS.

2.9.2 Paced Development Alternative

During the July 2011 alternatives development workshop, attendees discussed the potential for a paced development alternative that would analyze a range of development paces including 22 percent, 36 percent, 75 percent, and 100 percent of the development proposed in the Proposed Action. The objective of the paced development alternative was to respond to public and agency concerns related to project-related air emissions and impacts on air quality. Several cooperating agencies expressed concern that low paces of development may not be technically or economically feasible. A variety of components of this alternative are addressed in the General Conformity requirements for all alternatives described in Section 2.4.2 (*General Conformity*) and other components were integrated into Alternative A. This alternative was eliminated from further detailed analysis because lower paces of development may not be technically or economically feasible and because concerns associated with project-related emissions would be addressed by the General Conformity requirements that are common to all alternatives.

2.9.3 No Net Increase Emissions Alternative

This alternative was considered to address the EPA's designation of marginal ozone nonattainment for the UGRB that went into effect on July 20, 2012, as well as local and regional air quality concerns expressed during scoping and the alternatives development process. Under this alternative, the level of field development would have been limited to ensure that development and operations would result in no net increase of nitrogen oxides and volatile organic compound emissions, the precursor pollutants of ozone, through the use of emission offsets or credits. The no net increase alternative was eliminated from detailed analysis due to the lack of remaining offsets and credits available in UGRB that would be required to implement the alternative. Therefore, the no net increase alternative was eliminated from further detailed analysis and not considered a reasonable alternative. Additionally, any alternative that is selected for the ROD must demonstrate conformity before the BLM can approve it, so regulatory requirements for General Conformity will ultimately be addressed in the final selected alternative.

2.9.4 Project Area-wide Low Density of Development Alternative

The BLM considered an alternative that would limit the density of development to one well pad per 640-acres across the entire Project Area, which would reduce surface disturbance compared to the Proposed Action and other action alternatives. The BLM determined that this level of restriction was not warranted in all areas, that the Proposed Action already limits development to one well pad per 640-acres in Sage-Grouse PHMA, and that Alternatives A and B already limit well pad density in other areas where there are sensitive resources. The BLM further determined that limiting development to one well pad per 640 acres throughout the Project Area would not be responsive to the key issues associated with localized resources identified during scoping (e.g., Sage-Grouse Winter Concentration Areas, big game migration routes). Additionally, the Proponent indicated that limiting the density of development to one well pad per 640-acre area across the Project Area may not be economically feasible, and that the economic viability of this alternative would depend on a variety of factors that are beyond the Proponent's control. As a result, this alternative was eliminated from further detailed analysis.

2.9.5 Use of Surface Pipelines

The BLM considered the use of surface pipelines instead of buried pipelines to reduce surface disturbance. This alternative was eliminated from further detailed analysis because the BLM determined that, based on past and current technology and practice, surface pipelines would be technically or economically infeasible and may increase impacts to other resources (in addition to surface disturbance) compared to other action alternatives. Primary reasons why this option was eliminated from further analysis include:

- Surface pipelines are susceptible to ultraviolet light;
- surface pipelines can pose a safety threat to the public;
- surface pipelines would conflict with overhead powerlines more than buried pipelines;
- surface pipelines can be damaged due to outdoor human activities (e.g., surface pipelines are vulnerable to bullet holes); such incidents are not normally documented;
- surface pipelines are more likely to be affected by wildfires;
- surface pipelines can be a visual intrusion on the landscape;
- construction of surface pipelines still requires the use of track vehicles;
- surface pipelines are likely to corrode due to contact with the soil surface (soil resistivity);
- surface pipelines are likely to freeze due to extreme temperature changes, causing hydrates to collect in the pipe.

2.9.6 Evaporation Ponds

The BLM considered including onsite evaporation ponds to store and treat wastewater to reduce the number of vehicle trips and to reduce the need for water disposal and injection in other areas. The BLM determined that approved operations in the Project Area may not produce enough water to make evaporation ponds technically or economically feasible, and that evaporation ponds could result in additional surface disturbance, potential wildlife impacts, and increased potential for fugitive release of hydrocarbon emissions and other pollutants from evaporation as compared to water disposal and injection. Additionally, given past and current BLM experience in the BLM PFO and RSFO, evaporation ponds have not always proven to be successful. As a result, inclusion of onsite evaporation ponds was eliminated from further analysis.

2.9.7 Prohibiting Development in Lands with Wilderness Characteristics

The BLM considered including an alternative that would prohibit development in areas identified as lands with wilderness characteristics in the Project Area. Prohibiting development in lands with wilderness characteristics was eliminated from further analysis for not meeting the purpose and need and not honoring valid and existing lease rights.

2.9.8 Increased Level of Development for the No Action Alternative

The BLM considered including a No Action Alternative with an increased level of development in the Project Area (e.g., Jonah Energy requested analysis of a No Action Alternative with 61 wells per year). The BLM NEPA Handbook (H-1790-1) indicates that the No Action Alternative must only analyze what is reasonably foreseeable if the application is denied, and that the No Action Alternative should provide a useful baseline for comparison of environmental effects. The BLM determined that the No Action Alternative of three new wells per year represents the reasonably foreseeable development in the Project Area because an average of three new wells have been developed per year in the Project Area since 1997 (BLM 2011b). The BLM also determined that this historic rate of development would provide a useful baseline for comparison of environmental effects resulting from the action alternatives. As a result, an increased level of development for the No Action Alternative was eliminated from further analysis.

2.9.9 Additional Protection Measures for Development in Sage-Grouse Winter Concentration Areas

The BLM considered a range of additional protection measures for development in Sage-Grouse Winter Concentration areas, including shutting in wells during the wintering period; prohibiting RGFs and powerlines; requiring all powerlines be buried; a longer seasonal timing limitation; and other measures. The BLM determined that these additional protection measures for development in Sage-Grouse Winter Concentration Areas would not be technically or economically feasible. As a result, additional protection measures for development in Sage-Grouse Winter Concentration Areas, beyond those included in the alternatives, were eliminated from further analysis.

2.10 Comparison of Alternatives

This section provides a comparison of the alternatives, including a comparison of estimated surface disturbance among the alternatives (Table 2-27) and a comparison of key features of the alternatives (Table 2-28).

Table 2-27. Comparison of Surface Disturbance Estimates for the Alternatives

New Facility/Feature	Estimated New Surface Disturbance by Alternative														
	No Action			Proposed Action			Alternative A			Alternative B, Winter Concentration Area Development Scenario 1			Alternative B, Winter Concentration Area Development Scenario 2		
	Size or Number	*Short-term (acres)*	*Long-term (acres)*	*Size or Number*	*Short-term (acres)*	*Long-term (acres)*	*Size or Number*	*Short-term (acres)*	*Long-term (acres)*	*Size or Number*	*Short-term (acres)*	*Long-term (acres)*	*Size or Number*	*Short-term (acres)*	*Long-term (acres)*
Wells and Well Pads															
New Wells	30 wells[1]	111[1]	45[5]	3,500 wells	3,180	795	3,500 wells	3,004	751	3,500 wells	2,849	712	3,500 wells	2,849	712
Subtotal	-	**111**	**45**	-	**3,180**	**795**	-	**3,004**	**751**	-	**2,849**	**712**	-	**2,849**	**712**
Construction and Production Facilities															
Regional Gathering Facilities or Compressor Stations	0[2]	0	0	11[8]	220	220	11[8]	220	220	11[8]	220	220	11[8]	220	220
Subtotal	**0**	**0**	**0**	-	**220**	**220**	-	**220**	**220**	-	**220**	**220**	-	**220**	**220**
Linear Features															
Gas Pipelines	12 miles 30-foot wide ROW	45[3]	0[6]	227 miles Pipelines and Roads share 100-foot ROW	2,065	0[6]	195 miles Pipelines and Roads share 100-foot ROW	1,958	0[6]	205 miles Pipelines and Roads share 100-foot ROW	1,864	0[6]	205 miles Pipelines and Roads share 100-foot ROW	1,864	0[6]
Access Roads	12 miles 40-foot wide ROW	57[4]	34[7]	227 miles	688	688	215 miles	653	653	205 miles	621	621	205 miles	621	621
Electric Powerlines	0[2]	0	0	38.6 miles 40-foot ROW	187	187	38.6 miles 40-foot ROW	187	187	38.6 miles 40-foot ROW	188	188	38.6 miles 40-foot ROW	188	188
Condensate and Produced Water Pipelines in Project Area (share same trench)	NA	NA	NA	NA	NA	NA	50 miles 50-foot ROW[9]	302	0	NA	NA	NA	15 miles 75-foot ROW	132	0
Condensate Pipeline (outside Project Area)	NA	NA	NA	NA	NA	NA	70 miles 50-foot ROW	424[10]	0	NA	NA	NA	NA	NA	NA
Subtotal	-	**102**	**34**	-	**2,940**	**875**	-	**3,525**	**840**	-	**2,673**	**809**	-	**2,805**	**809**
Short-term Surface Disturbance Totals															
Total Short-term Surface Disturbance	-	**213**	-	-	**6,340**	-	-	**6,748[11]**	-	-	**5,742**	-	-	**5,874**	-
Total Short-term Surface Disturbance as percent of Project Area	-	**0.15%**	-	-	**4.5%**	-	-	**4.5%[11]**	-	-	**4.1%**	-	-	**4.2%**	-
Long-term Surface Disturbance Totals															
Total Long-term Surface Disturbance	-	-	**79**	-	-	**1,890**	-	-	**1,811**	-	-	**1,741**	-	-	**1,741**
Long-term Surface Disturbance as percent of Total Project Area	-	-	**0.06%**	-	-	**1.3%**	-	-	**1.3%**	-	-	**1.2%**	-	-	**1.2%**

[1]Assumes 3.7 acres of short-term disturbance per well for wells over a 10-year period, per the BLM PFO Proposed RMP and Final EIS (BLM 2008b).
[2]Assumes no new RGFs, compressor facilities, or powerlines.
[3]Assumes 1.5 acres of short-term disturbance for pipelines for each well per the BLM PFO Proposed RMP and Final EIS (BLM 2008b).
[4]Assumes 1.9 acres of short-term disturbance for access roads for each well per the BLM PFO Proposed RMP and Final EIS (BLM 2008b).
[5]Assumes 1.5 acres of long-term disturbance for access roads for each well per the BLM PFO Proposed RMP and Final EIS (BLM 2008b).
[6]Assumes surface disturbance from pipelines will be fully reclaimed after interim reclamation.
[7]Assumes 1.14 acres of long-term disturbance for access roads for each well per the BLM PFO Proposed RMP and Final EIS (BLM 2008b).
[8]Assumes 20 acres of short-term surface disturbance for RGFs that would persist for the life of the project (no interim reclamation).
[9]Assumes that the 50 miles of buried pipeline for the condensate and produced water from RGFs to offsite facilities would share the same trench. All disturbance in the Project Area associated with these pipelines is therefore accounted for under the Produced Water Pipeline.
[10]Represents surface disturbance outside of the Project Area for the buried condensate pipeline from the edge of the Project Area to the farthest potential condensate sales point (Granger Facility). If this option moves forward as part of the Preferred Alternative, the BLM

Table 2-27. Comparison of Surface Disturbance Estimates for the Alternatives

New Facility/Feature	Estimated New Surface Disturbance by Alternative														
	No Action			Proposed Action			Alternative A			Alternative B, Winter Concentration Area Development Scenario 1			Alternative B, Winter Concentration Area Development Scenario 2		
	Size or Number	*Short-term (acres)*	*Long-term (acres)*	*Size or Number*	*Short-term (acres)*	*Long-term (acres)*	*Size or Number*	*Short-term (acres)*	*Long-term (acres)*	*Size or Number*	*Short-term (acres)*	*Long-term (acres)*	*Size or Number*	*Short-term (acres)*	*Long-term (acres)*

would further define and analyze the route and corridor as part of the Project Area.

[11]Percentage disturbance in Project Area does not include the 424 acres of disturbance for the buried condensate pipeline from the edge of the Project Area to condensate sales points outside the Project Area. Total short-term surface disturbance in the Project Area would be an estimated 6,324 acres.

RGF Regional Gathering Facility
ROW Right-of-way

Note: Refer to Appendix D (*Surface Disturbance and Duration of Development Worksheets*) for more information on surface disturbance estimates.

Table 2-28. Comparison of Key Features of the Alternatives

Feature	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Description of Development and Production					
Total number of new wells	30	3,500	Same number of total wells as the Proposed Action; however, the location, timing, and pattern of well development would be different occurring sequentially in three geographically defined Phases.	Same as Proposed Action; however, development would be focused in the least environmentally sensitive areas (DA 2) and there would be fewer new well pads and less new development in the DA 1 area to reduce impacts to a range of resources in the DA 1 area (Map 6).	Same as Proposed Action; however, development would be focused in the least environmentally sensitive areas (DA 2) and there would be fewer new well pads and less new development in the DA 1 area to reduce impacts to a range of resources in the DA 1 area (Map 6).
Average number of new wells per year (development phase)	3	350	336 In addition, the number of wells per year could fluctuate more than the Proposed Action based on Phase and DA being developed during a given year.	336	336
Development phase duration (years)	10[1]	10	10.4	10.4	10.4
Field production duration (years)	40[1]	40	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Full production duration (years)	30[1]	30	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Total life of project (years)	40	40	40.4	40.4	40.4
Estimated initial production for each well	1–2 million cubic feet of gas per day	1–2 million cubic feet of gas per day	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Estimated ultimate recovery	1–2 billion cubic feet of gas per well	1–2 billion cubic feet of gas per well	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Development pattern (assumed)	Single-well or multi-well pads (non-clustered) development across the Project Area.	Lower density of development and fewer roads, pipelines, powerlines, RGFs in Sage-Grouse PHMA. Higher density of development and infrastructure in non Sage-Grouse PHMA.	Lower density of development and disturbance thresholds in wildlife habitat for focus species. Reduced density of development and disturbance thresholds would result in a more clustered pattern of development in wildlife habitat for focus species, compared to the Proposed Action.	Lower density of development in areas with a range of sensitive resources (DA 1) and in Sage-Grouse PHMA (DA 3). Higher density of development in areas with existing development and adjacent to the JIDPA (DA 2). Reduced density of development in DA 1 would result in a more clustered pattern of development in this area, compared to the Proposed Action.	Lower density of development in areas with a range of sensitive resources (DA 1) and in Sage-Grouse PHMA (DA 3). Higher density of development in areas with existing development and adjacent to the JIDPA (DA 2). Reduced density of development in DA 1 and centralizing above-ground facilities in Winter Concentration Areas would result in a more clustered pattern of development in these areas, compared to the Proposed Action.
Restrictions for certain facilities in certain areas	No additional restrictions beyond existing management.	No additional restrictions beyond existing management.	RGFs, compressor facilities, and powerlines would be prohibited in delineated mountain plover habitat in DA 3 and DA 6, raptor nest buffers in DA 1, DA 3, and DA 5, and burrowing owl nest buffers in DA 6.	No additional restrictions beyond existing management.	No additional restrictions beyond existing management.
Reclamation and Monitoring	Reclamation would occur in accordance with the Pinedale and Green River RMPs, as amended, and site-specific reclamation practices approved during site-specific permitting.	Reclamation and monitoring would occur in accordance with Appendix C (*Reclamation, Monitoring, and Weed Management Plan*).	Reclamation and monitoring would occur in accordance with Appendix C (*Reclamation, Monitoring, and Weed Management Plan*). However, for Alternative A, progression from one Phase to another would not occur until reclamation has been initiated for surface disturbance that occurred prior to the previous growing season.	Same as Proposed Action with application of additional resource protection measures for reclamation as described in Appendix B (*Resource Protection Measures*).	Same as Proposed Action with application of additional resource protection measures for reclamation as described in Appendix B (*Resource Protection Measures*).

Table 2-28. Comparison of Key Features of the Alternatives

Feature	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Density of development varies based on	Consistent with existing regulations and guidance, including the BLM Wyoming Sage-Grouse RMP Amendments (one disturbance location per 640 acres in Sage-Grouse PHMA).	Sage-Grouse PHMA and non-Sage-Grouse PHMA.	Sage-Grouse PHMA, Sage-Grouse Winter Concentration Areas, Delineated Habitats for Focus Species in DAs, General Habitat (areas not identified as habitat for focus species in DAs).	Sage-Grouse PHMA (DA3), the range of sensitive resources in DA 1, and areas more suitable for development based on existing development and proximity to JIDPA (DA 2).	Sage-Grouse PHMA (DA3), the range of sensitive resources in DA 1, and areas more suitable for development based on existing development and proximity to JIDPA (DA 2).
Phased Development	None	None	Development phased over time during the development period based on three geographically defined Phases (Map 4).	None	Within Sage-Grouse Winter Concentration Areas (Map 40b), development would be phased from east to west. No phasing in remainder of the Project Area.
Phasing of Development in Sage-Grouse PHMA	None	None	Development within Sage-Grouse PHMA is phased over the development period. Sage-Grouse PHMA is divided into three DAs with one of the DAs occurring in each of the three Phases.	None	None
Sage-Grouse PHMA density of development	Average of up to one disturbance location per 640 acre area. No more than 5 percent habitat disturbance per 640-acre area.	Average of up to one disturbance location per square mile (640 acre area). The one location and cumulative value of existing disturbances will not exceed 5 percent of suitable habitat of the DDCT area. Inside PHMA, all suitable habitat disturbed (any program area) will not exceed 5 percent within the DDCT area using the DDCT process.	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Sage-Grouse Winter Concentration Area density of development	No specific density of development.	Average of up to four disturbance locations per 640 acres.	Average of up to one disturbance location per 640 acres. Surface disturbance would not exceed 20 acres (3 percent) surface disturbance per 640 acres, inclusive of existing disturbances.	Average of up to one disturbance location per 640 acres in Winter Concentration Areas in DA 1.	Average of up to one disturbance location per 640 acres in Winter Concentration Areas in DA 1. Surface disturbance would not exceed 32 acres (5 percent) surface disturbance per 640 acres, inclusive of existing disturbances.
Additional Protection Measures in Sage-Grouse Winter Concentration Areas	None	Surface-disturbing and disruptive activities in Sage-Grouse Winter Concentration Areas (all DAs) would be prohibited from December 1 – March 14.	• Surface-disturbing and disruptive activities in Sage-Grouse Winter Concentration Areas (all DAs) would be prohibited from December 1 to March 14. • Within DA 1, development would be prohibited in areas containing greater than 5 percent sagebrush canopy cover • Within DA 1, surface disturbance would not exceed 20 acres (3 percent) surface disturbance per 640 acres, inclusive of existing disturbances. • Within DA 1, above-ground facilities would be centralized to locations outside of DA 1, where technically and economically feasible. • Within DA 1, Reardon, Chapel, Alkali Creek, and Burma Road travel routes would not be used during the winter stipulation period	Surface-disturbing and disruptive activities in sage-grouse Winter Concentration Areas (all DAs) would be prohibited from December 1 to March 14.	• Surface-disturbing and disruptive activities in sage-grouse Winter Concentration Areas (all DAs) would be prohibited from December 1 to March 14. • Surface disturbance would not exceed 32 acres (5 percent) surface disturbance per 640 acres, inclusive of existing disturbance. • Above-ground facilities would be centralized to locations outside of Winter Concentration Areas, where technically and economically feasible. • Within Winter Concentration Areas, development would be phased from east to west. • Buried pipelines would be developed to transport produced water and condensate from RGFs within Winter

Table 2-28. Comparison of Key Features of the Alternatives

Feature	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
			(12/1 – 3/14), unless development activity has been authorized within DA 1.		Concentration Areas and PHMA to RGFs outside of these areas. • Powerlines in Winter Concentration Areas would be buried, where feasible.
Non-PHMA Habitat average disturbance location density (disturbance locations per 640-acre area)	1	4	Varies by Habitat Type. 1 disturbance location per 640 acres in Winter Concentration Areas, 4 disturbance locations per 640 acres in delineated habitats for focus species in DAs, 4 disturbance locations per 640 acres in General Habitat (areas not identified as habitat for focus species in DAs).	Varies by DA. 1 disturbance location per 640 acres in DA 1. 4 disturbance locations per 640 acres in DA 2.	Varies by DA. 1 disturbance location per 640 acres in DA 1. 4 disturbance locations per 640 acres in DA 2.
Description of Wells and Well Pads					
Types of drilling	Vertical and Directional	Directional	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Types of production well pads	Single-well or multi-well	Multi-well	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Average well pad size (acres)	3.7 acres per well pad	5.5–19.0 acres per multi-well pad	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Number of wells per pad	1	1–64	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Maximum bottom-hole location density (bottom-hole per acre)	Up to 1 bottom-hole per 10 acres	Up to 1 bottom-hole per 10 acres	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Average bottom-hole location density (bottom-hole per acre)	1 bottom-hole per 2,300 acres	1 bottom-hole per 40 acres	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Depth of target formations (feet)	6,500–13,500	6,500–13,500	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Description of Ancillary Infrastructure					
Method of transporting condensate from RGFs to sales points	Truck	Truck	Buried pipeline	Truck	Buried pipelines would transport condensate from RGFs within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas. Condensate would then be trucked from RGFs outside of Winter Concentration Areas and PHMA to sales points.
Method of transporting produced water from RGFs to JIDPA Water Treatment Facility	Truck	Truck	Buried pipeline	Truck	Buried pipelines would transport produced water from RGFs within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas. Produced water would then be trucked to the JIDPA Water Treatment Facility.
New access roads (miles)	12	227	215	205	205
Access road and pipeline ROW width (feet)	40	Pipelines and roads would share a common 100-foot ROW corridor	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Buried gas gathering pipelines (miles)	12	227	195	205	205
Buried pipeline depth (feet)	6	6	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Buried condensate and produced water pipelines (miles)	0	0	120	0	15

Table 2-28. Comparison of Key Features of the Alternatives

Feature	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Powerline development locations and restrictions	No Powerlines	Powerlines to provide electrification at RGFs. All powerlines would be overhead.	Powerlines to provide electrification at RGFs. Powerlines in Sage-Grouse PHMA would be buried, where feasible. Analysis assumes all powerlines in Sage-Grouse PHMA would be overhead. Powerlines would be prohibited within delineated mountain plover habitat in DA 3 and DA 6, within raptor nest buffers in DA 1, DA 3, and DA 5, and within burrowing owl nest buffers in DA 6.[24]	Powerlines to provide electrification at RGFs. Powerlines in Sage-Grouse PHMA would be buried, where feasible. Analysis assumes all powerlines would be overhead.	Powerlines to provide electrification at RGFs. Powerlines in Sage-Grouse PHMA would be buried, where feasible. Analysis assumes all powerlines would be overhead.
Miles of powerlines	0	38.6 miles (86% in non-PHMA Habitat; 14% in PHMA)	38.6 miles	38.6 miles	38.6 miles
Powerline average ROW width (feet)	-	40	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Average voltage of Powerlines (kilovolt)	-	25	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Number and location of new Regional Gathering Facilities	0	11 (Assumes 2 in Sage-Grouse PHMA; 9 in non-PHMA Habitat)	11 (Assumes 6 in non-PHMA Habitat, 2 in PHMA, 2 in Winter Concentration Areas in DA 1, 1 in Delineated Habitats for Focus Species)	11 (Assumes 2 in DA 1, 7 in DA 2, 2 in DA 3)	11 (Assumes 2 in DA 1, 7 in DA 2, 2 in DA 3)
Water Use					
Total water use per well during drilling and completions (barrels/gallons)	35,000 bbls 1,470,000 gallons	35,000 bbls 1,470,000 gallons	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Recycled water use per well (barrels)	25,000 bbls (71% of water) Completions: 25,000 bbls	25,000 bbls (71% of water) Completions: 25,000 bbls	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Total groundwater use per well (barrels/gallons)[2]	10,000 bbls (29% of water) Drill and cement production: 7,200 bbls (21% of water); 302,400 gallons Drill/set surface casing: 2,800 bbls (8% of water)[2] 117,600 gallons	10,000 bbls (29% of water) Drill and cement production: 7,200 bbls (21% of water); 302,400 gallons Drill/set surface casing: 2,800 bbls (8% of water)[2] 117,600 gallons	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Total groundwater use for drilling per year during development phase (barrels/gallons)[3]	30,000 bbls 1,260,000 gallons	3,500,000 bbls 147,000,000 gallons	3,360,000 bbls 141,120,000 gallons	3,360,000 bbls 141,120,000 gallons	3,360,000 bbls 141,120,000 gallons
Groundwater use for hydrostatic testing per year during the development phase (barrels/gallons)[4]	1,374 bbls[4] 57,727 gallons	26,000 bbls 1,092,000 gallons	34,692 bbls[5] 1,457,048 gallons	24,174 bbls[6] 1,015,308 gallons	24,174 bbls[6] 1,015,308 gallons
Groundwater use for road construction dust control per year during the development phase (barrels/gallons)[7]	720 bbls 30,240 gallons	13,620 bbls 572,040 gallons	12,404 bbls 520,962 gallons	11,827 bbls 496,731 gallons	11,827 bbls 496,731 gallons
Average groundwater use for road maintenance dust control per year during the development phase (barrels/gallon)[8,9]	3,960 bbls 166,320 gallons	74,910 bbls 3,146,220 gallons	78,001 bbls 3,276,047 gallons	74,950 bbls 3,147,903 gallons	74,950 bbls 3,147,903 gallons

[24]*Includes raptor buffers for Alternative A identified as delineated habitats for focus species in DAs. Includes one-mile buffer of documented Ferruginous hawk and Bald Eagle nests, regardless of occupancy or current presence of nest; and 1/2-mile buffers of documented Burrowing Owl, American Kestrel, Prairie Falcon and/or unknown raptor nests regardless of occupancy or current presence of nest.*

Table 2-28. Comparison of Key Features of the Alternatives

Feature	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Groundwater use for new well construction dust control per year during the development phase (barrels/gallons)[10]	8,640 bbls 362,880 gallons	63,000 bbls 2,646,000 gallons	60,480 bbls 2,540,160 gallons	60,480 bbls 2,540,160 gallons	60,480 bbls 2,540,160 gallons
Total groundwater use per year during the development phase (barrels/gallons)	**44,694 bbls 1,877,148 gallons**	**3,677,530 bbls 154,456,260 gallons**	**3,545,577 bbls 148,914,234 gallons**	**3,531,431 bbls 148,320,102 gallons**	**3,531,431 bbls 148,320,102 gallons**
Total groundwater use per year during the development phase (acre-feet)	**5.8**	**474.0**	**457.0**	**455.2**	**455.2**
Total groundwater use during the development phase (barrels/gallons)	**446,940 bbls 18,771,480 gallons**	**36,775,300 bbls 1,544,562,600 gallons**	**36,874,001 bbls 1,548,708,034 gallons**	**36,726,882 bbls 1,542,529,061 gallons**	**36,726,882 bbls 1,542,529,061 gallons**
Total groundwater use during the development phase (acre-feet)	**58.0**	**4,740.0**	**4,752.8**	**4,734.1**	**4,734.1**
Total groundwater use per year for road maintenance dust control during the full production phase, years 11-40 (barrels/gallons)[11]	**7,200 bbls 302,400 gallons**	**136,200 bbls 5,720,400 gallons**	**129,000 bbls 5,418,000 gallons**	**123,000 bbls 5,166,000 gallons**	**123,000 bbls 5,166,000 gallons**
Total groundwater use per year during the full production phase (acre-feet)	**0.9**	**17.6**	**16.6**	**15.9**	**15.9**
Total groundwater use during the full production phase (years 11-40) (acre-feet)	**27.0**	**528.0**	**498.0**	**477.0**	**477.0**
Groundwater sources	Refer to Map 31 for location of existing water supply wells for groundwater sources. If needed, new wells would be drilled at appropriate locations to service development activities.	Refer to Map 31 for location of existing water supply wells for groundwater sources. If needed, new wells would be drilled at appropriate locations to service development activities.	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Total produced water for life of well (barrels per well)	100,000–500,000 bbls (assume average of 250,000 bbls per well)	100,000–500,000 bbls (assume average of 250,000 bbls per well)	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Produced water disposal per well (barrels)	100% transported to JIDPA Water Treatment Facility[12] 0% underground injection wells near RGFs[12]	25,000 bbls (10%) transported to JIDPA Water Treatment Facility[13] 225,000 bbls (90%) underground injection wells near RGFs[13]	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Produced water injection well target zone	100% of produced water transported to JIDPA Water Treatment Facility. No produced water injected underground.	The target zone would most likely be the lower 2/3 of the high-salinity Upper Fort Union Formation.	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Jobs					
Development phase	14.5	954	921 Would fluctuate more over time based on Phase being developed[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]
Full production phase	5.3	228	195 Would fluctuate more over time based on Phase being developed[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]

Table 2-28. Comparison of Key Features of the Alternatives

Feature	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Vehicle Trips and Use					
Alternative-specific route limitations	No identified route limitations beyond those identified in the applicable RMPs.	Project-related traffic would not utilize North Burma Road between the northern Project Area boundary and state Highway 351. Project-related traffic would not utilize South Burma Road east of the Project Area boundary.	Within DA 1, Reardon, Chapel, Alkali Creek, and Burma travel routes would not be used during the period of 11/5 to 3/13, unless development activity has been authorized in DA 1.	No identified route limitations beyond those included in the applicable RMPs. Project-related traffic could utilize North Burma Road north of the project boundary.	No identified route limitations beyond those included in the applicable RMPs. Project-related traffic could utilize North Burma Road north of the project boundary.
Drilling Activities					
Heavy vehicle trips (per day)	0	20	Same total as Proposed Action, but would fluctuate over time[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]
Light vehicle trips (per day)	3	306	Same total as Proposed Action, but would fluctuate over time[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]
Total vehicle trips (per day)	3	326	Same total as Proposed Action, but would fluctuate over time[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]
Completion Activities					
Heavy vehicle trips (per day)	1	165	Same total as Proposed Action, but would fluctuate over time[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]
Light vehicle trips (per day)	0	18	Same total as Proposed Action, but would fluctuate over time[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]
Total vehicle trips (per day)	1	183	Same total as Proposed Action, but would fluctuate over time[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]
Production Activities					
Heavy vehicle trips (per day)	19	121	0[16]	Same total as Proposed Action, but would fluctuate over time[15].	Same total as Proposed Action, but would fluctuate over time[15]. Vehicle traffic within Sage-Grouse PHMA and Winter Concentration Areas would be reduced during production, while vehicle traffic outside these areas would increase during production, compared to Proposed Action[17]
Light vehicle trips (per day)	186	1,163	Same total as Proposed Action, but would fluctuate over time[14]	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]
Total vehicle trips (per day)	205	1,284	1,163	Same total as Proposed Action, but would fluctuate over time[15]	Same total as Proposed Action, but would fluctuate over time[15]

[1] For purposes of analysis, the drilling and production phases are assumed to be the same as that of the Proposed Action.
[2] Jonah Energy estimated 2,800 bbls of groundwater needed to drill and set surface casing to 2,500 feet for a typical well. Groundwater use estimates are subject to reduction if improved water recycling practices and efforts are successful.
[3] Estimates based on estimated number of wells drilled per. Proposed Action = 350 new wells per year, Alternative A = 336 new wells per year, Alternative B = 336.
[4] Assumes that water use for hydrostatic testing would be proportional to water use for the Proposed Action based on the number of wells per year (three wells per year for No Action/350 wells per year for Proposed Action).
[5] Includes hydrostatic testing of 315 miles of pipeline including 195 miles for natural gas lines and 120 miles for condensate and produced water pipeline. Calculated based on the proportion of water use for hydrostatic testing per mile of pipeline for the Proposed Action multiplied by 88 miles of additional pipelines for Alternative A.
[6] Includes hydrostatic testing of 220 miles of natural gas pipelines including 205 miles for natural gas pipeline and 15 miles for condensate and produced water pipeline. Calculated based on the proportion of water use for hydrostatic testing per mile of pipeline for the Proposed Action.
[7] Estimates assume (1) an equal number of new access roads would be developed during each year of the development phase, and (2) an application rate of 600 bbls of water per mile of road per year for road construction dust control.
[8] Estimates assume an equal number of new access roads per year for road maintenance dust control each year after the road is constructed.
[9] Calculated based on average annual water use for road maintenance dust control during the development phase. The higher average annual water use for road maintenance dust control under alternatives A and B compared to the Proposed Action is due to the longer development phase under alternatives A and B, despite fewer miles of roads that would be developed under these alternatives.
[10] Estimates assume (1) an equal number of new well pad locations would be developed during each year of the development phase, (2) the No Action Alternative would include one well per pad and the action alternatives would average 16 wells per pad, (3) 6 days would be required to construct each well pad location, and (4) 480 bbls of water would be used per day for well pad construction dust control.
[11] Estimates assume an application rate of 600 bbls of water per mile of road per year for road maintenance dust control.

Table 2-28. Comparison of Key Features of the Alternatives

Feature	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)

[12]All produced water would be hauled to the JIDPA Water Treatment facility, since no RGFs would be constructed under the No Action Alternative. Depending on water requirements for drilling and completions operations under the No Action Alternative, varying quantities of this water would be injected at existing injection wells after processing at the JIDPA Water Treatment Facility.
[13]Based on estimated median total water production of 250,000 bbls/well for the life of the well.
[14]Same as Proposed Action, but would fluctuate more based on Phase and DA being developed.
[15]Same as Proposed Action, but would fluctuate more based on DA being developed.
[16]For Alternative A, condensate would be transported by buried pipeline to sales points outside the Project Area and produced water would be transported by pipeline to the JIDPA Water Treatment Facility.
[17]For Alternative B, buried pipelines would be developed to transport produced water and condensate from RGFs within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas. Produced water that is not injected at RGF locations and condensate would then be trucked from RGFs outside of Winter Concentration Areas and PHMA to treatment locations (produced water) and sales points (condensate). This development approach would reduce vehicle traffic to and from RGFs within PHMA and Winter Concentration Areas during production, but would increase vehicle traffic to and from RGFs outside of these areas during production.

bbls	Barrels (42-gallon standard oil barrel)
DA	Development Area
JIDPA	Jonah Infill Drilling Project Area
PFO	Pinedale Field Office
RGF	Regional Gathering Facility
ROW	Right-of-way

2.11 Summary of Impacts

Table 2-29 provides a summary of potential direct and indirect impacts by resource and compares the potential impacts across alternatives. The summary of impacts in Table 2-29 is based on the analysis of direct and indirect impacts for each resource described in detail in Chapter 4 (*Environmental Consequences*). Refer to each resource section in Chapter 4 (*Environmental Consequences*) for additional information on analysis assumptions, methods, and the detailed impacts analysis by resource.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Air Quality					
NAAQS and WAAQS	As indicated in Section 4.2.3.3 (*Far-Field Modeling Results for the Proposed Action*), NPL Project EIS air quality modeling indicates two potential exceedances of NAAQS, including exceedance of the 8-hour ozone design value at the Boulder monitoring site (Table 4-13) and exceedance of the 24-hour PM_{10} design value at the Wamsutter monitoring site (Table 4-16). These exceedances of NAAQS occurred during the base year scenario and NPL EIS modeling indicates that the exceedances would occur under the No Action Alternative, regardless of the NPL Project. Criteria pollutant concentrations would be lower than the corresponding base-year concentrations.	Similar to the No Action Alternative, NPL Project EIS air quality modeling indicates two potential exceedances of NAAQS, including exceedance of the 8-hour ozone design value at the Boulder monitoring site (Table 4-13) and exceedance of the 24-hour PM_{10} design value at the Wamsutter monitoring site (Table 4-16) under the future-year Proposed Action scenario. These modeled exceedances of NAAQS occurred during the base-year and are projected to occur under the No Action Alternative scenario, regardless of the NPL Project. The NPL Project is projected to contribute to a 0.1-ppb increase above the No Action Alternative 8-hour ozone design value at the Boulder station and a 0.3-μg/m^3 increase above the No Action Alternative PM_{10} design value at the Wamsutter site.	Similar to Proposed Action, but with minor net reductions in annual emissions of criteria pollutants during development due to slight reduction in number of new wells drilled per year.	Same as Alternative A.	Same as Alternative A.
HAPs	The potential for increased acute and/or long-term health impacts resulting from HAPs are expected to be minimal.	Short-term exposure to HAPs is expected to be very small compared to acute reference exposure levels. Long-term exposure to HAPS (for the production scenario) is estimated to be very small compared to reference concentrations, and long-term health impacts resulting from HAPs are expected to be minimal.	Similar to Proposed Action, though slightly less short-term exposure to HAPs per year during development due to slight reduction in number of new wells drilled per year.	Same as Alternative A.	Same as Alternative A.
NOx and VOC emissions and General Conformity	Development emissions would not exceed the UGRB ozone marginal nonattainment area annual General Conformity *de minimis* emission limits of 100 tons/year of NO_x and VOC.	Development in years 2 through 10 could exceed the UGRB ozone marginal nonattainment area annual General Conformity *de minimis* emission limits of 100 tons/year of NO_x.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Ozone and $PM_{2.5}$	**Ozone**: Future year 8-hour ozone design values are 3 to 9 ppb lower than the base-year values; would not result in projected future-year exceedances of the NAAQS for ozone. **$PM_{2.5}$**: Future year 24-hour average $PM_{2.5}$ design values are 0.1 to 2.2 μg/m^3 lower than the base-year values. Future year annual $PM_{2.5}$ design values are 0.1 to 0.9 μg/m^3 lower than the base-year values.	**Ozone**: Future year 8-hour ozone design values 0.1 ppb higher compared to the No Action; would not result in projected future-year exceedances of the NAAQS for ozone. **$PM_{2.5}$**: Simulated maximum difference in $PM_{2.5}$ (98th percentile 24-hour $PM_{2.5}$ concentration) between No Action and Proposed Action of 6.8 μg/m^3. Simulated maximum impact on annual average $PM_{2.5}$ concentration from project-related emissions of 2.5 μg/m^3. 24-hour $PM_{2.5}$ and annual design values not expected to result in exceedances of NAAQS.	Similar to Proposed Action, though slightly less per year during development due to slight reduction in number of wells per year.	Same as Alternative A.	Same as Alternative A.
Visibility	Modeling results indicate improved visibility compared to the base year. For Class I and	Modeling results indicate that the impacts on visibility within the nearby Class I and Class II	Relatively similar to Proposed Action, though slightly lower contribution to visibility	Same as Alternative A.	Same as Alternative A.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
	Class II areas, visibility is estimated to improve by 0.2 dv for the 20 percent best visibility days and by 0.7 dv for the 20 percent worst visibility days.	areas would be infrequent and small compared to visibility impairment thresholds less than or equal to 0.02 dv for the 20 percent best days and less than or equal to 0.01 dv for the 20 percent worst days.	impairment per year during development due to slight reduction in number of wells per year.		
Atmospheric Deposition	Nitrogen and sulfur deposition to sensitive lakes under this scenario is expected to be minimal.	The simulated change in deposition due to the Proposed Action does not exceed the DAT for sulfur deposition, but does exceed the DAT for nitrogen deposition in the Popo Agie Wilderness Area. The simulated change in ANC due to the Proposed Action does not exceed the thresholds for sensitive lakes considered in the analysis, and project-related emissions are not expected to significantly affect the ANC of the sensitive lakes.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Climate Change					
Greenhouse Gas Emissions and Contribution to Climate Change	Limited well development in the air analysis area would contribute limited GHG emissions relative to the regional and global budget of GHGs in the atmosphere, with minimal potential to contribute to climate change effects.	Estimated project GHG emissions in 2020 represent 0.27 percent of the total GHG emissions for the state. Project emissions would contribute to the regional and global GHGs in the atmosphere, and could contribute to climate change effects. It is not possible at this time to link projected GHG emissions associated with the Proposed Action to specific environmental impacts within the air quality analysis area.	Similar GHG emissions and potential contributions to climate change as the Proposed Action, though to slightly lesser degree each year during the development period due to slight reduction in number of new wells per year.	Same as Alternative A.	Same as Alternative A.
Cultural Resources					
Sublette Cutoff of the California NHT and the North Sublette Meadow Spring Variant of the Sublette Cutoff	Potential adverse impacts to the historic setting of the Sublette Cutoff and North Sublette Meadow Spring Variant if development and disturbance occurs within the three-mile viewshed of the trails.	Potential adverse impacts within the three-mile viewshed of the Sublette Cutoff and North Sublette Meadow Spring Variant would include project-related activities and construction that result in the introduction of visual elements that diminish the integrity of significant historic features. The greatest potential of impacts would occur in areas with the greatest density of development (i.e., non-PHMA).	Fewer adverse impacts than the Proposed Action due prohibition of RGFs, compressor stations, and powerlines in delineated mountain plover habitat and raptor buffers in DA 3 that are within the three-mile viewshed of the Sublette Cutoff and North Sublette Meadow Spring Variant.	Same as Proposed Action.	Same as Proposed Action.
Impacts to the Teakettle Dune Field	Potential direct adverse impacts to the Teakettle Dune Field if development and disturbance occurs in the dune field.	Increased potential for direct and indirect adverse impacts to the Teakettle Dune Field due to a higher density of development than under the No Action Alternative. Development and surface disturbance in the dune field could increase erosion and sand movement, destabilize areas of the dune field, increase the potential for exposure and degradation of cultural resources, and result in other adverse impacts to cultural resources in the area (e.g., increased potential for vandalism and illegal collecting due to increased exposure and	Potential impacts on cultural resources in the Teakettle Dune Field would be the same as those described for the Proposed Action as the density of development in areas that overlap the dune field are expected to be the same as the Proposed Action.	Potential impacts on cultural resources in the Teakettle Dune Field would be the same as those described for the Proposed Action as the density of development in areas that overlap the dune field are expected to be the same as the Proposed Action.	Potential impacts on cultural resources in the Teakettle Dune Field would be similar to the Proposed Action, unless buried pipelines between RGF locations crossed the Teakettle Dune Field. In that scenario, surface disturbance and construction associated with the buried pipelines would result in additional adverse impacts from erosion and destabilization of the dune field. However, it is likely that RGF locations and buried pipelines could be routed to avoid the Teakettle Dune Field.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		access). Greatest potential for impacts in the portion of the dune field outside of Sage-Grouse PHMA due to a higher density of development in this area.			
Impacts to Lander Cutoff of the Oregon and California NHTs	No anticipated impacts, since development and disturbance would not occur within the three-mile viewshed of the Lander Cutoff.	Same as No Action.	Same as No Action.	Same as No Action.	Same as No Action.
Project activities that diminish the integrity of a property's location, design, setting, materials, workmanship, feeling, or association that is listed or eligible for listing in the NHRP	Potential direct impacts to cultural resources resulting from the No Action Alternative could include unintentional destruction or damage to cultural resources and sites including physical destruction or alterations to the setting of NRHP-eligible sites, historic trails, or undiscovered cultural resources due to surface disturbance and project-related facilities and activity.	Potential direct impacts to cultural resources resulting from the Proposed Action could include unintentional destruction or damage to cultural resources and sites including physical destruction or alterations to the setting of NRHP-eligible sites, historic trails, or undiscovered cultural resources due to surface disturbance and project-related facilities and activity. These potential impacts may be greatest outside of Sage-Grouse PHMA, since these areas would have a higher density of development than Sage-Grouse PHMA under the Proposed Action. These potential impacts would also depend on the location of specific cultural resource sites to be identified during site-specific surveys during environmental review of the APDs and the results of the Title 54 (Section 106) process. To date, only approximately 12.2 percent of the NPL Project Area has been subject to cultural surveys consistent with current standards.	Similar impacts as described for the Proposed Action. However, the impacts would be reduced in Sage-Grouse Winter Concentration Areas and in delineated habitat for other focus species due to the reduced level of development and disturbance in these areas, compared to the Proposed Action. These potential impacts would also depend on the location of specific cultural resource sites to be identified during site-specific surveys during environmental review of the APDs and the results of the Title 54 (Section 106) process. To date, only approximately 12.2 percent of the NPL Project Area has been subject to cultural surveys consistent with current standards.	Similar impacts as described for the Proposed Action. However, the impacts would be reduced in DA 1, which has a lower density of development than the Proposed Action. These potential impacts would also depend on the location of specific cultural resource sites to be identified during site-specific surveys during environmental review of the APDs and the results of the Title 54 (Section 106) process. To date, only approximately 12.2 percent of the NPL Project Area has been subject to cultural surveys consistent with current standards.	Similar impacts as described for the Proposed Action. However, the impacts would be reduced in DA 1, which has a lower density of development than the Proposed Action, and in Sage-Grouse Winter Concentration Areas where additional protection measures are applied that could reduce these impacts, compared to the Proposed Action. These potential impacts would also depend on the location of specific cultural resource sites to be identified during site-specific surveys during environmental review of the APDs and the results of the Section 106 process. To date, only approximately 12.2 percent of the NPL Project Area has been subject to cultural surveys consistent with current standards.
Wildland Fire and Fuels					
Introduction of new ignition sources, increased chance of wildfire, and demand for prevention and suppression	Increased ignition sources and chance of wildfire commensurate with the anticipated development of three new wells per year and 213 acres of short-term disturbance. Construction of 12 miles of access roads would provide additional fire breaks and aid in response to wildfires.	Increased ignition sources, chance of wildfire, and potential for establishment and spread of invasive species commensurate with the development of 3,500 new wells and 6,340 acres of short-term disturbance. Potential beneficial impacts include the increased ability to spot wildfires from additional jobs and the construction of 227 miles of access roads, which would provide additional fire breaks and aid in response to wildfires.	Impacts would be similar to those described for the Proposed Action, though to a lesser degree due to reduced surface disturbance in the Project Area and a reduced density of development and surface disturbance thresholds in certain habitats. An additional 424 acres of short-term surface disturbance for the construction of a buried pipeline outside the Project Area would increase the potential for the spread of invasive plant species and human-induced ignitions along the pipeline corridor compared to the Proposed Action. Decreased beneficial impacts from the construction of 12 less miles of access roads than the Proposed Action, which would provide fewer fire breaks and access points for emergency wildfire response. Phased development under Alternative A would allow	Decreased ignition sources, chance of wildfire, and potential for establishment and spread of invasive species compared to the Proposed Action due to a decrease in short- and long-term surface disturbance. Reduced surface disturbance and fewer disturbance locations in DA 1, compared to the Proposed Action, would help to limit the expansion of the wildland-industrial interface in these areas by placing fewer demands on fire and fuels management to protect project facilities and allowing BLM to apply larger landscape-scale prescribed fires to reduce fuel loading. Decreased beneficial impacts from the construction of 22 less miles of access roads compared to the Proposed Action, would provide fewer fire breaks and access points for emergency wildfire response.	Decreased ignition sources, chance of wildfire, and potential for establishment and spread of invasive species compared to the Proposed Action due to a decrease in short- and long-term surface disturbance. Reduced surface disturbance, fewer disturbance locations, and a more clustered pattern of development in DA 1, compared to the Proposed Action, would help to limit the expansion of the wildland-industrial interface in these areas by placing fewer demands on fire and fuels management to protect project facilities and allowing BLM to apply larger landscape-scale prescribed fires to reduce fuel loading. Construction of buried pipelines within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas could increase the potential for accidental ignitions during

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
			additional time to evaluate fire and fuels management objectives and response to wildfires, reducing potential impacts compared to the Proposed Action. Alternative A would employ fewer workers during the development and production phases, reducing the ability to spot wildfires compared to the Proposed Action.		construction of these pipelines and alteration of fire regimes in adjacent areas from the spread of invasive species, compared to the Proposed Action. Decreased beneficial impacts from the construction of 22 less miles of access roads compared to the Proposed Action, would provide fewer fire breaks and access points for emergency wildfire response.
Geology and Minerals					
Topography and surface-water drainage	Potential impacts to geology would be minimal due to the generally low level of development under the No Action Alternative.	6,340 acres of short-term disturbance (4.5 percent of Project Area) and 1,890 acres of long-term disturbance (1.3 percent of Project Area) would result in potential direct impacts from alterations to existing topography from the construction of well pads, roads, and associated infrastructure and indirect impacts from weathering of disturbed areas and slope and drainage alterations, especially in areas where soils have higher susceptibility to erosion. Potential for these impacts would be greatest in non Sage-Grouse PHMA, corresponding with more intense development in these areas.	Decreased long-term surface disturbance (4.2 percent less than the Proposed Action) and additional limitations on surface disturbance in delineated habitats for focus species for Alternative A would result in indirect beneficial impacts on geology by preserving the existing topography in these areas more than the Proposed Action. Densities of development and associated impacts on geology would be similar to the Proposed Action in DAs that contain the fewest acres of delineated habitats for focus species. An additional 424 acres of short-term surface disturbance for the construction of a buried pipeline outside the Project Area would affect topography and drainage along the corridor to a greater extent than the Proposed Action.	Decreased short and long-term surface disturbance in comparison to the Proposed Action (9.4 percent less and 7.9 percent less, respectively) would reduce the potential for direct impacts from alterations to existing topography. Reduced surface disturbance, fewer disturbance locations, and a more clustered pattern of development in DA 1 would reduce the potential for adverse impacts to geology in that area by reducing the number and extent of disturbance locations that would affect existing topography or geologic features compared to the Proposed Action.	Decreased short and long-term surface disturbance in comparison to the Proposed Action (7.4 percent less and 7.9 percent less, respectively) would reduce the potential for direct impacts from alterations to existing topography. Reduced surface disturbance, fewer disturbance locations, and a more clustered pattern of development in DA 1 would reduce the potential for adverse impacts to geology in that area by reducing the number and extent of disturbance locations that would affect existing topography or geologic features compared to the Proposed Action. Construction of buried pipelines within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas could affect topography and drainage in localized areas, which would not be affected under the Proposed Action.
Cumulative gas and condensate production estimates	14,252 MMCF of gas and 98,167 bbls of condensate.	3,500 to 7,000 BCF of gas and 17.5 to 140 million bbls of condensate.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Potential preclusion of solid leasable and locatable mineral production	None	None	None	None	None

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Hazardous Materials and Solid Waste					
Hazardous materials, hazardous waste, and solid waste used/stored on site	Generation of hazardous and nonhazardous wastes and risk of leaks and spills associated with construction and operation activities could result in localized adverse impacts to human health and the environment, but minimal impacts are anticipated due to the relatively low level of development.	Construction and operation activities would generate hazardous and nonhazardous wastes and increase the risk of leaks and spills with the potential to affect human health or contaminate surrounding soils, surface waters, and groundwater. Refer to Appendix F (*Hazardous and Non-Hazardous Materials Management Summary*) for a complete list of all known hazardous and extremely hazardous materials that could be produced, used, stored, transported, and disposed of for the NPL Project.	Same amount of materials as the Proposed Action; however, Alternative A would reduce the overall potential for accidental spills of produced water and condensate by truck, but increase potential for spills and seepage from pipelines and the time required to detect and fix underground leaks, since produced water and condensate would be transported by a buried pipeline network and not by truck as under the Proposed Action. Utilizing North Burma Road as a primary route to transport hazardous materials and solid waste would increase the potential for spills along this route during transport of materials compared to the Proposed Action.	The amounts and uses of hazardous materials would be generally the same as for the Proposed Action, and impacts would be similar. Use of North Burma Road as a primary route to transport hazardous materials and solid waste and associated impacts would be the same as Alternative A.	Same amount of materials as the Proposed Action; however, Alternative B Winter Concentration Area development scenario 2 would increase the potential for spills and seepage from buried pipelines and the time required to detect and fix underground leaks due to the use of buried pipelines to transport produced water and condensate to RGFs outside of Winter Concentration Areas and PHMA. Use of North Burma Road as a primary route to transport hazardous materials and solid waste and associated impacts would be the same as Alternative A.
Land Use					
Pattern of oil and gas development	Single-well or multi-well pads (non-clustered) developed across the Project Area	Lower density of development in Sage-Grouse PHMA (i.e., one disturbance location per 640 acres) than non-PHMA Habitat (i.e., four disturbance locations per 640 acres). Development could occur across the Project Area at any time during the 10-year development period, consistent with all applicable laws, regulations, and stipulations.	The density of development would be lower than the Proposed Action in Sage-Grouse Winter Concentration Areas in DA 1 and within delineated habitats for focus species. The density of development would be similar to the Proposed Action in Sage-Grouse PHMA and general habitat (Map 5). The location, timing, and pattern of well development would be occur sequentially in three geographically defined phases (Map 4).	The density of development would be reduced in DA 1 compared to the Proposed Action (Map 6), resulting in reduced surface disturbance and fewer disturbance locations. The density of development would be similar to the Proposed Action in DA 2 and DA 3.	The density of development would be reduced in DA 1 compared to the Proposed Action (Map 6), resulting in reduced surface disturbance, fewer disturbance locations, and a more clustered pattern of development, especially within Sage-Grouse Winter Concentration Areas. The density of development would be similar to the Proposed Action in DA 2 and DA 3. Well development would be phased from east to west in Winter Concentration Areas for the 10-year development period.
Rights-of-way	Development of 30 new wells in the Project Area would require ROWs for access roads, pipelines, powerlines, and other infrastructure.	Development of 3,500 new wells would require a substantial increase in ROWs for access roads, pipelines, powerlines, and other infrastructure.	Alternative A would have the same number of new wells and 12 less miles of new roads than the Proposed Action. A buried pipeline network to transport condensate and produced water to sales points outside of the Project Area would result in 88 more miles of pipelines and associated ROWs compared to the Proposed Action.	Alternative B Winter Concentration Area development scenario 1 would have the same number of new wells as the Proposed Action. However, due to the reduced level of development from 22 less miles of roads and adjacent pipelines, there would be reduced ROWs compared to the Proposed Action.	Alternative B Winter Concentration Area development scenario 2 would have the same number of new wells as the Proposed Action. However, due to the reduced level of development from 22 less miles of roads and 7 less miles of pipelines, there would be reduced ROWs compared to the Proposed Action.
Potential for Land Use Conflicts	The No Action Alternative would result in minimal impacts on existing land uses in the Project Area, as it reflects the continuation of the existing rate of development observed in the Project Area over the last twenty years.	Development of 3,500 new wells and associated facilities and infrastructure could result in land use conflicts with other resource uses including livestock grazing and recreation. Potential land use conflicts would be greatest in areas with higher densities of development (e.g., non-PHMA Habitat) that overlaps areas of livestock grazing and other land uses. Land use changes could occur across the Project Area at any time during the 10-year development	Due to similar levels of development and disturbance as the Proposed Action, Alternative A would result in similar potential for land use conflicts though to a lesser degree due to the phased pattern of development, which would localize land use changes to the Phase being developed. This pattern of development would make the timing and location of land use changes more predictable for livestock grazing permittees, recreationists, and other land users, potentially enhancing their ability to	A lower density of development and fewer disturbance locations in DA 1 could decrease the potential for land use conflicts in DA 1 compared to the Proposed Action.	Due to a decrease in surface disturbance, a phased pattern of development, and use of buried powerlines in Sage-Grouse Winter Concentration Areas, where feasible, Alternative B Winter Concentration Area development scenario 2 could result in a decreased potential for land use conflicts in DA 1 compared to the Proposed Action.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		period, consistent with existing seasonal restrictions and other stipulations.	proactively avoid conflicts. Potential land use conflicts would be greatest in areas with higher densities of development (e.g., general habitat) that overlap lands used for livestock grazing or other uses.		
Lands with Wilderness Characteristics					
Impacts to Lands with Wilderness Characteristics	Development of three new wells per year and resulting surface disturbance, facilities, and project-related activity could occur in lands with wilderness characteristics units within the Project Area. The limited amount of development and disturbance, if any, that could have direct effects to lands with wilderness characteristics, would result in minor and localized impacts on naturalness or outstanding opportunities for solitude or primitive and unconfined forms of recreation.	Development of well pads, RGFs, overhead powerlines, pipelines, and access roads and ongoing operations would result in short- and long-term direct adverse impacts to lands with wilderness characteristics if development occurs within lands with wilderness characteristics units. All of the identified lands with wilderness characteristics in the Project Area (Map 12) occur outside of Sage-Grouse PHMA, where the density of development and resulting impacts would be greatest. The establishment of roads and ROWs from project-related development could affect the ability of existing lands with wilderness characteristics units to retain their qualification during future inventories. Any surface disturbance and project-related activities in lands with wilderness characteristics would result in a loss of wilderness characteristics while the disturbance/activity persists and until the area returns to pre-disturbance conditions.	Reduced potential for surface disturbance in lands with wilderness characteristics due to reduced density of development in Sage-Grouse Winter Concentration Areas (26,261 BLM-administered acres; 44 percent of lands with wilderness characteristics in the Project Area), surface disturbance threshold in other delineated habitats for focus species (10,308 BLM-administered acres), and other resource protection measures in delineated habitats for focus species (Map 5). For Alternative A, RGFs, compressor facilities, and powerlines would be prohibited within raptor nest buffers in DA 1, which overlaps 21,426 BLM-administered acres containing lands with wilderness characteristics reducing the potential impacts on naturalness resulting from these facilities, compared to the Proposed Action. Phasing of development would reduce the potential for development and disturbance to occur across all lands with wilderness characteristics simultaneously, which could occur under the Proposed Action.	Reduced potential for adverse impacts on lands with wilderness characteristics compared to the Proposed Action due to the reduced surface disturbance and fewer disturbance locations in the DA 1 area (Map 6), which overlaps 37,557 BLM-administered acres (63 percent) of lands containing wilderness characteristics in the Project Area. Reducing the level and extent of development in DA1, would reduce the frequency and intensity of visual contrasts and would reduce construction and other project-related activity that could degrade naturalness and opportunities for solitude in lands with wilderness characteristics, compared to the Proposed Action.	Reduced potential for adverse impacts on lands with wilderness characteristics compared to the Proposed Action due to the reduced surface disturbance, fewer disturbance locations, and a more clustered pattern of development in the DA 1 area (Map 6), which overlaps 37,557 BLM-administered acres (63 percent) of lands containing wilderness characteristics in the Project Area. Reducing the level and extent of development in DA1, especially within Sage-Grouse Winter Concentrations Areas, would reduce the frequency and intensity of visual contrasts and would reduce construction and other project-related activity that could degrade naturalness and opportunities for solitude in lands with wilderness characteristics, compared to the Proposed Action. For Alternative B Winter Concentration Area development scenario 2, buried pipelines would transport produced water and condensate from RGFs within Sage-Grouse Winter Concentration Areas to centralized RGFs outside of these areas. Short-term, adverse impacts from visual contrasts and noise in lands with wilderness characteristics could occur during construction of these pipelines; however, long-term impacts on wilderness characteristics would be reduced where Winter Concentration Areas overlap lands containing wilderness characteristics (26,261 BLM-administered acres) compared to the Proposed Action due to the reduction in heavy vehicle trips during the production phase. Within Sage-Grouse Winter Concentration Areas, phasing development from east to west would limit the potential for development and disturbance to be occurring across all Winter Concentration Areas at the same time, which also overlaps 26,261 BLM-administered acres of lands with wilderness characteristics. As a result, potential impacts to lands with wilderness characteristics would be less

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
					widespread during the development phase of Alternative B Winter Concentration Area development scenario 2 than for the Proposed Action, where development could occur across Winter Concentration Areas throughout the development period.
Livestock Grazing					
Loss of AUMs and Forage	Potential reduction in forage through the short-term loss of 25 AUMs and long-term loss of 9 AUMs.	Potential reduction in forage by the short-term loss of 780 AUMs and long-term loss of 232 AUMs. Other impacts would include reduced forage availability, changes in vegetative composition due to establishment and spread of invasive plants/noxious weeds, and potential decrease in palatability resulting from fugitive dust. Development and disturbance could occur across the Project Area during the development phase, resulting in potential adverse impacts to forage throughout the Project Area during the development phase.	Due to relatively similar levels of disturbance and AUM losses (779 short-term AUM loss and 222 long-term AUM loss), the anticipated impacts on livestock grazing from AUM loss would be similar to those under the Proposed Action. Alternative A would likely result in more localized forage loss than the Proposed Action since new development, and resulting disturbance and loss of AUMs, would be limited to the Phase being developed. Additionally, the BLM would require the initiation of interim reclamation of each Phase prior to development proceeding to the next Phase. As a result, Alternative A may decrease the total maximum amount of short-term surface disturbance and forage loss at any given time during Phases 2 and 3, which would reduce the amount of lost AUMs at any given time during this period compared to the Proposed Action.	Decreased surface disturbance would decrease the short-term loss of AUMs (712 AUMs lost) and long-term loss of AUMs (215 AUMs lost) compared to the Proposed Action. Reduced surface disturbance, fewer disturbance locations, and a more clustered pattern of development in DA 1, would reduce potential adverse impacts in this area compared to the Proposed Action.	Decreased surface disturbance would decrease the short-term loss of AUMs (727 AUMs lost) and long-term loss of AUMs (215 AUMs lost) compared to the Proposed Action. Reduced surface disturbance, fewer disturbance locations, and a more clustered pattern of development in DA 1, especially in Sage-Grouse Winter Concentration Areas, would reduce potential adverse impacts in this area compared to the Proposed Action. Alternative B Winter Concentration Area development scenario 2 would likely result in less widespread forage loss and impacts to grazing operations than the Proposed Action because new development, and resulting disturbance and loss of AUMs, would be phased from east to west in Winter Concentration Areas during the 10-year development phase.
Impact by Allotments	All allotments in the analysis area are likely to experience similarly low levels of surface disturbance and AUM loss under the No Action Alternative. The projected acreages of long-term surface disturbance would be greatest on the Sublette (22 acres) and South Desert (19 acres) allotments, since these allotments comprise a large percentage of the total acreage in the Project Area.	The projected acreages of long-term surface disturbance (and resulting AUM loss) under the Proposed Action would be greatest on the South Desert (611 acres), since this allotment comprises a substantial percentage of the total acreage in the Project Area and is not subject to density limitations for Sage-Grouse PHMA for the Proposed Action. Existing surface disturbance as a percentage of total allotment acreage is highest for the Sand Draw allotment, where existing surface disturbance is present on an estimated 7 percent (2,181 acres) of the allotment. Given the higher acreage of existing disturbance on the Sand Draw allotment, additional disturbance from the Proposed Action would likely result in more adverse impacts to livestock grazing in comparison to new disturbance in other allotments.	The projected acreage of long-term surface disturbance (and resulting AUM loss) under Alternative A would be greatest for the South Desert allotment (662 acres), since this allotment comprises a substantial percentage of the total acreage in the Project Area (primarily within DA 2 west) and contains a large proportion of general habitat, which would have the highest density of development and disturbance. Similar to the Proposed Action, given the higher acreage of existing disturbance on the Sand Draw allotment, additional disturbance from Alternative A would likely result in more adverse impacts to livestock grazing in comparison to new disturbance in other allotments. Reardon Canyon and Eighteen Mile allotments would experience the lowest levels of disturbance and AUM loss.	Similar to the Proposed Action and Alternative A, the projected acreage of long-term surface disturbance (and resulting AUM loss) under Alternative B Winter Concentration Area development scenario 1 would be greatest for the South Desert allotment (699 acres), since this allotment comprises a substantial percentage of the total acreage in the Project Area and lies largely within DA 2, where higher densities of development and disturbance are permitted. Similar to the Proposed Action, given the higher acreage of existing disturbance on the Sand Draw allotment, additional disturbance from Alternative B Winter Concentration Area development scenario 1 would likely result in more adverse impacts to livestock grazing in comparison to new disturbance in other allotments.	Same as Alternative B Winter Concentration Area development scenario 1.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		Reardon Canyon and Eighteen Mile allotments would experience the lowest levels of disturbance and AUM loss.		Reardon Canyon and Eighteen Mile allotments would experience the lowest levels of disturbance and AUM loss.	
Impacts from Roads and Traffic	Increased risk of livestock/vehicle collisions due to 12 miles of new access roads and associated increase in traffic. Small reductions in AUMs and low development would likely have negligible impacts on livestock grazing.	Increased risk of livestock/vehicle collisions due to 227 miles of new access roads and associated increase in traffic. Increased potential for spread and establishment of invasive species/noxious weeds from an expanded road network. Increased deposition of dust on vegetation could reduce palatability of forage to livestock.	Due to similar mileage of new roads (215 miles), the potential for livestock/vehicle collisions would be similar to the Proposed Action. Vehicle traffic under Alternative A may result in more adverse impacts than the Proposed Action in localized areas that have higher road densities and experience higher traffic volumes while development and production activities are occurring.	For Alternative B Winter Concentration Area development scenario 1, adverse impacts on livestock grazing from the road network would decrease compared to the Proposed Action due fewer miles of new roads (205 miles), especially within DA 1. Alternative B Winter Concentration Area development scenario 1 would result in a decreased potential for the spread and establishment of invasive species/noxious weeds compared to the Proposed Action.	For Alternative B Winter Concentration Area development scenario 2, adverse impacts on livestock grazing from the road network would decrease compared to the Proposed Action due fewer miles of new roads (205 miles), but would result in similar localized impacts to those described under Alternative A, especially from heavy truck traffic to RGF facilities on the perimeter of Winter Concentration Areas and PHMA during the production phase. Alternative B Winter Concentration Area development scenario 2 would result in a decreased potential for the spread and establishment of invasive species/noxious weeds compared to the Proposed Action.
Noise					
Construction Noise	Limited to no adverse impacts to sensitive noise receptors due to the relatively low level of development and compliance with all existing noise minimization requirements.	No anticipated impacts on residences or onsite workers from noise increase associated with project-related traffic or construction. Loudest construction noise would be associated with construction of well pads and RGFs. Construction of well pads and RGFs could result in exceedance of the 10 dBA noise threshold if these activities are located approximately one to three miles from the perimeter of a Sage-Grouse lek (Map 13), depending on the ambient noise levels monitored at the lek perimeters. Noise increases at Sage-Grouse leks resulting from construction activities could result in decreased lek attendance and lek abandonment, impacts to nesting and brood rearing activities, and other adverse effects on Sage-Grouse mating and behavior. These impacts would generally occur in the short-term while construction activities are occurring. Heavy trucks accessing construction sites could result exceedance of the 10 dBA threshold above ambient levels from 3,550 feet (0.67 mile) to 10,150 feet (1.92 miles), depending on the ambient sound levels at the perimeter of the Sage-Grouse leks.	Similar to the Proposed Action, but with reduced noise impacts to Sage-Grouse and other wildlife due to a phased development pattern in Sage-Grouse PHMA, a reduced density of development in Sage-Grouse Winter Concentration Areas, surface disturbance thresholds in delineated habitats for focus species that overlap or occur in close proximity to leks and other habitat, and additional resource protection measures that would reduce development and project-related activity in Sage-Grouse Winter Concentration Areas. Slightly longer period of noise impacts resulting from 0.4-year longer development phase than the Proposed Action; however, the magnitude of noise may be less because 14 fewer wells would be developed per year on average.	Similar to the Proposed Action, but with reduced noise impacts in DA 1 due to reduced density of development and fewer development locations in DA 1. Slightly longer period of noise impacts resulting from 0.4-year longer development phase than the Proposed Action; however, the magnitude of noise would be potentially less because 14 fewer wells would be developed per year on average.	Similar to the Proposed Action, but with reduced noise impacts in DA 1 and in Sage-Grouse Winter Concentration Areas due to reduced density of development and surface disturbance in DA 1 and disturbance thresholds, phasing of development, and centralizing facilities in Winter Concentration Areas. Constructing buried pipelines to transport produced water and condensate from RGFs within Sage-Grouse Winter Concentration Areas and PHMA to RGFs outside of these areas would increase the potential for short-term noise impacts during construction of these facilities. However, the buried pipelines to transport produced water and condensate would reduce truck traffic during production in PHMA and Winter Concentration Areas, reducing potential long-term noise impacts to Sage-Grouse from truck traffic in these areas, compared to the Proposed Action. Slightly longer period of noise impacts resulting from 0.4-year longer development phase than the Proposed Action; however, the magnitude of noise would be potentially less because 14 fewer wells would be developed per year on average.
Operational Noise	Limited to no adverse impacts to sensitive noise receptors due to the relatively low level of	Apart from flaring, equipment associated with operation of well pad facilities and RGFs would	Similar but reduced noise impacts compared to the Proposed Action due to phased development pattern and prohibition of RGFs	Similar but reduced noise impacts compared to the Proposed Action due to the reduced density	Similar but reduced noise impacts compared to the Proposed Action due to the reduced density of development in DA 1 that would reduce

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
	development and compliance with all existing noise minimization requirements.	be the loudest components of the Proposed Action during operation. Operation of well pad facilities and RGFs could result in exceedance of the 10 dBA noise threshold if these activities are located approximately 1 to 2.5 miles from the perimeter of a Sage-Grouse lek (Map 13), depending on the ambient noise levels monitored at the lek perimeters. Operations noise could result in adverse long-term noise impacts on Sage-Grouse attending leks if located within 1 to 2.5 miles of leks. Although the NPL Project would primarily use flareless technologies during completion and testing, flaring may be used in rare cases for safety reasons. Flaring events could result in exceedance of the 10 dBA noise threshold if flaring is conducted between 2.5 and 5.5 miles from the perimeter of Sage-Grouse lek locations (Map 13), depending on the ambient noise levels monitored at the lek perimeter.	and overhead powerlines in certain areas that could generate noise that affects Sage-Grouse. Reduced density of development and additional resource protection measures for delineated sensitive wildlife habitats would further reduce potential noise impacts where these areas are near Sage-Grouse leks.	of development in DA 1 that would reduce potential noise impacts to Sage-Grouse leks and Winter Concentration Areas.	potential noise impacts to Sage-Grouse leks and Winter Concentration Areas. The use of pipelines would decrease long-term noise impacts resulting from heavy truck traffic on roads used to access RGFs within Winter Concentration Areas and PHMAs, but would increase truck traffic and long-term noise impacts resulting from heavy truck traffic on roads used to access RGFs outside of these areas, compared to the Proposed Action.
Paleontology					
Impacts to the Wasatch, Bridger, and Green River (Laney Member) Formations (PFYC Class 5)	Minimal potential impacts to paleontological resources resulting from 213 acres of new surface disturbance (0.15 percent of the Project Area). The development of 12 miles of new access roads is unlikely to noticeably increase illegal vertebrate fossil collection.	Increased potential for exposure and possible destruction of paleontological resources compared to the No Action Alternative resulting from 6,340 acres of short-term disturbance (4.5 percent of the Project Area). A lower density of development in Sage-Grouse PHMA would reduce the potential for adverse impacts to the typically fossil-rich Bridger Formation present in this area. Construction of 227 miles of new access roads would increase access for both permitted and illegal vertebrate fossil collection. Increased access may increase potential for permitted paleontologists and geologists to make scientifically significant discoveries.	Similar adverse impacts to the Proposed Action, though to greater degree due to additional surface disturbance (6,748 acres). However, lower densities of development or disturbance thresholds in delineated habitats for focus species would reduce the potential for adverse impacts to paleontological resources in these areas by reducing the number of disturbance locations and surface disturbance. Conversely, the potential to discover significant paleontological resources would be reduced in sensitive wildlife habitats under Alternative A due to reduced development and access in these areas, compared to the Proposed Action. Reduced new access road construction (215 miles) would reduce access for both permitted and illegal vertebrate fossil collection, compared to the Proposed Action.	Similar adverse impacts to the Proposed Action, though to lesser degree due to reduced surface disturbance (5,724 acres). The DA 1 area contains a large proportion of the Wasatch Formation, which has high potential for vertebrate fossils; the reduced density of development and fewer disturbance locations in that area would further reduce adverse impacts compared to the Proposed Action. Conversely, the potential to discover significant paleontological resources would be reduced in DA1 due to the reduced level of development in this area, compared to the Proposed Action. Reduced new access road construction (205 miles) would reduce access for both permitted and illegal vertebrate fossil collection, compared to the Proposed Action.	Similar adverse impacts to the Proposed Action, though to lesser degree due to reduced surface disturbance (5,874 acres). The DA 1 area contains a large proportion of the Wasatch Formation, which has high potential for vertebrate fossils; the reduced density of development, fewer disturbance locations, and a more clustered pattern of development in that area would further reduce adverse impacts compared to the Proposed Action. Conversely, the potential to discover significant paleontological resources would be reduced in DA1 due to the reduced level of development in this area, compared to the Proposed Action. Reduced new access road construction (205 miles) would reduce access for both permitted and illegal vertebrate fossil collection, compared to the Proposed Action.
Recreation					
General	Noise, visual intrusions, increased human activity, and other effects associated with the development of three wells per year, continued activities at existing wells, and the construction of 12 miles of new access roads would result in limited and localized impacts to recreational opportunities and experiences.	Increased direct impacts to recreation including short-term impacts from noise created during construction activities and short- and long-term impacts from alterations to the recreational setting from natural gas wells, well pads, RGFs, pipelines, powerlines, and access roads from 6,340 acres of short-term and 1,890 acres of	Similar impacts to recreation as described for the Proposed Action, with the extent and severity of these impacts reduced in certain areas based on a reduced density of development in Sage-Grouse Winter Concentration Areas, surface disturbance thresholds in delineated habitats for focus	Similar impacts to recreation as described for the Proposed Action, though to a lesser degree in the DA 1 area due to a reduced density of development, fewer disturbance locations, and reduced human activity in this area, compared to the Proposed Action. Impacts to recreation settings and opportunities resulting from	Similar impacts to recreation as described for the Proposed Action, though to a lesser degree in the DA 1 area due to a reduced density of development, fewer disturbance locations, more clustered pattern of development, and reduced human activity in this area, compared to the Proposed Action. Impacts to recreation

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		long-term surface disturbance and associated activity. Disturbance and project activity would alter the natural setting and affect the recreational user experience in certain areas and, at the full-field scale of the Proposed Action, could result in substantial loss of recreation opportunities compared to the No Action Alternative.	species, and application of additional resource protection measures in delineated habitats for focus species in the DAs. Impacts to recreation settings and opportunities resulting from development phase activities would occur over a longer period (0.4 year longer) than the Proposed Action. However, fewer wells per year (an average of 14 fewer wells per year than the Proposed Action) could reduce the intensity of impacts compared to the Proposed Action. Additionally, the BLM would require the initiation of interim reclamation of each Phase prior to development proceeding to the next Phase. As a result, Alternative A would in a less widespread and more predictable pattern of development during Phases 2 and 3, which would reduce potential impacts on recreational activities.	development phase activities would occur over a longer period (0.4 year longer) than the Proposed Action. However, fewer wells per year (an average of 14 fewer wells per year than the Proposed Action) could reduce the intensity of impacts compared to the Proposed Action.	settings and opportunities resulting from development phase activities would occur over a longer period (0.4 year longer) than the Proposed Action. However, fewer wells per year (an average of 14 fewer wells per year than the Proposed Action) could reduce the intensity of impacts compared to the Proposed Action. Alternative B Winter Concentration Area development scenario 2 would likely result in less widespread impacts to recreation than the Proposed Action because new development would be phased from east to west in Winter Concentration Areas during the 10-year development phase. Burying powerlines in Winter Concentration Areas, where feasible, could further reduce impacts to recreational settings in that area.
Impacts to Hunting	Due to the relatively limited and localized development for the No Action Alternative, minimal impacts to hunting are anticipated.	The Proposed Action would affect hunting opportunities by (1) reducing the amount of wildlife and their habitat in the Project Area through disturbance or displacement; (2) modifying the migratory, foraging, or sheltering behaviors of wildlife, thus affecting their interactions with hunters; and (3) affecting hunters' desire to hunt within the Project Area by changing the recreational setting. These impacts to hunting would be substantially increased, compared to the No Action Alternative.	Alternative A would have similar impacts on hunting as the Proposed Action, but to a slightly lesser degree. Less long-term surface disturbance in sensitive wildlife habitat would result in reduced habitat loss for big game, Greater Sage-Grouse, and other upland birds and small game.	Alternative B Winter Concentration Area development scenario 1 would have similar impacts on hunting as the Proposed Action, but to a slightly lesser degree in the DA 1 area due to the reduced density of development, fewer disturbance locations, and reduced human activity in this area. This would decrease adverse impacts in comparison to the Proposed Action by maintaining habitat and associated hunting opportunities for big game (especially pronghorn), Sage-Grouse, and other upland birds and small game.	Alternative B Winter Concentration Area development scenario 2 would have similar impacts on hunting as the Proposed Action, but to a slightly lesser degree in the DA 1 area due to the reduced density of development, fewer disturbance locations, more clustered pattern of development, and reduced human activity in this area. This would decrease adverse impacts in comparison to the Proposed Action by maintaining habitat and associated hunting opportunities for big game (especially pronghorn), Sage-Grouse, and other upland birds and small game.
Green and New Fork Rivers SRMA	Limited and localized adverse impacts to the recreation setting of the Green and New Fork Rivers SRMA due to the relatively low level of development.	Potential for minimal visual impacts to the recreation setting of the Green and New Fork Rivers SRMA (3.4 miles from the Project Area at its closest point) due to the project-related development.	Potential impacts to the Green and New Fork Rivers SRMA would be reduced due to a reduced number of disturbance locations in Sage-Grouse Winter Concentration Areas and disturbance thresholds in delineated habitats for focus species (e.g., raptors, Sage-Grouse) in DA 1, which is the closest DA to the SRMA.	Potential impacts to the Green and New Fork Rivers SRMA would be reduced from the Proposed Action due to a reduced level of development and fewer ongoing human activities in DA 1, which is the closest DA to the SRMA.	Potential impacts to the Green and New Fork Rivers SRMA would be reduced from the Proposed Action due to a reduced level of development and fewer ongoing human activities in DA 1, which is the closest DA to the SRMA. The level of development and associated impacts would be further reduced within portions of DA 1 that overlap Winter Concentration Areas, which are subject to additional development limitations.
Wind River Front MA	Limited and localized adverse impacts to the recreation setting of the Wind River Front MA due to the relatively low level of development.	Little potential for visual impacts to the recreation setting of the Wind River MA due to 6.2 miles distance from the Project Area. Traffic associated with the Proposed Action could result in indirect adverse impacts to recreational users accessing recreation areas outside of the Project Area, including this MA.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Ross Butte MA	Limited and localized adverse impacts to the recreation setting of the Ross Butte MA due to the relatively low level of development.	Ross Butte MA overlaps 444 BLM-administered acres in the Project Area. Potential for Proposed Action to result in direct and indirect impacts that alter the recreational setting of the Ross Butte MA.	Fewer direct and indirect adverse impacts to the recreational setting of the Ross Butte MA than the Proposed Action due to the reduced density of development in Sage-Grouse Winter Concentration Areas that overlap or are within view of the Ross Butte MA.	Fewer direct and indirect adverse impacts to the recreational setting of the Ross Butte MA than the Proposed Action due to the reduced level of development in DA 1, which would reduce surface disturbance and impacts to the recreational setting of the Ross Butte MA.	Fewer direct and indirect adverse impacts to the recreational setting of the Ross Butte MA than the Proposed Action due to the reduced level of development in DA 1, especially within Sage-Grouse Winter Concentration Areas, which would reduce surface disturbance and impacts to the recreational setting of the Ross Butte MA.
OHV Use and Other Motorized Recreation	Limited and localized adverse and beneficial impacts on OHV use due to the relatively low level of development.	Construction of 227 miles of new access roads would benefit those that enjoy motorized recreation in a modified environment, but would adversely affect recreationists seeking a natural setting or primitive forms of recreation.	Construction of 215 miles of new access roads would result in proportional beneficial and adverse impacts to OHV use compared to the Proposed Action.	Construction of 205 miles of new access roads would result in proportional beneficial and adverse impacts to OHV use compared to the Proposed Action.	Same as Alternative B Winter Concentration Area development scenario 1.
Socioeconomics					
Jobs, Population, Housing	Impacts from the creation of 14 new development and production jobs; however, these jobs are expected to be filled by current residents in the analysis and no estimated increase in population or housing would occur.	Impacts from the creation of 954 new development and production jobs. An estimated 370 new workers would relocate to the region resulting in a regional population increase of 973 people. Workers relocating to the region would most likely occupy vacant rentals and existing homes listed on the market. Based on the estimated number of workers moving to the region, and the availability of housing, Sublette County could accommodate the expected influx of 247 households for the Proposed Action. With its much larger housing stock, Sweetwater County could also accommodate the expected NPL Project-related influx of 123 households.	Fewer impacts on jobs as there would be 33 fewer production jobs throughout the life of the project. Approximately 9 percent fewer households would relocate to the project vicinity than under the Proposed Action, and growth-related social impacts, including impacts on housing, public services, and utilities would be proportionally less.	Same as the Proposed Action.	Same as the Proposed Action.
Quality of Life Impacts	No anticipated impacts to quality of life due to relatively low level of development that is similar to existing conditions.	Potential quality of life impacts could result from (1) changes in visual setting for people who travel along U.S. Highway 191 or recreate in the surrounding backcountry where project features may be visible, (2) increased traffic volumes especially on state Highway 351 and U.S. Highway 191 (3) induced inflation reducing real income (4), additional educational funding, (5) potential increase in some per capita crime incidences, and (6) potential impacts to air quality. No impacts to ground water quality or quantity that would affect water users would be expected to occur, and no noise related impacts would be expected to occur.	Same as the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.
Economic Impacts	Direct, indirect, and induced increases in jobs, labor income, and output in the region; however, given the low rate of well development and the percent of these effects	The Proposed Action would result in an approximate 10 percent increase in employment, a 6 percent increase in labor income, and an approximate 17 percent increase in economic output in the three-	Under Alternative A, the number of workers could fluctuate more than the Proposed Action during development depending on the Phase and DA being developed; however, the labor income and total expenditure of well	Under Alternative B Winter Concentration Area development scenario 1, jobs, labor expenses, and non-labor expenses of project development would be approximately 4 percent less than under the Proposed Action,	Economic impacts would be substantially similar to those described for Alternative B Winter Concentration Area development scenario 1.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
	in relation to the regional economy, these effects would be minimal.	county region relative to baseline levels. These increases would provide a noticeable stimulus to the regional economy. Natural gas and condensate production would gradually decline after the 10-year development period as wells become uneconomical and are plugged and abandoned. Declines in project-related income and employment in the years following the development phase would be compounded by contractions in industries that support gas and oil development, potentially causing recession-like socioeconomic conditions to prevail in portions of the SESA. Unemployment rates and numbers of low-income households could increase, while demands for social services to assist low-income residents could increase. Economic impacts to grazing and agriculture would include reduction in available forage and AUMs, reduced forage and agricultural value and income, and more intensive management of livestock and agriculture. Economic impacts to recreation would include reduction in consumptive and non-consumptive recreation in the Project Area. However, due to lack of developed recreation sites and permits in the Project Area, economic impacts would be minimal.	development are expected to be the same as those described for the Proposed Action. The stimulus provided to the regional economy by production under Alternative A, and its secondary effects, would be slightly smaller than, but qualitatively similar to, those under the Proposed Action. Annual development phase economic impacts would be approximately 4 percent smaller than under the Proposed Action, because on average 14 fewer wells would be developed annually. For Alternative A the development phase economic effects would extend over a slightly longer period due to the longer duration of the development phase (0.4 years longer than the Proposed Action. In addition, development phase economic impacts could be more variable from year to year than the Proposed Action due to the phased development pattern. Economic contraction effects during the post-development period would be essentially the same as for the Proposed Action, including potential increases in unemployment, low-income households, and demands for social services. Economic impacts to livestock grazing would be similar to the Proposed Action though slightly greater due to less resource protection measures for livestock grazing, compared to the Proposed Action. Economic impacts to recreation would be similar to the Proposed Action though to a lesser degree due to a reduced density of development in Sage-Grouse Winter Concentration Areas, surface disturbance thresholds in delineated habitats for focus species, and application of additional resource protection measures in delineated habitat for focus species in the DAs.	because on average 14 fewer wells would be developed annually. For Alternative B Winter Concentration Area development scenario 1, the development phase economic effects would extend over a slightly longer period due to the longer duration of the development phase (0.4 years longer than the Proposed Action. Overall, the regional economic impacts resulting from development and production under Alternative B Winter Concentration Area development scenario 1 would be approximately the same as the Proposed Action. Annual reductions in livestock production value and regional economic output resulting from lost AUMs would be slightly less than the Proposed Action, resulting in proportionally less impacts as those described for the Proposed Action. Impacts to recreation, tourism, and travel related spending would be similar to those described for the Proposed Action, though to a lesser degree in DA 1, due to a reduced level of development in this area. Economic contraction effects during the post-development period would be essentially the same as for the Proposed Action, including potential increases in unemployment, low-income households, and demands for social services.	

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Fiscal Impacts	Fiscal impacts would continue consistent with historic trends under the No Action Alternative.	Projected project revenues would be at total of $17,850 million. Impacts from substantial increases in available funding for public uses at the county and regional levels, and, to smaller extents, at the state and federal levels, compared to the No Action Alternative. As a result, the Proposed Action would produce a long-term revenue source that would increase the region's capacity to provide public services for its residents.	Same as the Proposed Action, except taxable purchases are expected to increase by $4.3 million per year during the production period as a result of additional pipeline construction under Alternative A.	Same as Proposed Action.	Same as Proposed Action.
Non-Market Values	Due to the relatively low level of development for the No Action Alternative and the limited potential impact on social and quality of life conditions, the No Action Alternative would have minimal impacts on nonmarket values.	Development of approximately 3,500 wells and the resulting impacts on the natural environment and social/quality of life conditions could result in impacts to direct use (e.g., diminished recreational setting and opportunities), indirect use (e.g., air quality and water quality impacts), and passive use (e.g., conversion of the Project Area to a more industrial landscape) nonmarket values.	Impacts to nonmarket values would be similar to those discussed for the Proposed Action though to a slightly lesser degree. Compared to the Proposed Action, additional resource protection measures for sensitive wildlife habitats could reduce impacts to direct use and passive use nonmarket values associated with wildlife including hunting opportunities, wildlife viewing, and preservation of wildlife diversity and abundance for future generations. However, since the overall level of development (3,500 new wells) would be similar to the Proposed Action, any differences in impacts to nonmarket values are expected to be negligible.	Impacts to nonmarket values would be similar to those discussed for the Proposed Action though to a slightly lesser degree. For Alternative B Winter Concentration Area development scenario 1, increased emphasis on conserving a range of sensitive resources and considering landscape-scale impacts during planning for site-specific development could reduce impacts to direct use, indirect use, and passive use nonmarket values, compared to the Proposed Action. However, since the overall level of development (3,500 new wells) would be similar to the Proposed Action, any differences in impacts to nonmarket values are expected to be negligible.	Impacts to nonmarket values would be substantially similar to those described for Alternative B Winter Concentration Area development scenario 1.
Environmental Justice	Existing land uses, including mineral development and economic impacts, would continue consistent with historic trends.	Several resource impacts could adversely impact environmental justice communities under the Proposed Action; however, there are no anticipated adverse impacts that would disproportionately affect environmental justice communities.	Development-phase environmental justice impacts would be slightly less intense, but slightly more prolonged, than under the Proposed Action because fewer wells would be developed annually. Overall impacts would be approximately the same as the Proposed Action, with no environmental justice populations disproportionately adversely affected.	Same as Alternative A.	Same as Alternative A.
Soils					
Acres of short-term soil disturbance (percentage of Project Area)	213 (0.15 percent of Project Area)	6,340 (4.5 percent of Project Area)	6,748 (4.8 percent of Project Area), includes 424 acres outside of Project Area for buried condensate and produced water pipeline	5,742 (4.1 percent of Project Area)	5,874 (4.2 percent of Project Area)
Acres of long-term soil disturbance (percentage of Project Area)	79 (0.06 percent of Project Area)	1,890 (1.3 percent of Project Area)	1,811 (1.3 percent of Project Area)	1,741 (1.2 percent of Project Area)	1,741 (1.2 percent of Project Area)
Impacts to Soils	Adverse impacts to soils due to direct disturbance, compaction, mixing, and increased erosion potential that could result in loss of soil productivity and erosion in limited and localized areas. Minimal impacts are anticipated due to the relatively low level of development and surface disturbance for the No Action Alternative.	Surface disturbance would impact soils to varying degrees depending on the amount, placement, and type of surface disturbance and the disturbed soil's characteristics. Soil impacts would include removal of soil and vegetation, bare soil, soil compaction, and undesirable mixing of soil horizons. These impacts could subsequently result in a loss of soil productivity,	Impacts to soils would be similar to those described for the Proposed Action, but the degree of impacts would be slightly more in the short term and slightly less in the long term compared to the Proposed Action due to a slight increase in short-term disturbance (6.4 percent) and a slight decrease in long-term disturbance (4.2 percent). The location of	In general, adverse soil impacts for Alternative B Winter Concentration Area development scenario 1 would be similar to the Proposed Action, but the extent and degree of impacts would be decreased based on the decrease in surface disturbance (9.4 percent less in the short term, and 7.9 percent less in the long term), compared to the Proposed Action. The	In general, adverse soil impacts for Alternative B Winter Concentration Area development scenario 2 would be similar to the Proposed Action, but the extent and degree of impacts would be decreased based on the decrease in surface disturbance (7.4 percent less in the short term, and 7.9 percent less in the long term), compared to the Proposed Action. The

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		increased susceptibility of the soil to wind and water erosion, increased sedimentation and surface runoff, elevated salt loads in affected water resources, and the spread of invasive species and noxious weeds. Short-term and long-term soil impacts would depend on the success of interim and final reclamation.	disturbance and soil impacts would vary from the Proposed Action based on the density of development and resource protection measures for Alternative A. An average of 14 fewer wells would be developed per year than the Proposed Action, resulting in slightly less soil impacts per year compared to the Proposed Action.	location of disturbance and soil impacts would vary from the Proposed Action based on the density of development and resource protection measures for Alternative B Winter Concentration Area development scenario 1. An average of 14 fewer wells would be developed per year than the Proposed Action, resulting in slightly less soil impacts per year compared to the Proposed Action.	location of disturbance and soil impacts would vary from the Proposed Action based on the density of development and resource protection measures for Alternative B Winter Concentration Area development scenario 2. An average of 14 fewer wells would be developed per year than the Proposed Action, resulting in slightly less soil impacts per year compared to the Proposed Action.
Disturbance to Soils with Limiting Characteristics, including Low Reclamation Potential Soils	Vegetation and soil removal, bare soil, and other soil impacts resulting from continued development at historic rate of three new wells per year would increase erosion rates and limit reclamation potential, especially if development occurs in areas with soils with limiting characteristics. Minimal impacts are anticipated due to the relatively low level of development and surface disturbance for the No Action Alternative.	Direct adverse impacts primarily resulting from grading, leveling, and removal of vegetation and soil. Considering the total acreage of soils with limiting characteristics in high to moderate risk categories, and the estimated distribution of development, the primary soil-limiting characteristics for development and reclamation would be droughtiness, wind erosion, alkalinity, and, to a lesser extent, sodicity. Potential impacts and appropriate mitigation for proposed development on soils with low reclamation potential would be further assessed during site-specific permitting of APDs.	Impacts to soils with limiting characteristics would be similar to the Proposed Action, but with the acreage of estimated disturbance on soils with limiting characteristics proportionally more in the short term (6.4 percent increase) and proportionally less in the long term (4.2 percent decrease). The reduced density of development in Sage-Grouse Winter Concentration Areas and surface disturbance thresholds in delineated habitats for focus species would reduce the level of development in these areas and reduce potential direct and indirect impacts to soils in these areas, compared to the Proposed Action. Potential impacts and appropriate mitigation for proposed development on soils with low reclamation potential would be further assessed during site-specific permitting of APDs.	Decrease in short- and long term surface disturbance compared to the Proposed Action, with proportional decreases in impacts to soils with limiting characteristics. The greatest decrease in surface disturbance relative to the Proposed Action would occur in DA 1, which would limit the potential for surface disturbance and resulting impacts to soils with limiting characteristics in this area. Potential impacts and appropriate mitigation for proposed development on soils with low reclamation potential would be further assessed during site-specific permitting of APDs.	Decrease in short- and long term surface disturbance compared to the Proposed Action, with proportional decreases in impacts to soils with limiting characteristics. The greatest decrease in surface disturbance relative to the Proposed Action would occur in DA 1 (especially within Winter Concentration Areas), which would limit the potential for surface disturbance and resulting impacts to soils with limiting characteristics in this area. Potential impacts and appropriate mitigation for proposed development on soils with low reclamation potential would be further assessed during site-specific permitting of APDs.
Surface Runoff and Erosion	Vegetation and soil removal, bare soil, and other soil impacts resulting from continued development at historic rates can result in increased surface runoff and erosion, especially if development occurs in areas with high water and wind erosion potential (Map 23, Map 24). Based on the AGWA modeling, on average, the surface runoff efficiency for the present conditions scenario was less than four percent, with average runoff for all upland planes of 0.035 inches.	Based on the AGWA modeling, watersheds showing an increase in surface runoff under the Proposed Action after a two-inch, 24-hour, 25-year storm event are the upper reaches of Alkali Creek, the central reach of Alkali, a small portion of the upper watershed of Reardon Draw and the upper reaches of Eighteen Mile Canyon. Based on the AGWA modeling, all increases in surface runoff and sediment transport would stay within the boundaries of the Project Area.	Surface runoff and erosion for Alternative A would be similar to the Proposed Action, though slightly higher due to a 6.4 percent increase in short-term surface disturbance compared to the Proposed Action. Within the Project Area, Alternative A would result in slightly less surface runoff and erosion due to the 0.25 percent decrease in short-term surface disturbance compared to the Proposed Action. Alternative A, though not specifically modeled, would be within the range of scenarios simulated by the AGWA modeling and would be most similar to the 2-mile buffer scenario. Refer to Appendix J (*AGWA Technical Report*) for more information on surface runoff and erosion. Impacts on surface runoff and erosion from long-term surface-disturbance would be substantially similar to the Proposed Action (Appendix J (*AGWA Technical Report*).	Surface runoff and erosion for Alternative B Winter Concentration Area development scenario 1 would be similar to the Proposed Action, except to a lesser degree due to the 9.4 percent decrease in short-term surface disturbances compared to the Proposed Action. This surface disturbance decrease would reduce the potential for surface runoff and erosion, especially in DA 1, compared to the Proposed Action. Alternative B Winter Concentration Area development scenario 1, though not specifically modeled, would be within the range of scenarios simulated by the AGWA modeling between the 2-mile buffer scenario and the worst-case scenario. Refer to Appendix J (*AGWA Technical Report*) for more information on surface runoff and erosion. Impacts on surface runoff and erosion from long-term surface-disturbance would be substantially similar to the Proposed Action (Appendix J [*AGWA Technical Report*]).	Surface runoff and erosion for Alternative B Winter Concentration Area development scenario 2 would be similar to the Proposed Action, except to a lesser degree due to the 7.4 percent decrease in short-term surface disturbances compared to the Proposed Action. This surface disturbance decrease would reduce the potential for surface runoff and erosion, especially in DA 1, compared to the Proposed Action. Alternative B Winter Concentration Area development scenario 2, though not specifically modeled, would be within the range of scenarios simulated by the AGWA modeling between the 2-mile buffer scenario and the worst-case scenario. Refer to Appendix J (*AGWA Technical Report*) for more information on surface runoff and erosion. Impacts on surface runoff and erosion from long-term surface-disturbance would be substantially similar to the Proposed Action (Appendix J [*AGWA Technical Report*]).

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Special Designations					
Sublette Cutoff of the California NHT and the North Sublette Meadow Springs Variant of the Sublette Cutoff	Potential adverse impacts to the Sublette Cutoff and North Sublette Meadow Springs Variant if development and disturbance occurs within the three-mile viewshed of the trails.	Potential adverse impacts within the three-mile viewshed of the Sublette Cutoff and North Sublette Meadow Springs Variant would include project-related activities and construction that result in the introduction of visual elements that diminish the visual setting of the trails. The greatest potential of impacts would occur in areas with the greatest density of development (i.e., non-PHMA).	Fewer impacts than the Proposed Action due prohibition of RGFs, compressor stations, and powerlines in delineated mountain plover habitat and raptor buffers in DA 3 that are within the three-mile viewshed of the Sublette Cutoff and North Sublette Meadow Spring Variant.	Same as Proposed Action.	Same as Proposed Action.
Impacts to the Ross Butte MA	Limited potential for localized adverse impacts to the setting of the Wind River Front MA due to the relatively low level of development.	Potential for direct short- and long-term adverse impacts if surface disturbance occurs within the 444 BLM-administered acres of the Ross Butte MA overlapping the Project Area.	Similar impacts as described for the Proposed Action, but to a lesser degree due to limitations on the density of development for the protection of Sage-Grouse Winter Concentration Areas and delineated habitats for focus species in DA 1.	Similar impacts as described for the Proposed Action, but to a lesser degree due to the reduced level of development in DA 1.	Similar impacts as described for the Proposed Action, but to a lesser degree due to the reduced level of development in DA 1, especially within Sage-Grouse Winter Concentration Areas.
Impacts to the Wind River Front MA	Limited potential for localized adverse impacts to the setting of the Wind River Front MA due to the relatively low level of development.	Direct impacts to the Wind River MA unlikely due to the 6.2-mile distance at its closest point to the Project Area. Minimal potential for indirect impacts resulting from project-related development visible in the background views of the Project Area.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Transportation and Access					
Miles of new roads	12	227	215	205	205
Total vehicle trips (per 24-hour day) during full production	205	1,284	1,163 The phased development pattern for Alternative A could localize and concentrate vehicle trips to the Phase that is being developed, compared to the Proposed Action and Alternative B where new development and associated vehicle trips could be occurring across the Project Area during the development period.	1,284	1,284
Vehicle Collisions	The risk of additional traffic fatalities would increase slightly, from 0.01 to 0.04 fatalities over approximately 40 years (life of the project).	The risk of approximately one to five additional traffic fatalities could result from the Proposed Action over approximately 40 years (life of the project).	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Vegetation					
Vegetation Communities	The majority of estimated surface disturbance would occur within the sagebrush-steppe community (140 acres of short-term disturbance and 52 acres of long-term disturbance).	The majority of estimated surface disturbance would occur within the sagebrush-steppe community (4,177 acres of short-term disturbance and 1,245 acres of long-term disturbance), followed by the Great Basin Saltbush Scrub community (1,704 acres of short-term disturbance and 508 acres of long-term disturbance).	Similar impacts as described for the Proposed Action, but varying in extent and location based on surface disturbance, resource protection measures for sensitive wildlife habitat, and the sequential phasing of development. Interim reclamation required after each development phase would decrease the total maximum amount of short-term surface disturbance and	Similar impacts as described for the Proposed Action but varying in extent and location based on changes in surface disturbance from reductions in the density of development and number of surface disturbance locations in DA 1. The majority of estimated surface disturbance would occur within the sagebrush-steppe	Similar impacts as described for the Proposed Action but varying in extent and location based on changes in surface disturbance from reductions in the density of development and number of surface disturbance locations in DA 1. Additionally, impacts to vegetation communities would be less widespread due to

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
			area of cleared vegetation at any given time, compared to the Proposed Action. The majority of estimated surface disturbance would occur within the sagebrush-steppe community (4,166 acres of short-term disturbance and 1,193 acres of long-term disturbance), followed by the Great Basin Saltbush Scrub community (1,700 acres of short-term disturbance and 487 acres of long-term disturbance). An average of 14 fewer wells would be developed per year under Alternative A, decreasing the amount of new surface disturbance and potential vegetation impacts each year of the development phase compared to the Proposed Action.	community (3,783 acres of short-term disturbance and 1,147 acres of long-term disturbance), followed by the Great Basin Saltbush Scrub community (1,543 acres of short-term disturbance and 468 acres of long-term disturbance). An average of 14 fewer wells would be developed per year under Alternative A, decreasing the amount of new surface disturbance and potential vegetation impacts each year of the development phase compared to the Proposed Action.	the phased pattern of development in Winter Concentration Areas. The majority of estimated surface disturbance would occur within the sagebrush-steppe community (3,870 acres of short-term disturbance and 1,147 acres of long-term disturbance), followed by the Great Basin Saltbush Scrub community (1,579 acres of short-term disturbance and 468 acres of long-term disturbance). An average of 14 fewer wells would be developed per year under Alternative A, decreasing the amount of new surface disturbance and potential vegetation impacts each year of the development phase compared to the Proposed Action.
Riparian and Wetland Communities	Low probability to disturb riparian and wetland communities due to the relatively low level of development.	Increased probability to disturb riparian and wetland communities compared to the No Action Alternative. Potential impacts would most likely be associated with the crossing of riparian and wetland communities by linear features, such as roads (227 miles of new access roads), pipelines, and powerlines.	Similar probability to disturb riparian and wetland communities compared to the Proposed Action due to the crossing of riparian and wetland communities by linear features. Although there would be an increased acreage of short-term surface disturbance under Alternative A due to 88 miles of additional buried pipelines, the buried condensate and produced water pipeline that would extend outside of the Project Area would likely be run parallel to drainages and be sited to avoid riparian and wetland communities, minimizing the potential for impacts.	Decreased potential to disturb riparian and wetland areas due to a decrease in acreage of estimated short-term and long-term surface disturbance, 22 fewer miles of new access roads and adjacent buried pipelines compared to the Proposed Action.	Decreased potential to disturb riparian and wetland areas due to a decrease in acreage of estimated short-term and long-term surface disturbance, 22 fewer miles of new access roads, and 7 fewer miles of buried pipelines, compared to the Proposed Action. However, potential adverse impacts related to disturbance from burying powerlines, where feasible, under Alternative B Winter Concentration Area development scenario 2 would not occur under the Proposed Action.
Invasive Species and Noxious Weeds	Potential for the establishment and spread of invasive species on 213 acres in the short term and 79 acres in the long term, where vegetation removal and soil disturbance would occur.	Increased potential for the establishment and spread of invasive species on 6,340 acres in the short term and 1,890 acres in the long term, where vegetation removal and soil disturbance would occur. The potential for adverse impacts to native vegetation communities would be greater than under the No Action Alternative due to the substantially greater area of disturbance.	Similar impacts as described for the Proposed Action, but the location and extent could vary based on reduced density of development and additional resource protection measures in Sage-Grouse Winter Concentration Areas and other delineated habitats for focus species, which would reduce the potential for spread and establishment of invasive species and noxious weeds in these areas. Initiating reclamation for each Phase before moving to the next Phase may reduce the extent and potential for establishment and spread of invasive species and noxious weeds across the Project Area, compared to the Proposed Action.	Similar impacts as described for the Proposed Action, though to a lesser degree in the DA 1 area due to a reduced density of development and fewer surface disturbance locations.	Similar impacts as described for the Proposed Action though to a lesser degree in the DA 1 area due to a reduced density of development, fewer surface disturbance locations, and a more clustered pattern of development (especially within Winter Concentration Areas), compared to the Proposed Action.
Special Status Plant Species	Minimal potential for direct and indirect impacts to occurring or potentially occurring special status plant species due to the relatively	Potential for direct impacts including mortality and destruction of seed banks in disturbance sites. Numerous potential indirect impacts as	Reduced potential for direct and indirect impacts due to a reduced density of development in Sage-Grouse Winter Concentration Areas and surface disturbance thresholds and other resource protection	Similar direct impacts to the Proposed Action, but to a lesser degree in the DA 1 area due to a reduced density of development and fewer number of surface disturbance locations,	Similar direct impacts to the Proposed Action, but to a lesser degree in the DA 1 area due to a reduced density of development, fewer number of surface disturbance locations, and a more

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
	low level of development and pre-construction survey requirements.	listed in Section 4.18.3.3 (*Special Status Plant Species*). Pre-construction surveys would be required for all special status plants that have potential habitat in areas of proposed development, as determined by the BLM, which would reduce potential for impacts to special status plant species	measures in delineated habitats for focus species would reduce surface disturbance and development in these areas that could affect special status plant species, compared to the Proposed Action. Prohibiting RGFs, compressor facilities, and powerlines within delineated mountain plover habitat in DA 3 and DA 6, within raptor nest buffers in DA 1, DA 3, and DA 5, and within burrowing owl nest buffers in DA 6 would reduce potential impacts compared to the Proposed Action. Similar impacts to the Proposed Action would result from requiring pre-construction surveys for all special status plants that have potential habitat.	compared to the Proposed Action. Similar impacts to the Proposed Action would result from requiring pre-construction surveys for all special status plants that have potential habitat.	clustered pattern of development (especially within Winter Concentration Areas), compared to the Proposed Action. Similar impacts to the Proposed Action would result from requiring pre-construction surveys for all special status plants that have potential habitat.
Visual Resources					

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Types of Visual Impacts	Direct, adverse impacts on visual resources would result from 213 acres of estimated short-term surface disturbance and 79 acres of long-term surface disturbance in the Project Area by creating line, form, color, and texture contrasts. Due to the relatively small percentage of the Project Area that would have surface disturbance, adverse impacts on the visual setting within the Project Area or sensitive viewing locations in the analysis area would be minor and localized.	The Proposed Action would result in direct adverse impacts on visual resources from short- and long-term surface disturbance, including development and operations of new natural gas facilities that modify the natural visual characteristics of the landscape in the Project Area by creating line, form, color, and texture contrasts. Direct, adverse impacts on visual resources would result from 6,340 acres of short-term surface disturbance (4.5 percent of the Project Area) and 1,890 acres of long-term surface disturbance (1.3 percent of the Project Area). Construction activities could also result in indirect, adverse impacts on visual resources from construction vehicles, human activity, and other construction-related activity, which can adversely impact visual resources due to new form, line, color, and texture contrasts. Construction-related impacts and project facilities that result in only short-term disturbance (i.e., pipelines) would persist until interim reclamation is complete and vegetation type and structure in previously disturbed areas is reclaimed to match pre-disturbance conditions consistent with surrounding undisturbed areas. Construction and operations activities could also result in indirect, adverse impacts on visual resources through vehicle-related fugitive dust, which can adversely impact scenic quality. Development and operations could also result in indirect, adverse impacts on visual resources by increasing potential spread and establishment of invasive plant species that can contribute to alternative vegetative cover and increased frequency and severity of wildland fire. Solar panels installed at well pads would result in long-term visual impacts that would vary in intensity based on the time of day, season, light conditions, and reflective angle. In general, visual impacts would be greatest for viewers looking towards the portions of the Project Area outside of Sage-Grouse PHMA, as these areas would have the highest density of development.	Similar impacts to visual resources as under the Proposed Action, with the extent and severity of these impacts reduced in delineated habitats for focus species based on the reduced densities of development, surface disturbance thresholds in delineated habitats for focus species, and application of additional resource protection measures these areas, compared to the Proposed Action. Alternative A could create additional line, form, color, and texture contrasts on the 424 acres of surface disturbance outside of the Project Area for a buried pipeline to transport produced water and condensate to sales points.	Similar impacts to visual resources as under the Proposed Action, but to a lesser degree in the DA 1 area. For Alternative B Winter Concentration Area development scenario 1, the DA 1 area would have a decreased density of development, reduced short-term and long-term surface disturbance, and less miles of new access roads and pipelines, compared to the Proposed Action.	Similar impacts to visual resources as under the Proposed Action, but to a lesser degree in the DA 1 area. For Alternative B Winter Concentration Area development scenario 2, the DA 1 area would have a decreased density of development, reduced short-term and long-term surface disturbance, less miles of new access roads and pipelines, and more clustered pattern of development, especially within Winter Concentration Areas, compared to the Proposed Action. Burying powerlines in Winter Concentration Areas, where feasible, would reduce long-term visual impacts from new form, line, color, and texture contrasts that would result from overhead powerlines

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
Intensity of Visual Impacts Across the Project Area and in VRM Class III	The intensity of visual impacts would be uniform and relatively minor based on the limited level of development for the No Action Alternative.	Visual impacts resulting from surface disturbance and project-related activities would be more concentrated outside of Sage-Grouse PHMA, which would have a higher density of development than areas within Sage-Grouse PHMA. Areas with higher density of development generally overlap VRM Class IV.	Reduced adverse impacts on VRM Class III areas compared to the Proposed Action due to the reduced density of development, surface disturbance threshold of 3 percent disturbance per 640 acres, and additional protection measures in Winter Concentration Areas that overlap VRM Class III areas. Alternative A also prohibits RGFs, compressor facilities, and above-ground powerlines, likely to create the most-visible line and form contrasts, in delineated mountain plover habitat in DA 3 and DA 6 (3,044 acres), within raptor nest buffers in DA 1, DA 3, and DA 5 (37,928 BLM-administered acres), and within burrowing owl nest buffers in DA 6 (1,914 BLM-administered acres), further reducing potential adverse impacts to visual resources, especially where these restrictions overlap VRM Class III areas. For Alternative A, drilling and completions would only occur in certain DAs based on the Phase being developed. As a result, the visual impacts occurring during drilling and completions described under the Proposed Action, including line, form, and color contrasts, would be more localized under Alternative A and less widespread across the Project Area at any given time compared to the Proposed Action.	Similar to Alternative A, Alternative B Winter Concentration Area development scenario 1 would reduce the density of development in VRM Class III areas more than the Proposed Action, which would reduce impacts on VRM Class III areas. Under Alternative B Winter Concentration Area development scenario 1, the DA 1 area encompasses 93 percent (20,969 BLM-administered acres) of the of VRM Class III area in the Project Area. The reduced density of development, reduced short-term and long-term surface disturbance, and less miles of new access roads and pipelines, would reduce potential impacts in the VRM Class III area, thereby reducing the potential for adverse impacts on visual resources in this area, compared to the Proposed Action.	Similar to Alternative A, Alternative B Winter Concentration Area development scenario 2 would reduce the density of development in VRM Class III areas more than the Proposed Action, which would reduce impacts on VRM Class III areas. Under Alternative B Winter Concentration Area development scenario 2, the DA 1 area encompasses 93 percent (20,969 BLM-administered acres) of the of VRM Class III area in the Project Area. The reduced density of development, reduced short-term and long-term surface disturbance, less miles of new access roads and pipelines, and more clustered pattern of development, especially in Winter Concentration Areas within DA 1, would reduce potential impacts in the VRM Class III area, thereby reducing the potential for adverse impacts on visual resources in this area, compared to the Proposed Action. Phasing development across Winter Concentration Areas would further reduce the extent of visual impacts in that area during the 10-year development phase, compared to the Proposed Action. Burying powerlines in Winter Concentration Areas, where feasible, would reduce visual impacts over the long term.
Impacts from Sensitive Viewing Locations	Due to the relatively small percentage of the Project Area that would have surface disturbance, adverse impacts on the visual setting from sensitive viewing locations in the analysis area would be minor and localized.	*Views from Highways:* The visual setting of drivers looking west would be altered by the Proposed Action; however, a large amount of the Project Area's eastern portion would be within Sage-Grouse PHMA, where development would be limited to one multi-well pad per 640-acre area, limiting new contrasts in the visual setting in foreground to middleground from U.S. Highway 191. *Views from Wind River Front MA*: New natural gas facilities in the Project Area would be visible from this MA, but would be unlikely to substantially affect the viewshed of the casual observer in the MA, due to the limited amount of area within the MA having views of the Project Area, the MA's distance from the Project Area, and existing oil and gas development between the MA and the Project Area already altering the natural landscape. *Views From the Green and New Fork River SRMA:* Due to the distance between the SRMA	Adverse impacts on visual resources from sensitive viewing locations would be similar to those described under the Proposed Action, but to a lesser degree. Reduced potential for adverse impacts on VRM Class III areas would also reduce the potential for direct and indirect adverse impacts on the visual values of the Ross Butte MA and indirect impacts on the viewshed of the New Fork and Green Rivers SRMA compared to the Proposed Action. Potential indirect impacts on the viewshed of the Wind River Front MA would be similar to those under the Proposed Action. The potential impacts from well pad development on the viewsheds in the Wind River Front SRMA, U.S. Highway 191, and the Sublette Cutoff of the California NHT and North Sublette Meadow Spring Variant of the Sublette Cutoff would be similar to the Proposed Action, as Alternative A would have the same density of development in Sage-Grouse PHMA, which	Adverse impacts on visual resources from sensitive viewing locations would be similar to those described under the Proposed Action, but to a lesser degree. For Alternative B Winter Concentration Area development scenario 1, a reduced density of development, reduced short-term and long-term surface disturbance, and fewer miles of new access roads and pipelines in DA 1, which encompasses a portion of the Ross Butte MA, would reduce the potential for visual impacts in this MA compared to the Proposed Action. Potential indirect impacts on the viewshed of the Wind River Front MA would be similar to those under the Proposed Action. Impacts on the viewshed of the Sublette Cutoff of the California NHT, the North Sublette Meadow Spring Variant of the Sublette Cutoff, the Lander Cutoff of the Oregon and California NHTs, the Wind River Front SRMA, and U.S. Highway 191 would be similar to those	Adverse impacts on visual resources from sensitive viewing locations would be similar to those described under the Proposed Action, but to a lesser degree. For Alternative B Winter Concentration Area development scenario **2**, a reduced density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads and pipelines, and more clustered pattern of development, especially in Winter Concentration Areas within DA 1, which encompasses a portion of the Ross Butte MA, would reduce the potential for visual impacts in this MA compared to the Proposed Action. Potential indirect impacts on the viewshed of the Wind River Front MA would be similar to those under the Proposed Action. Except for localized, short-term adverse impacts from buried pipeline construction to RGFs in PHMA, visual impacts on the viewshed of the Sublette Cutoff of the California NHT, the

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		and the Project Area (3.4 miles), the Proposed Action is unlikely to create visual contrasts that would have notable impacts on the visual setting of the SRMA. *Views from the Wind River Front SRMA:* existing development in the Jonah and Pinedale Anticline fields and the distance from the Project Area to most viewing points in the SRMA would limit adverse impacts to the natural visual setting in the SRMA. *Views From the Ross Butte MA*: The Ross Butte MA overlaps 444 BLM-administered acres of the westernmost portion of the Project Area (Map 14) within VRM Class III (Map 27). The Proposed Action would create line, form, and color contrasts from views within the MA, resulting in direct short- and long-term impacts on the visual values of the MA and attract the attention of visitors in the MA. *Views from the Sublette Cutoff of the California NHT and the North Sublette Meadow Spring Variant:* While the Proposed Action would not physically alter the NHTs (surface disturbance with 1/4-mile of the trails would be prohibited), development and operations would result in direct adverse impacts on the integrity of the setting and landscape of the trails if development occurs within the three-mile viewshed of the trails. *Views from the Lander Cutoff of the Oregon and California NHTs:* The Proposed Action would not result in surface disturbance or development within three-miles of the Lander Cutoff of the Oregon and California NHTs, which is the VRM Class II area associated with the trail. In addition, views of the Project Area from the Lander Cutoff would be in the background and intermittently shielded by topography. As a result, there are no anticipated impacts to the historic setting of the trail resulting from the Proposed Action.	comprises most of the foreground and middleground view from these areas. However, a surface disturbance threshold of 3 percent disturbance per 640 acres in delineated habitats for focus species and prohibiting RGFs, compressor facilities, and powerlines within delineated mountain plover habitat in DA 3 and DA 6 and within raptor nest buffers in DA 3 and DA 5 would further reduce the potential for indirect adverse impacts on viewsheds in these areas, compared to the Proposed Action. Potential impacts from Alternative A to the viewshed of the Lander Cutoff of the California NHT would be similar to those described for the Green and New Fork Rivers SRMA.	described under the Proposed Action, as Alternative B Winter Concentration Area development scenario 1 would have the same density of development in this area, which overlaps the portion of the Project Area nearest to these viewing areas.	North Sublette Meadow Spring Variant of the Sublette Cutoff, the Lander Cutoff of the Oregon and California NHTs, the Wind River Front SRMA, and U.S. Highway 191 would be similar to those described under the Proposed Action, as Alternative B Winter Concentration Area development scenario 2 would have the same density of development in this area, which overlaps the portion of the Project Area nearest to these viewing areas.
Water Resources					
Surface water	Minimal potential for linear crossings of ephemeral drainages associated with new road construction. Limited potential to adversely impact surface water quality from accidental spills or releases.	Potential impacts to surface waters, including direct and indirect alterations of ephemeral drainages from road and pipeline crossings; accidental spills of completions fluids, drilling fluids, and formation fluids; and, on and off-site	Similar impacts as described for the Proposed Action, but the extent and degree of impacts would be slightly more in the short term and slightly less in the long term, based on the difference in estimated surface disturbance and resulting impacts on runoff, erosion,	Similar impacts as described for the Proposed Action, though potentially lesser in DA 1. A reduced density of development and surface disturbance in DA 1, would reduce potential impacts to surface water quality from increased erosion, sediment loads, and storm water	Similar impacts as described for the Proposed Action, though potentially lesser in DA 1. A reduced density of development and surface disturbance in DA 1, especially within Winter Concentration Areas, would reduce potential impacts to surface water quality from increased

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
	Limited potential to decrease infiltration rates, alter stream channel discharge, or increase sedimentation rates of drainages within the analysis area.	degradation of surface water quality from sedimentation, turbidity and salinity.	sedimentation, and other surface water impacts. Phased development pattern of Alternative A could result in more localized impacts to certain watersheds. The buried pipeline network under Alternative A would reduce the potential for accidental spills and releases to surface waters when compared to the Proposed Action, but would increase pipeline crossings at ephemeral drainages while also increasing the potential for seepage and spills and the time required to detect and fix underground leaks.	runoff in this area, compared to the Proposed Action. The potential for hazardous materials and formation fluids spills to affect surface water quality would be similar to the Proposed Action.	erosion, sediment loads, and storm water runoff in this area, compared to the Proposed Action. The potential for hazardous materials and formation fluids spills to affect surface water quality would be similar to the Proposed Action, but potentially greater in localized areas where pipelines would be buried constructed between RGFs within and on the perimeter of Winter Concentration Areas and PHMA.
Impacts from Groundwater Withdrawal	The No Action Alternative would result in an estimated groundwater withdrawal of 44,694 bbls (5.8 acre-feet) of groundwater per year during the development phase for dust control, drilling, completions, and hydrostatic testing. An additional 7,200 bbls (0.9 acre-feet) of groundwater would be withdrawn during each year of the production phase for road maintenance dust control. Due to the relatively low level of water use, minimal impacts are anticipated.	Withdrawal of up to 474.0 acre-feet of groundwater per year during the 10-year development phase and 17.6 acre-feet per year during the 30-year production phase would be a permanent removal of water from the upper Wasatch and result in lowering of the potentiometric surface. Numerical modeling of groundwater withdrawal from water wells in the adjacent JIDPA shows that the lowered potentiometric surface would be greatest within a few miles of the water wells, and would be expected to recover in less than six years. The JIDPA numerical groundwater model also predicted the area of depressed groundwater would not extend outside of the Project Area and groundwater elevations outside the Project Area would not likely be affected by the withdrawal and use of water from the Wasatch Aquifer. The vertical separation and lack of permeable connections between zones of low quality water and the Wasatch extraction zone suggest that there is a very low likelihood of adverse impacts to water quality in the Wasatch Aquifer due to groundwater withdrawal for the Proposed Action.	For Alternative A, impacts resulting from groundwater withdrawal would be similar to those described for the Proposed Action, though slightly less during each year of the development period due to the estimated 3.6 percent decrease in annual groundwater use during the development phase and a 5.7 percent decrease in annual groundwater use during the production phase. The differences in total groundwater use during the development phase (0.3 percent more than the Proposed Action) and production phase (5.7 percent less than the Proposed Action) are not anticipated to notably change impacts, compared to the Proposed Action.	For Alternative B Winter Concentration Area development scenario 1, impacts resulting from groundwater withdrawal would be similar to the Proposed Action, though slightly less due to the estimated 4.0 percent decrease in annual groundwater use during the development phase and a 9.7 percent decrease in annual groundwater use during the production phase, compared to the Proposed Action. The differences in total groundwater use during the development phase (0.1 percent less than the Proposed Action) and production phase (9.7 percent less than the Proposed Action) are not anticipated to notably change impacts, compared to the Proposed Action.	Same impacts as Alternative B Winter Concentration Area development scenario 1.
Groundwater Quality Impacts Resulting from the Injection of Formation Fluids	For the No Action Alternative there would be no underground injection of produced water and no potential impacts to groundwater quality resulting from injection of produced water.	Up to 500,000 bbls of produced water generated by each well over the lifetime of the well; 90 percent of produced water disposed of in Class II Underground Injection wells in the Project Area, 10 percent hauled by truck to the JIDPA water treatment facility. It is unlikely that hydraulic connections that would allow upward migration of formation fluids between the upper Fort Union Formation (used for injection) and Upper Wasatch Aquifer are present in the Project Area. In addition, application of LORS for drilling and completion	Same as the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		activities and implementation of resource protection measures identified in Appendix B (*Resource Protection Measures*) would further reduce potential for water quality impacts resulting from well completions. As a result, water quality impacts resulting from well completions are not anticipated.			
Wild Horses					
Impacts to Wild Horses	Minor and localized adverse impacts to wild horses due to the relatively small percentage of the Project Area disturbed.	Potential impacts to wild horses include the loss of available forage or habitat components resulting from surface disturbances in the Little Colorado HMA. Direct and indirect impacts would be greatest in 23 percent of the Little Colorado HMA not overlapping Sage-Grouse PHMA, where the density of development would be an average of four well pads per 640-acre area. Increased potential for vehicle/wild horse collisions and displacement associated with increased traffic.	Similar impacts as described for the Proposed Action, but the degree of impacts would be less due to a reduced density of development in delineated habitats for focus species that overlap the Little Colorado HMA, prohibition of certain facilities in areas that overlap the HMA, and the phasing of development. In addition, for Alternative A, RGFs, compressor stations, and powerlines would be prohibited within raptor nest buffers in DA 3 and DA 5 and within mountain plover habitat for DA 3, which may further reduce surface disturbance and human activity in these portions of the HMA, compared to the Proposed Action. Surface disturbance and human activity from development phase activities and resulting impacts to wild horses in the Little Colorado HMA would be slightly reduced each year, but would occur over a slightly longer period, compared to the Proposed Action.	Similar impacts are expected as described for the Proposed Action because the density of development, surface disturbance, and other project-related activity in the Little Colorado HMA portion of the Project Area would be the same as the Proposed Action. Surface disturbance and human activity from development phase activities and resulting impacts to wild horses in the Little Colorado HMA would be slightly reduced each year, but would occur over a slightly longer period, compared to the Proposed Action.	Except for localized, short-term adverse impacts from buried pipeline construction to RGFs in PHMA, similar impacts are expected as described for the Proposed Action, as the density of development, surface disturbance, and other project-related activity in the Little Colorado HMA portion of the Project Area would be the same as the Proposed Action. Surface disturbance and human activity from development phase activities and resulting impacts to wild horses in the Little Colorado HMA would be slightly reduced each year, but would occur over a slightly longer period, compared to the Proposed Action.
Wildlife and Special Status Species					
Big Game	Potential adverse impacts to big game species due to habitat loss and degradation and human presence, but no notable alternations to baseline population trends and habitat conditions are anticipated due to the relatively low level of development and because the area has already been substantially disturbed through previous and ongoing development.	Potential direct impacts to moose, elk, mule deer, and pronghorn include (1) mortalities from vehicular collisions from increased traffic on existing roads and 227 miles of new access roads, and (2) poisoning from chemicals. Numerous potential indirect impacts, including habitat loss, fragmentation, increased avoidance by and displacement of individuals and groups, decreased habitat quality, and migration disruptions as listed in Section 4.22.3.1 (*Big Game*), would occur. All big game populations would continue to fluctuate based on natural factors, but pronghorn and mule deer populations could face permanent displacement from seasonal habitat and disruption of migration routes, especially in areas outside of Sage-Grouse PHMA.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 4.2 percent decrease in long-term surface disturbance compared to the Proposed Action, limiting the density of development and reduced surface disturbance in pronghorn crucial winter range, in DAs 1, 2, 3, and 6, and limiting the density of development in Winter Concentration Areas for Sage-Grouse in DA 1. Density of development could still result in displacement of big game from seasonal habitat during the development phase, especially in DA 4 where pronghorn is not identified as a focus species and no additional protections are provided. An estimated 12 fewer miles of new access roads would reduce the potential for disturbance and collisions with big game compared to the Proposed Action.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action. A lower density of development, less short-term and long-term surface disturbance, and less human activity (e.g., noise, traffic) in the DA 1 area would reduce impacts to big game habitat and migration routes in this area, compared to the Proposed Action. The majority of the pronghorn crucial winter range and pronghorn migration routes in the Project Area occur in DA 2, which would have the same density of development as the Proposed Action and would expect similar adverse impacts as the Proposed Action.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action. A lower density of development, less short-term and long-term surface disturbance, a more clustered pattern of development, and less human activity (e.g., noise, traffic) in the DA 1 area, especially within Winter Concentration Areas, would reduce impacts to big game habitat and migration routes in this area, compared to the Proposed Action. The majority of the pronghorn crucial winter range and pronghorn migration routes in the Project Area occur in DA 2, which would have the same density of development as the Proposed Action and would expect similar adverse impacts as the Proposed Action.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
				An estimated 22 fewer miles of new access roads would reduce the potential for disturbance and collisions with big game compared to the Proposed Action.	An estimated 22 fewer miles of new access roads would reduce the potential for disturbance and collisions with big game compared to the Proposed Action.
Other Mammals	The relatively low level of development under the No Action Alternative, which would not include new powerlines that provide perches for avian predators, is unlikely to substantially alter the condition or availability of habitats utilized by other mammals from baseline conditions.	Potential direct impacts on other mammal species are similar to *Big Game* above. Numerous indirect impacts as described in Section 4.22.3.2 (*Other Mammals*) would be similar to those described for *Big Game* above with the exception of indirect impacts on seasonal habitats which are not delineated for *Other Mammals*. Predation on small mammals may increase through an increase in perches and reduction in vegetative cover. Mammal populations would continue to fluctuate based on natural factors, but development and disturbance resulting from Project activities could play a larger role in population fluctuations than the No Action Alternative.	Similar impacts as described for the Proposed Action, but to a lesser degree due to 4.2 percent decrease in long-term surface disturbance, prohibiting overhead powerlines across 43,025 acres including raptor nest buffers, burrowing owl nest buffers, and delineated mountain plover habitat, and installing bottomless culverts and slit fences under roadways. Resource protection measures in Sage-Grouse Winter Concentration Areas such as prohibiting development in areas containing greater than 5 percent sagebrush canopy cover in DA 1 would confer beneficial impacts to other small mammal species in sagebrush habitat. An estimated 12 fewer miles of new access roads would reduce the potential for collisions with low mobility small mammals compared to the Proposed Action.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action and by reducing the density of development in DA 1, which would reduce adverse impacts to other mammals utilizing this area compared to the Proposed Action. An estimated 22 fewer miles of new access roads would reduce the potential for collisions with low mobility small mammals compared to the Proposed Action.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action and by reducing the density of development in DA 1, which would reduce adverse impacts to other mammals utilizing this area compared to the Proposed Action. An estimated 22 fewer miles of new access roads and reduced vehicle traffic in Winter Concentration Areas and PHMAs during the production phase would reduce the potential for collisions with low mobility small mammals compared to the Proposed Action. However, certain roads outside of these areas would have more vehicle traffic relative to the Proposed Action, and would therefore result in a greater collision hazard.
Raptors	The relatively low level of development under the No Action Alternative, which would not include new powerlines that provide perches for avian predators, is unlikely to substantially alter the condition or availability of habitats utilized by raptors from baseline conditions.	Potential direct impacts to raptors include (1) mortalities from vehicular collisions from increased traffic on existing roads and 227 miles of new access roads, (2) poisoning and/or tank and trench entrapment, (3) potential collision with 38.6 miles of powerlines. Numerous potential indirect adverse impacts as described in Section 4.22.3.3 (*Raptors*) would likely result in raptor population declines in the Project Area. Adverse impacts would be greatest in non-PHMA Habitat.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 4.2 percent reduction in surface disturbance, prohibiting overhead powerlines, RGFs, and compressor facilities within delineated raptor nest buffers in DAs 1, 3, and 5 (40,331 acres) which would reduce potential for collisions and electrocution and overall surface disturbance in raptor nest buffers. Additional reduction of impacts in areas where raptor foraging, wintering, or nesting habitat overlaps focus species habitat compared to the Proposed Action. Phased development would reduce development pressure in raptor nesting areas during sensitive periods.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action and reduction in the density of development, amount of surface disturbance, habitat fragmentation, and human activity where raptors are most prevalent in the Project Area within DA 1.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action and reduction in the density of development, amount of surface disturbance, habitat fragmentation, and human activity where raptors are most prevalent in the Project Area within DA 1. Phasing development across Sage-Grouse Winter Concentration Areas would further reduce fragmentation of raptor habitats in that area during the development phase. Burying powerlines in Winter Concentration Areas, where feasible, would reduce electrocution hazards and may reduce predatory success.
Other Birds	Due to the relatively low level of development for the No Action Alternative, requirements to conduct pre-construction surveys for raptor nests, and other existing protection measures for raptor species, potential impacts are not anticipated to notably alter the population	Potential direct and indirect impacts as described above for raptors, with the exception of impacts on prey availability and predation which are not applicable to other birds that do not prey on small mammals.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 4.2 percent reduction in surface disturbance and to the limitation of development in delineated habitats for focus species and the prohibition of overhead powerlines on 43,025 acres.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action; a reduction in the density of development, surface disturbance, and human activity within DA 1.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action; a reduction in the density of development, surface disturbance, and human activity within DA 1. Burying powerlines in Winter

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
	trends and habitat conditions for other bird species from baseline conditions.	Impacts on any given species would be proportional to the loss of adequate habitat, degradation of vegetative cover, and individual species' tolerance of disturbance (including noise and dust). Ravens and other birds adapted to disturbance would likely have a competitive advantage over other, more sensitive bird species. Positive impacts to disturbance-adapted bird species are anticipated as a result of the Proposed Action.			Concentration Areas, where feasible, could reduce predation by raptors.
Amphibians and Reptiles	Continued development under the No Action Alternative could impede distribution of some species or individuals as they attempt to move through disturbed upland habitats located between aquatic habitats; however, the relatively low level of development under the No Action Alternative is unlikely to substantially alter the condition or availability of habitats utilized by amphibians and reptile species from baseline conditions.	Direct and indirect impacts to amphibian and reptile species would be similar to those described for *Other Mammals*, although mortality rates for reptiles are expected to be higher than for amphibians resulting from vehicle collisions compared to the No Action Alternative. Amphibians could experience additional indirect adverse impacts from barriers to movement between upland habitat and aquatic or riparian habitats, and reduced water quality caused by increased erosion and sedimentation due to surface disturbance. Amphibian and reptile populations would continue to fluctuate based on natural factors, but development and disturbance could play a larger role in population fluctuations and impacts to amphibians and reptiles.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 4.2 percent reduction in surface disturbance, reduced densities of development and surface disturbance thresholds in certain DAs, and the phasing of development. Potential adverse impacts would be especially reduced compared to the Proposed Action in Sage-Grouse Winter Concentration Areas in DA 1 from reduced density of disturbance and surface disturbance thresholds and where suitable amphibian and reptile habitat overlaps the 43,025 acres where powerlines, are prohibited which could result in reduced predation from perching birds. Alternative A would reduce the potential for adverse impacts from habitat fragmentation and mortality or injury from collisions with vehicles compared to the Proposed Action through additional resource protection measures, including the use of bottomless culverts and slit fencing under roadways.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent reduction in surface disturbance. Alternative B Winter Concentration Area development scenario 1 would result in a lower density of development, reduced short-term and long-term surface disturbance, fewer miles of access roads, and reduced human activity in DA 1, especially within Winter Concentration Areas, compared to this area under the Proposed Action.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent reduction in surface disturbance. Alternative B Winter Concentration Area development scenario 2 would result in a lower density of development, reduced short-term and long-term surface disturbance, fewer miles of access roads, a more clustered pattern of development, and reduced human activity in DA 1, especially within Winter Concentration Areas, compared to this area under the Proposed Action. Phasing development across Winter Concentration Areas would further reduce fragmentation of amphibian and reptile habitats in that area during the development phase. Burying powerlines in Winter Concentration Areas, where feasible, could reduce predation by raptors.
Fisheries	Due to the relatively low level of development and associated surface disturbance, potential indirect impacts to downstream fisheries from sedimentation would not notably change from baseline conditions. The No Action Alternative would result in an estimated withdrawal of 5.8 acre-feet of groundwater per year during the development phase and 0.9 acre-feet of groundwater per year during the full production phase. Given the relatively low level of development for the No Action Alternative, these groundwater withdrawals are not anticipated to notably alter the population trends and habitat conditions for other fish and fisheries from the baseline conditions.	Potential indirect impacts on fish and fisheries outside, but hydrologically-connected to, the Project Area could result from project-related activities that result in increased sedimentation and salinity of surface waters and groundwater depletions, including an estimated 1,890 acres of long-term surface disturbance under the Proposed Action. Potential indirect adverse impacts to fisheries habitat associated with the use of 474.0 acre-feet per year of water for dust control, drilling, completions, and hydrostatic testing during the 10-year development phase and an additional 17.6 acre-feet per year for dust control during the production phase, which would contribute to water depletions. Additional potential impacts include increases in erosion,	Similar impacts as described for the Proposed Action but to a lesser degree due to the 4.2 percent less long-term surface disturbance and associated reduction in downstream sedimentation compared to the Proposed Action. Compared to the Proposed Action, Alternative A would use approximately 3.6 percent less groundwater per year during the development phase and 5.7 percent less groundwater per year during the production phase, resulting in proportionately reduced impacts from water depletions each year.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance, resulting in a reduced potential for adverse indirect impacts to water quality, erosion, and sedimentation compared to the Proposed Action. Compared to the Proposed Action, Alternative B Winter Concentration Area development scenario 1 would use approximately 4.0 percent less groundwater per year during the development phase and 9.7 percent less groundwater per year during the production phase, resulting in proportionately reduced impacts from water depletions.	Similar impacts as described for the Proposed Action, but to a lesser degree due to a 7.9 percent decrease in long-term surface disturbance, resulting in a reduced potential for adverse indirect impacts to water quality, erosion, and sedimentation compared to the Proposed Action. Compared to the Proposed Action, Alternative B Winter Concentration Area development scenario 2 would use approximately 4.0 percent less groundwater per year during the development phase and 9.7 percent less groundwater per year during the production phase, resulting in proportionately reduced impacts from water depletions.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		sedimentation, and salinity of surface waters in the Project Area and downstream areas.			
Special Status Wildlife Species *Federally Listed Species*	Due to the relatively low level of development and associated surface disturbance, impacts to Federally Listed Species would not notably change from baseline conditions. The No Action Alternative would result in an estimated withdrawal of 5.8 acre-feet of groundwater per year during the development phase and 0.9 acre-feet of groundwater per year during the full production phase. Given the relatively low level of development for the No Action Alternative, these groundwater withdrawals are not anticipated to notably alter the population trends and habitat conditions for Colorado River Fish Species from baseline conditions.	Black-footed ferret has not been documented within the analysis area since 1985 (WyNDD 2012) and evidence suggests that the species has been extirpated from the State of Wyoming, except within experimental reintroduction sites (USFWS 2013b). As a result, there are no anticipated impacts to black-footed ferret resulting from the Proposed Action. The Colorado pikeminnow, razorback sucker, bonytail chub, and humpback chub are not known or expected to occur within the analysis area. Therefore, direct impacts on these species are not anticipated from development under the Proposed Action. However, these four species occur downstream of the analysis area, within the Green and Colorado Rivers below Flaming Gorge Dam and could be indirectly affected by the estimated 1,890 acres of long-term surface disturbance and associated sedimentation and hydrologic changes. Potential indirect adverse impacts to populations of Colorado pikeminnow, razorback sucker, bonytail chub, and humpback chub downstream of the analysis area due an estimated withdrawal of 474.0 acre-feet of groundwater per year for drilling, completions, hydrostatic testing, and dust control during the development phase and an estimated withdrawal of 17.6 acre-feet per year during the full production phase. This groundwater use for the Proposed Action could contribute to water depletions and alterations of the hydrological regime. Mitigation by payment of a depletion charge to the Upper Colorado River Endangered Fish Recovery Program would be required.	Similar to the Proposed Action, no anticipated impacts to Black-footed ferret. Less adverse impacts to the Colorado River Fish Species than the Proposed Action due to a 4.2 percent decrease in long-term surface disturbance compared to the Proposed Action. Compared to the Proposed Action, Alternative A would use approximately 3.6 percent less groundwater per year during the development phase and 5.7 percent less groundwater per year during the production phase, resulting in proportionately reduced impacts from water depletions each year. Mitigation as described in the Proposed Action would also be required under Alternative A.	Similar to the Proposed Action, no anticipated impacts to black-footed ferret. Less adverse impacts to the Colorado River Fish Species than the Proposed Action due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action. Compared to the Proposed Action, Alternative B Winter Concentration Area development scenario 1 would use approximately 4.0 percent less groundwater per year during the development phase and 9.7 percent less groundwater per year during the production phase, resulting in proportionately reduced impacts from water depletions. Mitigation as described in the Proposed Action would also be required under Alternative B Winter Concentration Area development scenario 1.	Similar to the Proposed Action, no anticipated impacts to black-footed ferret. Less adverse impacts to the Colorado River Fish Species than the Proposed Action due to a 7.9 percent decrease in long-term surface disturbance compared to the Proposed Action. Compared to the Proposed Action, Alternative B Winter Concentration Area development scenario 2 would use approximately 4.0 percent less groundwater per year during the development phase and 9.7 percent less groundwater per year during the production phase, resulting in proportionately reduced impacts from water depletions. Mitigation as described in the Proposed Action would also be required under Alternative B Winter Concentration Area development scenario 2.
Special Status Wildlife Species *BLM Sensitive Species* *Sage-Grouse*	Habitat, noise, and ongoing human presence could adversely impact Sage-Grouse; however, the relatively low level of development under the No Action Alternative Application of the Sage-Grouse management decisions and the application of conservation measures described in the BLM Sage-Grouse RMP Amendments	Potential direct impacts to Sage-Grouse include (1) increase in mortality due to vehicle collisions, accidental poisoning, tank and trench entrapment, and collision with wire exclosure fences, and (2) decrease in chick survival rates close to development and production activities. Numerous potential indirect impacts including decreased quantity and quality of suitable	Similar impacts as described for the Proposed Action, but to a lesser degree due to 4.2 percent less long-term surface disturbance and additional resource protection measures. Alternative A would have the same restrictions in PHMA as the Proposed Action; however, development within PHMA would be phased	Similar impacts as described for the Proposed Action, but to a lesser degree due to 7.9 percent less long-term surface disturbance and the decreased density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads, and reduced human activity in DA 1. The reduced level of development and human activity in DA 1 would reduce impacts to Sage-	Similar impacts as described for the Proposed Action, but to a lesser degree due to 7.9 percent less long-term surface disturbance and the decreased density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads, more clustered pattern of development, and reduced human activity in DA 1, especially in Sage-Grouse Winter Concentration Areas.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
	(BLM 2015e) would limit the severity of these adverse impacts.	habitat, increased avoidance and displacement, increased habitat fragmentation, increased predation, and decreased insect availability as described in Section 4.22.3.8.2 (*Impacts on BLM Wyoming Sensitive Species*). Per the BLM Sage-Grouse RMP Amendments (BLM 2015e), density of development and surface disturbance thresholds would be reduced in Sage-Grouse PHMA; however, estimated short-term disturbance of 663 acres and long-term disturbance of 216 acres in Sage-Grouse PHMA, could still result in increased adverse impacts to Sage-Grouse as described above compared to the No Action Alternative. The density of development and surface disturbance is higher in Winter Concentration Areas, which could lead displacement of Sage-Grouse from Winter Concentration Areas outside of PHMA. Project-related traffic would not be allowed on North Burma Road north of the Project Boundary, which would decrease the potential vehicle and traffic-related impacts on Sage-Grouse in these areas.	during the development period within each of the three geographically defined DAs. Alternative A would also limit the density of development and apply surface disturbance thresholds in Winter Concentration Areas and provide for additional resources protection measures in DA 1 which would reduce Sage-Grouse direct and indirect impacts to Sage-Grouse in Winter Concentration Areas as compared to the Proposed Action. Short-term surface disturbance in Sage-Grouse PHMA would be greater than under Alternative A than under the Proposed Action due to the buried condensate and produced water pipeline; however this action would reduce the number and frequency of vehicle trips and the potential for vehicle collisions as compared to the Proposed Action. Project-related traffic would be allowed on North Burma Road north of the Project Boundary, which would increase potential vehicle and traffic-related impacts on Sage-Grouse in these areas as compared to the Proposed Action. Prohibiting powerlines in raptor buffers and delineated mountain plover habitat in DAs 1 and 3 where Sage-Grouse suitable habitat overlaps would reduce the perching structures for raptors and corvids, potentially reducing predation, compared to the Proposed Action.	Grouse Winter Concentration Areas compared to the Proposed Action. Direct and indirect impacts would be greatest in DA 2, which would include the highest density of development. Project-related traffic would be allowed on North Burma Road north of the Project Boundary, which would increase potential vehicle and traffic-related impacts on Sage-Grouse in these areas as compared to the Proposed Action.	Sage-Grouse Winter Concentration Areas would have the greatest limitations on surface distance and require a phased development pattern. As a result, fewer adverse impacts on Sage-Grouse Winter Concentration Areas are anticipated than for the Proposed Action. Direct and indirect impacts would be greatest in DA 2, which would include the highest density of development. Project-related traffic would be allowed on North Burma Road north of the Project Boundary, which would increase potential vehicle and traffic-related impacts on Sage-Grouse in these areas as compared to the Proposed Action. The construction of buried pipelines and powerlines in Winter Concentration Areas and PHMA could result in short-term adverse impacts, but would decrease long-term impacts from vehicle collisions and avoidance of tall structures compared to the Proposed Action.
Special Status Wildlife Species *BLM Sensitive Species* *Other Species*	Due to the relatively low level of development and associated surface disturbance, impacts to other BLM sensitive species would not notably change from baseline conditions. Localized adverse impacts could occur where development under the No Action Alternative coincides with occurrences or habitat of these species.	*Pygmy Rabbit:* Direct adverse impacts would be similar to those described for *Other Mammals* above. Indirect adverse impacts including habitat fragmentation decreased dispersal opportunities, and decreased quality of sagebrush-steppe habitat would be greatest in areas where pygmy rabbit occurrence and/or suitable habitat overlaps areas outside of Sage-Grouse PHMA. *White-tailed Prairie Dog:* Direct and indirect adverse impacts would be similar to those described for *Big Game* and *Other Mammals* with the exception of indirect impacts on seasonal habitats. The spread of invasive species from surface disturbance could reduce overall quality of forage for the herbivorous prairie dog which could reduce populations.	*Pygmy Rabbit:* Similar impacts as described for the Proposed Action but with reduced extent and severity due to a 4.2 percent reduction in long-term surface disturbance, reduced density of development and surface disturbance thresholds in DA 1 where suitable habitat overlaps Sage-Grouse Winter Concentration Areas, and on 43,025 acres in DAs 1, 3, 5, and 6 where powerlines are prohibited in raptor and burrowing owl nest buffers and delineated mountain plover habitat which would reduce the potential for predation. *White-tailed Prairie Dog:* Fewer impacts than the Proposed Action due to limitations on surface disturbance in delineated prairie dog towns within DA 7, phasing of development, and the prohibition of overhead powerlines on	*Pygmy Rabbit:* Similar impacts as described for the Proposed Action but with reduced extent and severity due to a 7.9 percent reduction in long-term surface disturbance and reduction in the density of development within DA 1. *White-tailed Prairie Dog:* Similar impacts as described for the Proposed Action, but to a lesser degree in the DA 1 area which overlaps 10.2 percent of prairie dog colonies in the Project Area and would result in reduced habitat loss and fragmentation due to decreased density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads, and reduced human activity as compared to the Proposed Action. *Long-eared Myotis:* Similar impacts as described for the Proposed Action, but to a	*Pygmy Rabbit:* Similar impacts as described for the Proposed Action but with reduced extent and severity due to a 7.9 percent reduction in long-term surface disturbance and reduction in the density of development within DA 1 (especially within Winter Concentration Areas). Burying powerlines in Winter Concentration Areas, where feasible, could reduce predation by raptors. *White-tailed Prairie Dog:* Similar impacts as described for the Proposed Action, but to a lesser degree in the DA 1 area which overlaps 10.2 percent of prairie dog colonies in the Project Area and would result in reduced habitat loss and fragmentation due to decreased density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads, more

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		Areas lacking vegetation would present barriers to movement and vulnerability to predation. Potential direct and indirect impacts would be greatest where prairie dog colonies or occurrence overlap areas outside of Sage-Grouse PHMA. *Long-eared Myotis:* Adverse direct and indirect impacts resulting from development under the Proposed Action would be similar to those described for *Raptors*. Additional adverse indirect impacts to breeding and/or foraging habitat relating to noise from construction, vehicle traffic, and increased human activity. *Raptors:* Potential adverse impacts on bald eagle, burrowing owl, and ferruginous hawk populations similar to those described above for *Raptors*. Ferruginous hawk may be more sensitive to disturbance during the nesting period than other raptor species; the Proposed Action is likely to result in population declines across the Project Area. Burrowing owls may be indirectly adversely affected by disturbance to prairie dog colonies; however burrowing owls may also benefit from reclamation activities due to the creation of more open areas and subsequent increased potential nesting sites. *Long-billed Curlew:* Potential direct and indirect impacts similar to those described above for *Other Birds* but less due to the low documented occurrence of long-billed curlew in the analysis area. *Mountain Plover:* Potential direct and indirect impacts similar to those described above for *Raptors*, with the exception of poaching/hunting. Impacts associated with prairie dog colonies could also affect mountain plover as prairie dog colonies provide suitable nesting habitat. Direct and indirect impacts would be greatest in areas where mountain plover habitat and/or occurrences overlaps areas outside of Sage-Grouse PHMA. *Other Avian Species:* Potential direct and indirect impacts to sagebrush-obligate species similar to those described above for *Other Birds* and *Sage-Grouse*.	43,025 acres, which would reduce the potential for predation. *Long-eared Myotis:* Similar impacts as described for the Proposed Action, but to a lesser degree due to a reduction in long-term surface disturbance, phased development, and a reduction in vehicle trips. *Raptors:* Potential adverse impacts to bald eagle, burrowing owl, and ferruginous hawk populations similar to those described above for *Raptors* and overall to a lesser degree than under the Proposed Action, especially in DAs 1, 3, 5 where the surface disturbance threshold would be reduced in delineated raptor nest buffers and certain facilities would be prohibited. *Long-billed Curlew:* Similar impacts as described for the Proposed Action, but to a lesser degree due to resource protection measures for other wildlife species such as white-tailed prairie dog in DA 7 and mountain plover in DA 3 and 6. *Mountain Plover:* Similar impacts as described for the Proposed Action, but to a lesser degree due to resource protection measures applied in mountain plover habitat in DA 3 and 6 and prairie dog towns in DA 7. *Other Avian Species:* Similar impacts as described for the Proposed Action, but to a lesser degree due to additional limitations on development in Sage-Grouse Winter Concentration Areas in DA 1 as compared to the Proposed Action. *Flannelmouth Sucker:* Similar impacts as described above for *Fisheries*.	lesser degree due to a reduction in the density and total amount of disturbance within DA 1, which would reduce impacts from habitat loss and fragmentation. *Raptors:* Potential adverse impacts to bald eagle, burrowing owl, and ferruginous hawk populations similar to those described above for *Raptors* and overall to a lesser degree in the DA 1 area than under the Proposed Action due to a reduction in disturbance and human activity. *Long-billed Curlew:* Similar impacts as described for the Proposed Action, but a lesser degree of habitat loss and fragmentation would occur in the DA 1 area, which would reduce direct and indirect impacts on long-billed curlew in DA 1 compared to the Proposed Action. *Mountain Plover:* Similar impacts as described for the Proposed Action, but to a lesser degree in DA 1 due to the decreased density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads, and reduced human activity compared to the Proposed Action. *Other Avian Species:* Similar impacts as described for the Proposed Action, but to a lesser degree in the DA 1 area due to the decreased density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads, and reduced human activity compared to the Proposed Action. *Flannelmouth Sucker:* Similar impacts as described above for *Fisheries*.	clustered pattern of development, and reduced human activity as compared to the Proposed Action. *Long-eared Myotis:* Similar impacts as described for the Proposed Action, but to a lesser degree due to a reduction in the density and total amount of disturbance within DA 1 which would reduce impacts from habitat loss and fragmentation. *Raptors:* Potential adverse impacts to bald eagle, burrowing owl, and ferruginous hawk populations similar to those described above for *Raptors* and overall to a lesser degree in the DA 1 area than under the Proposed Action die to a reduction in disturbance and human activity. *Long-billed Curlew:* Similar impacts as described for the Proposed Action, but a lesser degree of habitat loss and fragmentation would occur in the DA 1 area, which would reduce direct and indirect impacts on long-billed curlew in DA 1 compared to the Proposed Action. *Mountain Plover:* Similar impacts as described for the Proposed Action, but to a lesser degree in DA 1 due to the decreased density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads, more clustered pattern of development, and reduced human activity compared to the Proposed Action. *Other Avian Species:* Similar impacts as described for the Proposed Action, but to a lesser degree in the DA 1 area due to the decreased density of development, reduced short-term and long-term surface disturbance, fewer miles of new access roads, more clustered pattern of development, and reduced human activity compared to the Proposed Action. *Flannelmouth Sucker:* Similar impacts as described above for *Fisheries*.

Table 2-29. Summary of Impacts for the Alternatives

	No Action	Proposed Action	Alternative A	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 1 (Preferred Alternative)	Alternative B, Sage-Grouse Winter Concentration Area Development Scenario 2 (Preferred Alternative)
		Flannelmouth Sucker: Potential indirect impacts from increased erosion, sedimentation, and water depletion as described above for *Fisheries*.			

AUM animal unit month
ANC Acid Neutralizing Capacity
bbl barrel
BCF billion cubic feet
DA Development Area
DAT Deposition Analysis Threshold
dBA A-weighted decibels
dv deciviews
HMA Herd Management Area
JIDPA Jonah Infill Drilling Project Area
MA Management Area
MMCF million cubic feet
NHT National Historic Trail
NPL Normally Pressured Lance
NRHP National Register of Historic Places
OHV off-highway vehicle
RGF Regional Gathering Facility
ROW right-of-way
SRMA Special Resource Management Area
VRM Visual Resource Management

CHAPTER 3– AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes the existing environment (including biological, physical, social, economic, and human-made elements), prior to implementing the Proposed Action, that could be affected by the Proposed Action and alternatives. Acreages and percentages presented in this chapter pertain to all land in the Project Area, unless otherwise noted. If acreages apply only to BLM-administered land, the text indicates "BLM-administered acres". Acreages were calculated using geographic information system (GIS) technology. Minor variations in acreages are possible due to clipping of GIS data, topology, rounding, and other factors. As a result, acreages throughout the EIS should be considered approximate. Any variations in acreages are considered to be negligible.

3.1.1 General Setting of the Project Area

The Project Area is primarily on Bureau of Land Management (BLM)-administered lands managed by the BLM Pinedale Field Office (PFO) and Rock Springs Field Office (RSFO) within Townships 27 through 29 North, Ranges 107 through 110 West, 6th Principal Meridian in Sublette County, Wyoming. The Project Area is entirely within Sublette County; however, the southern boundary of the Project Area is directly adjacent to the Sweetwater County line (Map 1).

The Project Area is in the northern portion of the Green River Basin (GRB), referred to as the Upper Green River Basin (UGRB). Topography in the Project Area is characterized by low rolling hills interspersed with buttes, rock outcrops, large draws, and deep canyons. The region contains mostly shrub-steppe vegetation dominated by Wyoming big sagebrush. Other sagebrush species, rabbitbrush, saltbrush, and a variety of grasses are also in the area. Characteristic fauna inhabiting the Project Area and surrounding areas include pronghorn antelope, mule deer, Greater Sage-Grouse (Sage-Grouse), various raptor and passerine species, white-tailed prairie dog, and other species of mammals and reptiles. The Project Area is in a semiarid (dry and cold) mid-continental climate regime, which is characterized by dry, windy conditions with limited rainfall and long, cold winters.

3.1.2 NPL Natural Gas Development Project Overview

Jonah Energy proposes to continue and expand oil and gas development operations on its leases in the Project Area. Approximately 116 wells have been drilled within the Project Area including 85 oil and gas-related wells and 31 stock water wells (WOGCC 2015). Refer to Section 2.3.1 (*Existing Development in the Project Area*) for more information on past and ongoing development in the Project Area. Under the Proposed Action for the NPL Project, Jonah Energy proposes to directionally drill natural gas wells within the Project Area on an average of one disturbance location per 640-acre area in Sage-Grouse PHMA and four disturbance locations per 640-acre area outside of PHMA, for an estimated total of up to 3,500 wells. Each multi-well pad would encompass between 5.5 and 19 acres. Under the Proposed Action, the wells, along with associated infrastructure, would be constructed over a 10-year period at a rate of up to 350 wells per year based on an average of 10 drill rigs working at any one time, or until the resource base is fully developed. The 10 year development period would be followed by a 30-year full production period.

Oil and gas and associated liquids would generally be transported from wells via pipeline to Regional Gathering Facilities (RGFs) for operations including gas/liquid separation, electric compression, liquid storage, gas dehydration, water disposal at injection wells, and truck loading. (The trucks would be used to haul produced water for processing and condensate to sales locations). To minimize air emissions, Jonah Energy would use electric compression at each RGF. The NPL Project also includes construction of associated facilities and infrastructure—including roads, gas pipelines, powerlines, and separation, dehydration, metering, and fluid storage facilities—to the extent such facilities are not already constructed.

Exact locations of future wells are currently unknown. Jonah Energy would develop criteria for selecting well locations to delineate the extent of the oil and gas resources and would refine those criteria as more information on subsurface conditions and oil and gas resources becomes available from delineation drilling. Initial delineation wells would be drilled as needed to advance understanding of the oil and gas resources in previously unexplored portions of the Project Area, typically using single well pads. Findings of these initial delineation efforts would determine if further delineation efforts should be undertaken in areas adjacent to the initial delineation wells.

Jonah Energy estimates bottom-hole location spacing at a density of no greater than one well per every 10 acres to recover natural gas and associated liquid reserves. Although average bottom-hole density throughout the Project Area is proposed to be approximately one well per every 40 acres, it is anticipated that actual bottom-hole density would vary widely, depending on resource potential.

Target formations would include the Lance Pool and other potentially productive formations identified during exploration and testing, with total depths ranging from approximately 6,500 to 13,500 feet. Jonah Energy could attempt deeper tests as technical and economic conditions warrant. Placement of final surface locations would be contingent on any environmental constraints identified during the application for permit to drill (APD) process and the onsite inspection reviews conducted by the BLM. The exact placement of future surface locations, facilities, and access roads would be determined during the APD process.

Initial production for each well is estimated at one to two million cubic feet of gas per day (MMCF/d), with an estimated ultimate recovery of one to two billion cubic feet (BCF) of gas per well. Actual production would depend on reservoir conditions encountered during exploration.

3.1.3 Resource Values and Uses Brought Forward for Analysis

Based on internal (BLM and cooperating agency) and external (public) scoping, or issue identification, the BLM identified issues and concerns for analysis in this Environmental Impact Statement (EIS). Refer to Section 1.7 (*Public and Agency Scoping*) for more information. In order to analyze and respond to the issues and concerns, the resource values and uses of the affected environment are identified and described in this chapter. For this EIS analysis, the following resources and uses are brought forward for analysis:

- Air Quality
- Climate Change
- Cultural Resources and Tribal Concerns
- Wildland Fire and Fuels Management
- Geology and Mineral Resources
- Hazardous Materials and Solid Waste
- Land Use
- Lands with Wilderness Characteristics
- Livestock Grazing
- Noise
- Paleontology
- Recreation
- Socioeconomics
- Soil Resources
- Special Designations
- Transportation and Access

- Vegetation and Special Status Plant Species
- Visual Resources
- Water Resources
- Wild Horses
- Wildlife and Fisheries and Special Status Wildlife Species

3.1.4 Analysis Area

The analysis area for direct and indirect impacts varies by resource depending on the geographic extent of the resource or use and the extent of the effects of the Proposed Action and alternatives on a resource or use. In some cases (e.g., vegetation), the analysis area is the Project Area because that is the extent of the effects of the NPL Project on the resource. In other cases (e.g., air quality), the analysis area may be larger because the effects on the resource extend beyond the Project Area. The analysis area for each resource value or use is defined in the overview section of each resource discussion that follows.

3.1.5 Past and Ongoing Actions Contributing to Existing Conditions

A variety of past and ongoing actions near the Project Area have contributed to the existing condition of biological, physical, social, economic, and human-made elements of the environment. Past and ongoing actions near the Project Area include livestock grazing, recreation, agriculture, and, oil and gas development. Development of the oil and gas fields adjacent to the Project Area, including the Pinedale Anticline to the north, the Riley Ridge and Big Piney/LaBarge Platform to the west, and the Jonah Infill Drilling Project Area (JIDPA) to the immediate northeast, has increased the level of human activity in the area while decreasing the amount of land available for other uses. Prior to this surge in mineral exploration, the lands were primarily used for livestock grazing and recreation (BLM 2006a). Thus far, the development of oil and gas resources within the Project Area has proceeded at a slower pace than in surrounding fields with 55 producing natural gas wells in the Project Area. The Project Area therefore remains a largely rural and undeveloped expanse with occasional range improvements, roads, and oil and gas development facilities distributed across the landscape. Refer to Section 2.3.1 (*Existing Development in the Project Area*) for more information on existing development and disturbance in the Project Area.

Refer to Section 4.23 (*Cumulative Impacts*) for additional information on past and ongoing projects relative to the cumulative impacts analysis.

3.2 Air Quality

3.2.1 Overview

The analysis area for near-field air quality impacts is the area within 5 kilometers (km) of the Project Area in Sublette County. The analysis area for far-field impacts is the area within 12- and 4-km resolution air quality modeling grids centered on and surrounding the Project Area including portions of southwestern Wyoming, northern Colorado, and northeastern Utah (Map 7).

This section describes the topography, climate, and existing air quality of the air-quality analysis area encompassing the Project Area. Air pollutants addressed include greenhouse gases, volatile organic compounds (VOCs), and criteria air pollutants, hazardous air pollutants (HAPs), and sulfur and nitrogen compounds that could impair visibility or cause atmospheric deposition, including acid rain.

The U.S. Environmental Protection Agency (EPA) regulates air quality, and the Wyoming Department of Environmental Quality (WDEQ) has primary responsibility for enforcing Federal and state air quality regulations in Wyoming. The BLM's role in air-resource management is to ensure that BLM-authorized activities comply with applicable air quality standards and that the BLM's land use management actions support compliance with the Clean Air Act and all State and Federal air quality rules, regulations and standards.

3.2.2 Laws, Ordinances, Regulations, and Standards

The analysis of the impacts of the NPL Project on air quality resources, which is being prepared under the guidelines of NEPA, is governed by the Federal Land Policy and Management Act of 1976 and the 1970 Clean Air Act (CAA) and its amendments. The development of new oil and gas projects is subject to the provisions of EPA's New Source Performance Standards (NSPS) (40 CFR Part 60, Subpart OOOO). In 2016, the NSPS were updated under Subpart OOOOa to address emissions of greenhouse gases (GHGs) and volatile organic compounds (VOC) to include additional emission limits and requirements for oil and natural gas production sources and activities (EPA 2016a). For such projects, analyses are also guided by the 2011 Federal Interagency Memorandum of Understanding (MOU). In addition, projects located in Wyoming in areas not currently in attainment of the National Ambient Air Quality Standards (NAAQS), must comply with the specific Nonattainment Area Regulations promulgated by the Wyoming Department of Environmental Quality (DEQ) Air Quality Division (AQD).

The Clean Air Act (CAA) is the comprehensive federal law that provides for regulation of air emissions from stationary and mobile sources, national ambient air quality standards (NAAQS) to protect public health and public welfare, and protection of visibility in relatively pristine areas such as national parks and wilderness areas. The CAA prescribes the measures that EPA and other federal agencies and state, local, and tribal governments must take in order to regulate air pollution and achieve air quality that meets the NAAQS. The Wyoming Department of Environmental Quality (WDEQ) Air Quality Division (AQD) has been delegated authority by EPA to implement federal programs of the CAA. The WDEQ-AQD is responsible for managing air quality through the Wyoming Air Quality Standards and Regulations (WAQSR) and the Wyoming State Implementation Plan.

In June 2011, the U.S. Department of Agriculture, U.S. Department of the Interior (DOI), and the U.S. Environmental Protection Agency (EPA) signed the "*Memorandum of Understanding (MOU) Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions Through the NEPA Process*." This MOU outlines an approach to the analysis of impacts to air quality and air quality related values, such as visibility in Class I and sensitive Class II areas, in connection with oil and gas development on federal lands, and identifies a path to protect air quality while allowing for oil and gas development on federally managed lands.

Chapter 8 of the Wyoming Air Quality Standards and Regulations stipulates the compliance requirements for any federal actions or federal projects located within a designated nonattainment area. The NPL Project must comply with the General Conformity requirements of WAQSR, Chapter 8 before the project can be authorized by the BLM. Refer to Section 2.4.2 (*General Conformity*) for more information on the General Conformity requirements relevant to the NPL Project.

Indicators of stress on air resources include nonattainment of regulatory standards for criteria pollutants, exceeding thresholds for HAPs, and exceeding Levels of Concern (LOCs) for total atmospheric deposition and visibility impairment. The sections below further describe these indicators and their relationships to regulatory thresholds and standards.

3.2.2.1 Criteria Air Pollutants

To protect human health and welfare, the CAA requires the EPA to establish National Ambient Air Quality Standards (NAAQS) for pollutants harmful to public health or the environment. The EPA has set NAAQS for the following criteria pollutants: ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb). Air-pollutant concentrations greater than the NAAQS represent a risk to human health. If the air quality in a geographic area meets the NAAQS, it is designated as an *attainment* area; areas that do not meet the NAAQS are designated *nonattainment* areas and must develop comprehensive state plans to reduce pollutant concentrations to a safe level. Attainment/nonattainment is determined separately for each criteria pollutant. The WDEQ has also established state-specific air quality standards for criteria pollutants. The standards and relevant averaging periods are summarized in Table 3-1.

Table 3-1. Summary of Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Averaging Period	Units	NAAQS	WAAQS
Ozone	8-hour[1]	ppm	0.070	0.075
		ppb	70	75
SO_2	1-hour[2]	ppb	75	--
		µg/m³	197	--
NO_2	1-hour[3]	ppb	100	100
		µg/m³	188	188
	Annual[4]	ppb	53	53
		µg/m³	100	100
CO	1-hour[5]	ppm	35	35
		µg/m³	40,000	40,000
	8-hour[5]	ppm	9	9
		µg/m³	10,000	10,000
PM_{10}	24-hour[6]	µg/m³	150	150
	Annual[4]	µg/m³	--	50
$PM_{2.5}$	24-hour[7]	µg/m³	35	35
	Annual[8]	µg/m³	12	15

Source: EPA 2015a.

[1]The three-year average of the fourth-highest daily maximum 8-hour average O_3 concentration must not exceed this standard.
[2]The three-year average of the 99th percentile of the daily maximum 1-hour average SO_2 concentration must not exceed this standard.
[3]The three-year average of the 98th percentile of the daily maximum 1-hour average NO_2 concentration is not to exceed this standard.
[4]Not to be exceeded.
[5]Not to be exceeded more than once per year.
[6]Not to be exceeded more than once per year on average over three years.
[7]The three-year average of the 98th percentile 24-hour average $PM_{2.5}$ concentration is not to exceed this standard.
[8]The three-year average of the annual average $PM_{2.5}$ concentration is not to exceed this standard.

CO	Carbon monoxide	ppb	Parts per billion
NAAQS	National Ambient Air Quality Standards	ppm	Parts per million
NO_2	Nitrogen dioxide	SO_2	Sulfur dioxide
$PM_{2.5}$	Fine particulate matter	WAAQS	Wyoming Ambient Air Quality Standards
PM_{10}	Coarse particulate matter	µg/m³	micrograms per cubic meter

3.2.2.2 Ozone Nonattainment Designation

On April 30, 2012, the EPA formally recognized Wyoming's UGRB as an ozone nonattainment area with a marginal classification (40 CFR 81). This action was taken based on the 2008 8-hour average ozone standard of 75 ppb. The design value used in the designation is 78 ppb. A revised standard of 70 ppb was promulgated by EPA on October 1, 2015.

In recent years, the State of Wyoming has launched various initiatives, including policies, monitoring, and emission inventories, to address the ozone nonattainment status. Ozone monitoring within the UGRB Ozone Nonattainment area shows five consecutive winters (2012, 2013, 2014, 2015 and 2016) without an ozone exceedance (State of Wyoming 2016). Based on these new data, EPA issued a Final Rule on June 3, 2016 that included a Determination of Attainment for the UGRB by the attainment date of July 20, 2015 (81 FR 26697; 40 CFR 52.2623). However, this determination is not a redesignation. The UGRB will remain designated nonattainment for the 2008 ozone standard until EPA issues a formal redesignation of the area to Maintenance status.[25]

As a result of the nonattainment designation, the BLM must comply with General Conformity regulations in 40 CFR 93 Subpart B and Chapter 8, Section 3 of the Wyoming Air Quality Standards and Regulations (WAQSR). Per these regulations, the BLM must demonstrate that new actions occurring within the nonattainment area will conform with the Wyoming State Implementation Plan (SIP) by demonstrating that they will not: (1) cause or contribute to a new violation of the ozone standard; (2) interfere with provisions in the SIP for maintenance of any standard; (3) increase the frequency or severity of any existing violation; or (4) delay timely attainment of any standard or any required interim emissions reductions or other milestone. The BLM must first conduct an applicability analysis to determine if this Federal action will require a conformity determination.

A conformity determination must be completed for this Federal action if the total of direct and indirect emissions from the NPL Project exceed the *de minimis* levels specified in 40 CFR 93.153(b) and WAQSR Chapter 8, Section 3. For a marginal nonattainment area, the *de minimis* threshold is 100 tons/year of oxides of nitrogen (NO_x) or VOCs (the precursor pollutants that form ozone in the atmosphere). Federal actions estimated to have an annual net emissions increase less than the *de minimis* levels are not required to demonstrate conformity under the General Conformity regulations. In addition, any portion of the NPL Project that requires a permit under the State of Wyoming's New Source Review (NSR) or Prevention of Significant Deterioration (PSD) programs is also excluded from the Federal agency's General Conformity analysis, per 40 CFR 93.153(d) and WAQSR Chapter 8, Section 3. Since the potential emissions from the Proposed Action for the NPL Project would exceed 100 tons/year for NO_x, the BLM must include a conformity determination with its Record of Decision for the alternative selected. The conformity determination for the NPL Project must be final and approved before and if the NPL Project is authorized to proceed.

3.2.2.3 Visibility

Visibility, also referred to as visual range, is a subjective measure of the distance that light or an object can clearly be seen by an observer. Light extinction is used as a measure of visibility and is calculated from the monitored components of fine particle mass (aerosols) and relative humidity. It is expressed in terms of deciviews, a measure for describing perceived changes in visibility. One deciview is defined as

[25] *On November 16, 2017, EPA published a final designation of attainment for the UGRB for the 2015 8-hour ozone standard, effective January 16, 2018 (81 FR 54232, 40 CFR 81). This attainment designation for the 2015 ozone standard does not affect compliance requirements for the UGRB nonattainment area under the 2008 standard.*

a change in visibility that is just perceptible to an average person, which is approximately a 10-percent change in light extinction. To estimate potential visibility impairment, monitored aerosol concentrations are used to reconstruct visibility conditions for each monitored day. The aerosol species include ammonium sulfate, ammonium nitrate, organic matter, elemental carbon, soil elements, and coarse mass. The daily values are then ranked from clearest to haziest and divided into three categories to indicate the mean visibility for all days (average), the 20 percent of days with the clearest visibility (20 percent clearest), and the 20 percent of days with the worst visibility (20 percent haziest). Visibility can also be defined by standard visual range (SVR) measured in miles, which is the farthest distance at which an observer can see a black object viewed against the sky above the horizon; the larger the SVR, the cleaner the air. Visibility is important to visitors who come to enjoy the often long-range scenic beauty of public lands in the region. Having clear days for such viewing opportunities is especially important for many visitors who are in the area for only a short period.

The regional haze rule promulgated by the EPA in 1999 requires that states establish goals (expressed in deciviews) that provide for reasonable progress toward achieving natural visibility conditions in Class I[26] areas (national parks and wilderness areas) within a state (Map 7). Visibility within these areas is measured as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) network.

3.2.2.4 Hazardous Air Pollutants

There are a wide variety of HAPs, including benzene, toluene, ethylbenzene, xylene (also referred to as BTEX), n-hexane, and formaldehyde that occur during oil and gas development and production activities. National Emission Standards for Hazardous Air Pollutants (NESHAPS) are stationary source standards for hazardous air pollutants. Hazardous air pollutants (HAPs) are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. In addition, some states have established “significance thresholds” to evaluate human exposure for potential acute and chronic inhalation illness and cancer risks.

3.2.2.5 Atmospheric Deposition

Atmospheric deposition refers to processes in which air pollutants are removed from the atmosphere and deposited into terrestrial and aquatic ecosystems. Air pollutants can be deposited by precipitation (rain and snow) or the gravitational settling of pollutants on soil, water, and vegetation. Much of the concern about deposition is due to secondary formation of acids and other compounds from emitted nitrogen and sulfur species, such as NO_X and SO_2, which can contribute to acidification of lakes, streams, and soils and affect other ecosystem characteristics, including nutrient cycling and biological diversity.

Substances deposited include:

- Acids such as sulfuric acid (H_2SO_4) and nitric acid (HNO_3), sometimes referred to as acid rain
- Air toxics such as pesticides, herbicides, and VOCs
- Heavy metals such as mercury
- Nutrients such as nitrates (NO_3^-) and ammonium (NH_4^+).

The accurate measurement of atmospheric deposition is complicated by contributions to deposition by several components including rain, snow, cloud water, particle settling, and gaseous pollutants.

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[26] *Class I air quality areas include national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that existed or were authorized as of August 7, 1977. They receive the highest degree of air quality protection under the CAA.*

Deposition varies with precipitation and other meteorological variables (e.g., temperature, humidity, winds, atmospheric stability), which, in turn, vary with elevation and time.

LOCs for total deposition of nitrogen and sulfur compounds in Class I Wilderness Areas are discussed in the *Federal Land Managers' Air Quality Related Values Work Group Report* (USFS et al. 2010). Total nitrogen deposition of 2.2 kilograms per hectare per year (kg/ha/yr) or less represents the cumulative critical load that is considered protective of high alpine ecosystems in Wyoming that are most sensitive to adverse impacts from atmospheric deposition. For total sulfur deposition, the LOC is 3 kg/ha/yr.

3.2.3 Local Topography and Climate

The Project Area is in the UGRB, which lies between two mountain ranges—the Wyoming Range to the west with peak elevations of approximately 11,500 feet above sea level, and the Wind River Range to the east with peak elevations of approximately 13,800 feet above sea level. Topography within the basin is generally gently rolling, with elevations ranging from approximately 7,000 to 8,200 feet. To the south, the topographic features include rivers, valleys, and buttes, which typically range in height from 50 to 150 feet. Topography in the Project Area is characterized by low rolling hills interspersed with buttes, rock outcrops, large draws, and deep canyons.

The Project Area is in a semiarid (dry and cold) mid-continental climate regime, characterized by dry, windy conditions, with limited rainfall and long, cold winters. The nearest long-term meteorological measurement station is in Big Piney, Wyoming, approximately 20 miles northwest of the Project Area. Variations in elevation and topography across the analysis area result in variations in climatic conditions; therefore, site-specific conditions in the Project Area likely vary somewhat from those reported below.

Table 3-2 describes temperature, precipitation, and wind information for the analysis area encompassing the Project Area, based on meteorological data from the Big Piney – Marbleton Airport measurement station. The temperature and precipitation information is based on daily ambient measurements for the period from 1948 through 2012.

Table 3-2. Climate Information from Big Piney – Marbleton Airport

Climate Component	Big Piney, WY
Mean annual maximum temperature (degrees Fahrenheit)	52.8
Mean summer (June, July, August) maximum temperature (degrees Fahrenheit)	76.6
Mean annual minimum temperature (degrees Fahrenheit)	17.7
Mean winter (December, January, February) minimum temperature (degrees Fahrenheit)	-3.2
Mean annual temperature (degrees Fahrenheit)	36.9
Mean annual precipitation (inches)	7.3
Mean annual snowfall (inches)	28.6
Mean annual wind speed (miles per hour)[1]	6.4
Prevailing wind direction (indicates direction from which the winds are blowing)	NW

Source: WRCC 2012.

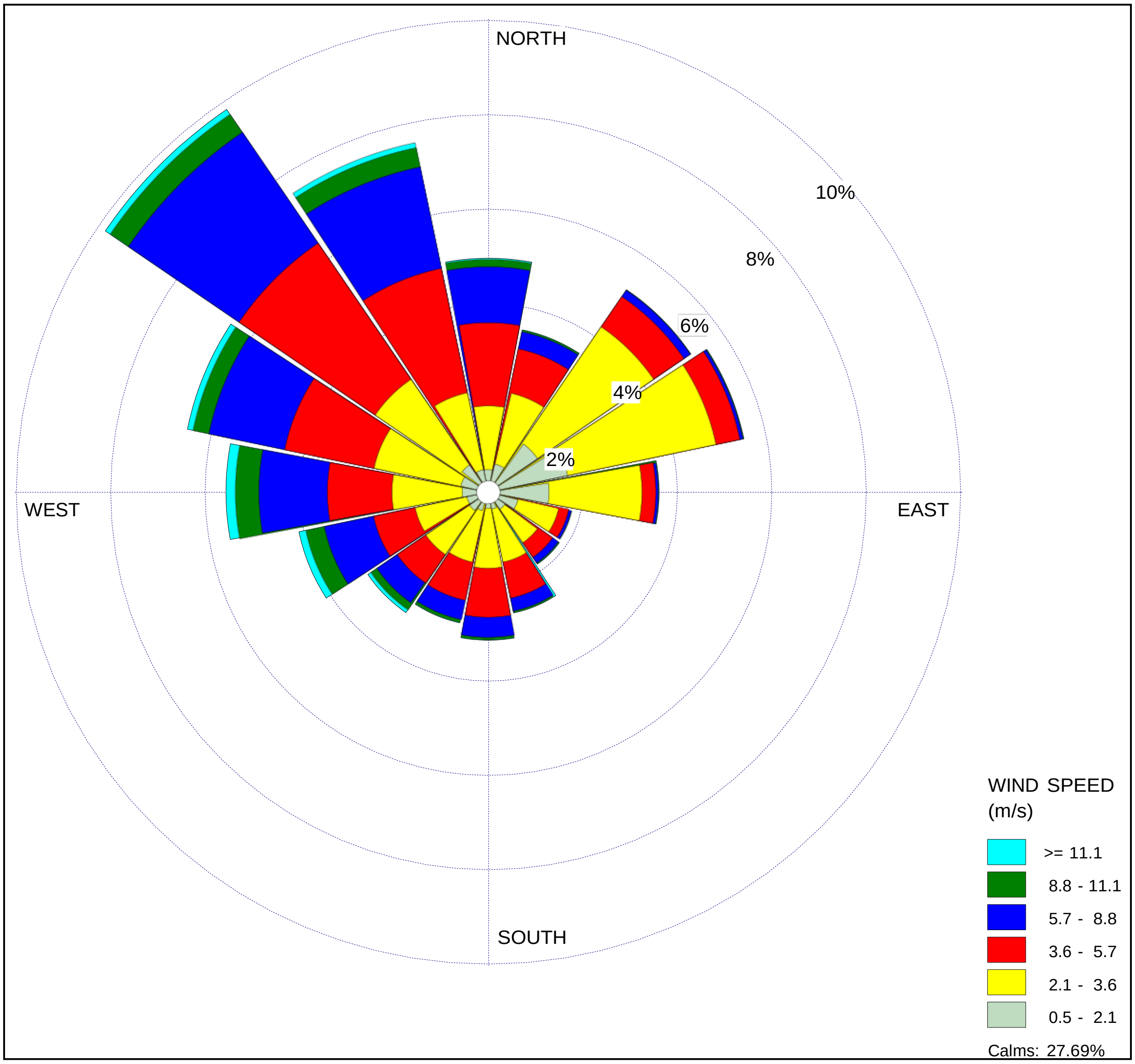
[1]Wind information is for the period 2000–2010.

NW Northwest
WY Wyoming

On average, July is the warmest month (with an average maximum temperature of 80.1 degrees Fahrenheit [°F]) and January is the coldest month (with an average minimum temperature of -5.0°F). Average monthly precipitation is greatest in May (1.03 inches of rainfall). Average snowfall amounts are about the same for November through March (about four inches), with the greatest average snow depth in February.

Figure 3-1 illustrates the frequency of observed wind speed and wind direction for the Big Piney – Marbleton Airport from 2000–2010. In the wind rose diagram, wind direction is defined as the direction from which the wind is blowing. The length of the bar within that wind-direction sector indicates the frequency of occurrence of a particular wind direction. The shading indicates the distribution of wind speeds. Observed winds are calm approximately 28 percent of the time. Wind directions are from the west, west/northwest, northwest, and north/northwest about 30 percent of the time.

Figure 3-1. Distribution of Surface Wind Direction and Wind Speed for the Big Piney – Marbleton Airport for 2000–2010



Sources: NCDC 2012; Lakes Environmental 2012.

3.2.4 Air Quality Monitoring

There are several air quality monitors operated by the WDEQ in the analysis area encompassing the Project Area. Due to an increasing awareness that high ozone concentrations can occur within the analysis area, there are currently ten ozone monitoring sites within the analysis area; many of the monitors also measure NO_X and PM_{10}, and two of the monitors measure $PM_{2.5}$. In addition, $PM_{2.5}$, its component species, and visibility are monitored at two IMPROVE monitoring sites in Bridger Wilderness (to the northeast of the Project Area): Bridger Wilderness (BRID1) and Boulder Lake (BOLA1). Under certain conditions, this nearby Class I area may be a downwind receptor relative to the Project Area.

Atmospheric wet deposition of sulfate, nitrate, ammonium, and other species is measured at Pinedale (WY06) and South Pass (WY97) as part of the National Atmospheric Deposition Program (NADP). Atmospheric dry deposition of sulfate, nitrate, ammonium, and other species is also measured at Pinedale (PND165) as part of the Clean Air Status and Trends Network (CASTNet). Table 3-3 summarizes air quality and deposition data availability within the analysis area. Only currently operating monitoring sites are listed in the table.

Table 3-3. Air Quality Monitoring Sites within the Analysis Area

Site Name	ID	County	Monitoring Years		Pollutants Measured	Location	
			Start	*End*		*Longitude*	*Latitude*
WDEQ							
Big Piney	56-035-0099	Sublette	2011	--	O_3, PM_{10}, $PM_{2.5}$, NO_2	42.487	-110.099
Boulder	56-035-0099	Sublette	2005	--	O_3, PM_{10}, NO_2	42.719	-109.753
Daniel South	56-035-0100	Sublette	2005	--	O_3, PM_{10}, NO_2	42.791	-110.055
Juel Spring	56-035-0700	Sublette	2010	--	O_3, NO_2	42.373	-109.563
Pinedale	56-035-0101	Sublette	2009	--	O_3, $PM_{2.5}$, NO_2	42.853	-109.885
Hiawatha	56-037-0077	Sweetwater	2011	--	O_3	41.158	-108.619
Moxa Arch	56-037-0300	Sweetwater	2010	--	O_3, PM_{10}, NO_2	41.751	-109.788
Wamsutter	56-037-0020	Sweetwater	2006	--	O_3, PM_{10}, NO_2	41.678	-108.024
South Pass	56-013-0099	Fremont	2007	--	O_3, PM_{10}, NO_2	42.528	-108.720
Murphy Ridge	56-041-0101	Uinta	2007	--	O_3, PM_{10}, NO_2	41.369	-111.042
IMPROVE							
Bridger National Forest	BRID1	Sublette	1988	--	Speciated $PM_{2.5}$, Visibility	42.975	-109.758
Boulder Lake	BOLA1	Sublette	2009	--	Speciated $PM_{2.5}$, Visibility	42.846	-109.665
NADP							
Pinedale	WY06	Sublette	1978	--	Wet deposition	42.929	-109.787
South Pass City	WY97	Fremont	1978	--	Wet deposition	42.495	-108.829
Sink's Canyon	WY02	Fremont	1984	--	Wet deposition	42.734	-108.850
CASTNet							
Pinedale	PND165	Sublette	1987	--	Dry deposition	42.921	-109.787

Sources: WDEQ 2014b; VIEWS 2014.

IMPROVE Interagency Monitoring of Protected Visual Environments
NADP National Atmospheric Deposition Program
NO_2 nitrogen dioxide
O_3 ozone
$PM_{2.5}$ fine particulate matter
PM_{10} coarse particulate matter
WDEQ Wyoming Department of Environmental Quality

3.2.5 Current Conditions and Trends

3.2.5.1 Emissions

Table 3-4 provides anthropogenic emission totals for Sublette County, Wyoming, by major source category for several criteria pollutants based on the 2011 National Emission Inventory (NEI), which is a record of historical emissions information reported to the EPA every three years by the states (EPA 2014c). The emission estimates in the table were provided by the WDEQ. The major emission source categories include area sources (e.g., low-level minor point sources), non-road sources (e.g., construction equipment, off-road recreational vehicles), on-road mobile sources (e.g., cars and trucks), and point sources (major sources with elevated stacks).

Table 3-4. Criteria Pollutant Inventory for 2011 (tons per year) for Sublette County, Wyoming

Source	NO_X	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Area Source	2,379	9,193	2,326	45	17,854	2,009
Nonroad Mobile	212	532	1,650	1	29	28
Onroad Mobile	539	262	2,887	2	28	22
Point Source	1,344	1,316	874	163	189	160
Total	**4,475**	**11,303**	**7,736**	**211**	**18,100**	**2,219**

Source: EPA 2014c.

CO carbon monoxide
NO_X oxides of nitrogen
PM particulate matter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Note: Minor variations in totals are due to rounding.

Table 3-4 indicates that the majority of emissions in Sublette County are from area sources, which comprise numerous low-level point and other sources associated with oil and natural gas development within the county. In 2011, a number of oil and gas development companies were operating in the county, primarily in the JIDPA and Pinedale Anticline fields. Table 3-5 provides a more refined breakdown of emissions for Sublette County for 2011 for activities and sources associated with oil and gas production and development. These data are from a different inventory developed by the WDEQ and the totals do not match those obtained from the EPA as shown in Table 3-4. Nevertheless, the overall emissions totals indicate that, with the exception of PM emissions, which are primarily from road dust produced by vehicular traffic on paved and unpaved roadways, the majority of emissions, especially NO_X and VOCs, are from oil and gas development sources.

Table 3-5. Criteria Pollutant Inventory for 2011 (tons per year) for Sublette County, Wyoming Oil and Gas Development Activities

Source	NO_X	VOC	CO	SO_2	PM
Stationary Engines	1,361	831	1,017	3	25
Heaters	626	47	526	4	48
Tanks	113	1,020	68	0	0
Dehydration Units	446	2,627	111	0	0
Pneumatic Pumps	127	3,116	32	0	0
Fugitives	0	3,220	0	0	0
Venting and Blowdown	8	862	2	0	0
Drill Rigs	463	41	308	1	23
Completions	754	54	287	34	22
Truck Loading	0	228	0	0	0
Construction Mobile	76	10	46	4	3
Nonroad Mobile	4	1	11	0	0
Other Sources	7	85	16	156	0
Total	**3,984**	**12,143**	**2,424**	**201**	**121**

Source: WDEQ 2012a.

CO carbon monoxide
NO_X oxides of nitrogen
PM particulate matter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Note: Minor variations in totals are due to rounding.

In addition to the oil and gas development sources operating in the county, other emissions are associated with population-related sources including vehicular traffic and home heating.

3.2.5.2 Emission Trends

Since emissions in Sublette County are dominated by oil and gas development sources, recent trends in emissions follow the level of activity in the JIDPA and Pinedale Anticline fields. As explained in more detail in the discussion of ozone in the following section, in 2012, Sublette County and portions of Sweetwater and Lincoln counties were originally designated by the EPA as a nonattainment area for the 8-hour average ozone NAAQS (2008 standard) due to the occurrence of high “wintertime” ozone events that have been observed in the area during the winter months since 2005. Table 3-6 and Table 3-7 summarize natural gas development emissions for Sublette County for 2009 and 2010, respectively, and Figure 3-2 graphically compares emissions for the 2009 through 2011 period. Although this is a relatively short period, the NO_x and CO emissions for the county did decrease over this period with notable reductions in drilling and completion activities. Such reductions are due in part to the deliberate effort to reduce emissions by introducing cleaner equipment, and in part by the curtailment of development activity in the county in response to economic and market conditions and the resulting effects on the demand for natural gas. Efforts to reduce emissions include WDEQ requirements for operators statewide to install Best Available Control Technology (BACT) equipment in an effort to reduce NO_X and VOC emissions (precursors to ozone formation) by using newer, cleaner equipment including replacing diesel drill rigs with natural gas powered rigs, and by powering other equipment (e.g., pumps, compressors, heaters, etc.) by electrification rather than by internal combustion engines. The VOC emissions increased slightly in 2010 but decreased in 2011.

Table 3-6. Criteria Pollutant Inventory for 2009 (tons per year) for Sublette County, Wyoming Oil and Gas Development Activities

Source	NO_X	VOCs	CO	SO_2	PM
Stationary Engines	1,313	863	974	6	18
Heaters	979	54	822	6	74
Tanks	221	1,169	55	0	0
Dehydration Units	423	3,025	106	0	0
Pneumatic Pumps	114	3,099	29	0	0
Fugitives	0	3,529	0	0	9
Venting and Blowdown	1	380	0	0	0
Drill Rigs	1,180	66	558	41	28
Completions	756	99	305	34	18
Truck Loading	0	386	0	0	0
Construction Mobile	84	10	43	8	10
Non-road Mobile	3	1	9	0	0
Other Sources	11	226	42	0	0
Total	**5,084**	**12,908**	**2,942**	**95**	**158**

Source: WDEQ 2012a.

CO carbon monoxide
NO_X oxides of nitrogen
PM particulate matter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Note: Minor variations in totals are due to rounding.

Table 3-7. Criteria Pollutant Inventory for 2010 (tons per year) for Sublette County, Wyoming Oil and Gas Development Activities

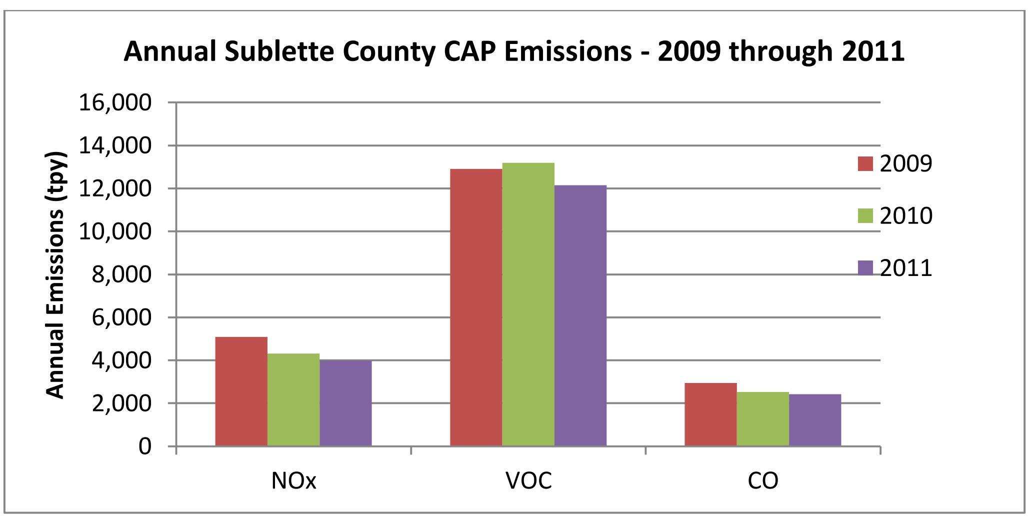
Source	NO_X	VOCs	CO	SO_2	PM
Stationary Engines	1,301	903	856	4	25
Heaters	622	34	523	4	47
Tanks	121	1,031	30	0	0
Dehydration Units	422	3,047	106	0	0
Pneumatic Pumps	141	3,207	35	0	0
Fugitives	0	3,613	0	0	1
Venting and Blowdown	4	890	1	0	0
Drill Rigs	758	60	443	2	26
Completions	864	63	439	25	27
Truck Loading	0	265	0	0	0
Construction Mobile	68	11	44	4	10
Non-road Mobile	4	1	10	0	0
Other Sources	10	72	42	0	0
Total	**4,316**	**13,197**	**2,529**	**39**	**136**

Source: WDEQ 2012a.

CO carbon monoxide
NO_X oxides of nitrogen
PM Particulate Matter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Note: Minor variations in totals are due to rounding.

Figure 3-2. Comparison of Criteria Pollutant Emissions (tons per year) for 2009–2011 for Sublette County, Wyoming Oil and Gas Development Activities



Source: WDEQ 2012a.

Table 3-8 through Table 3-10 summarize natural gas development HAPs emissions for Sublette County for 2009 through 2011, and Figure 3-3 compares these emissions graphically. The HAPs emissions increase slightly from 2009 to 2010 due to an increase in production emissions, followed by a decrease in 2011.

Table 3-8. HAPs Emissions for 2009 (tons per year) for Sublette County, Wyoming Oil and Gas Development Activities

Source	Benzene	Ethyl-benzene	Formalde-hyde	N-hexane	Toluene	Xylene
Stationary Engines	0.4	0.0	97.1	0.1	0.2	0.1
Heaters	0.0	0.0	0.7	17.4	0.0	0.0
Tanks	5.5	0.2	0.0	13.2	9.8	4.0
Dehydration Units	327.3	14.9	0.0	36.4	716.7	455.1
Pneumatic Pumps	20.7	0.0	0.0	38.6	42.5	22.4
Fugitives	23.4	5.7	0.0	49.0	97.6	200.3
Venting and Blowdown	2.8	0.1	0.0	5.6	5.5	3.1
Drill Rigs	0.4	0.0	5.3	0.5	0.2	0.1
Completions	0.0	0.0	0.1	0.0	0.0	0.0
Truck Loading	0.0	0.0	0.0	0.0	0.0	0.0
Construction Mobile	0.0	0.0	0.0	0.0	0.0	0.0
Non-Road Mobile	0.0	0.0	0.0	0.0	0.0	0.0
Other Sources	8.5	0.0	0.0	0.3	0.3	0.1
Total	**389.0**	**20.9**	**103.2**	**161.1**	**873.0**	**685.2**

Source: WDEQ 2012a.

Note: Minor variations in totals are due to rounding.

Table 3-9. HAPs Emissions for 2010 (tons per year) for Sublette County, Wyoming Oil and Gas Development Activities

Source	Benzene	Ethyl-benzene	Formalde-hyde	N-hexane	Toluene	Xylene
Stationary Engines	0.7	0.0	89.1	0.3	0.3	0.1
Heaters	0.0	0.0	0.5	11.2	0.0	0.0
Tanks	4.7	0.1	0.0	10.7	8.2	3.6
Dehydration Units	303.5	19.5	0.0	38.2	715.3	463.2
Pneumatic Pumps	21.2	0.2	0.0	41.2	44.0	28.7
Fugitives	28.4	6.4	0.0	53.3	132.1	231.2
Venting and Blowdown	6.6	0.3	0.0	18.0	14.1	8.5
Drill Rigs	0.2	0.0	2.1	0.0	0.1	0.0
Completions	0.0	0.0	10.9	0.0	0.0	0.0
Truck Loading	0.0	0.0	0.0	0.0	0.0	0.0
Construction Mobile	0.0	0.0	0.0	0.0	0.0	0.0
Non-Road Mobile	0.0	0.0	0.0	0.0	0.0	0.0
Other Sources	12.8	0.0	0.0	0.0	0.0	0.0
Total	**378.1**	**26.6**	**102.5**	**172.9**	**914.1**	**735.3**

Source: WDEQ 2012a.

Note: Minor variations in totals are due to rounding.

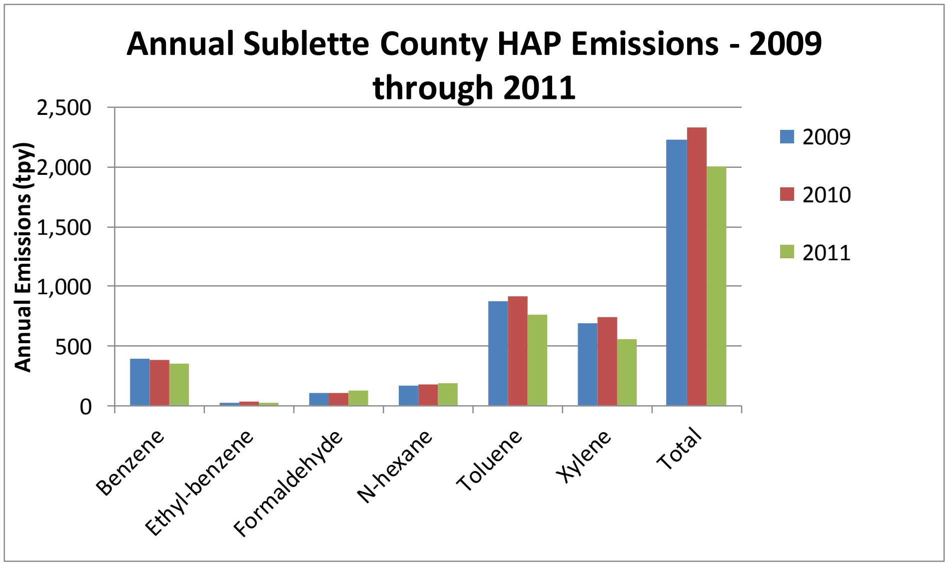
Table 3-10. HAPs Emissions for 2011 (tons per year) for Sublette County, Wyoming Oil and Gas Development Activities

Source	Benzene	Ethyl-benzene	Formalde-hyde	N-hexane	Toluene	Xylene
Stationary Engines	2.1	0.2	110.3	5.7	1.7	0.8
Heaters	0.1	0.1	0.5	11.3	0.7	1.7
Tanks	4.6	0.1	0.0	10.9	8.1	3.5
Dehydration Units	273.0	12.9	0.0	38.2	581.4	334.7
Pneumatic Pumps	22.1	0.8	0.0	47.5	44.8	25.1
Fugitives	25.8	5.2	0.0	54.8	109.9	184.5
Venting and Blowdown	6.4	0.3	0.0	20.0	14.3	9.0
Drill Rigs	0.0	0.0	2.4	0.0	0.0	0.0
Completions	0.0	0.0	9.1	0.0	0.0	0.0
Truck Loading	0.0	0.0	0.0	0.0	0.0	0.0
Construction Mobile	0.0	0.0	0.0	0.0	0.0	0.0
Nonroad Mobile	0.0	0.0	0.0	0.0	0.0	0.0
Other Sources	17.6	0.0	0.0	0.0	0.0	0.0
Total	**351.6**	**19.6**	**122.3**	**188.3**	**760.9**	**559.4**

Source: WDEQ 2012a.

Note: Minor variations in totals are due to rounding.

Figure 3-3. Comparison of HAPs Emissions (tons per year) for 2009–2011 for Sublette County, Wyoming Oil and Gas Development Activities



Source: WDEQ 2012a.

3.2.5.3 Ozone

Ozone is formed in the lower atmosphere by a series of reactions involving sunlight and precursor emissions of NO_X and VOCs. Ozone and its precursors can be transported both into and out of the analysis area.

Ground-level ozone is a regional air quality issue affecting the UGRB and the analysis area encompassing the Project Area. On April 30, 2012, the EPA designated the UGRB as a marginal nonattainment area for ozone based on the 2008 8-hour average ozone standard of 75 ppb. The designated nonattainment area includes Sublette County and portions of Lincoln and Sweetwater counties. This designation was based on ozone data for 2008 through 2010, as well as an analysis of whether nearby areas contribute to the nonattainment issues. Compliance with the 8-hour ozone NAAQS is based on the ozone "design value," which is defined as the three-year average of the annual fourth-highest observed 8-hour average ozone concentration. An ozone design value is first calculated for each monitoring site within a given area. The area-wide ozone design value is then defined as the maximum over all sites within the area. If the design value exceeds the applicable 8-hour ozone NAAQS, the area is designated nonattainment.

Ozone is currently measured at ten monitoring sites within southwestern Wyoming (the region encompassing the Project Area). All ten sites have sufficient data to calculate one or more three-year design values. Ozone design values for each of these sites, for the three most recent three-year design value periods (2010-2012, 2011-2013 and 2012-2014), are listed in Table 3-11.

Table 3-11. Ozone Design Values for 2010-2012 through 2012-2014 for Ozone Monitoring Sites in Southwestern Wyoming Compared with the NAAQS

Site Name	ID	County	Ozone Design Value (ppb)			NAAQS (ppb)
			2010-2012	*2011-2013*	*2012-2014*	
Big Piney	56-035-0099	Sublette	--	65	63	70
Boulder	56-035-0099	Sublette	80	78	63	70
Daniel South	56-035-0100	Sublette	68	68	64	70
Juel Spring	56-035-0700	Sublette	68	68	64	70
Pinedale	56-035-0101	Sublette	68	68	61	70
Hiawatha	56-037-0077	Sweetwater	--	64	63	70
Moxa Arch	56-037-0300	Sweetwater	66	66	64	70
Wamsutter	56-037-0020	Sweetwater	64	63	62	70
South Pass	56-013-0099	Fremont	67	65	64	70
Murphy Ridge	56-041-0101	Uinta	65	65	63	70

Source: EPA 2014c.

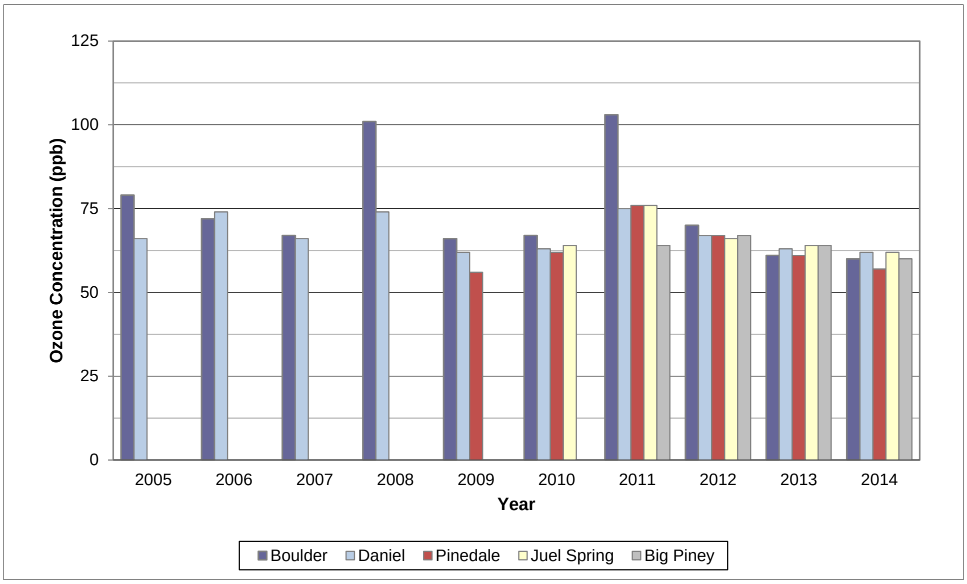
NAAQS National Ambient Air Quality Standards
ppb parts per billion

The design values for the Boulder monitoring site for the 2010-2012 and 2011-2013 design value periods are greater than the 2015 NAAQS. For the 2012-2014 period, the design values are lower than the previous periods and are below the NAAQS for all sites. Figure 3-4 displays the fourth-highest 8-hour average ozone concentrations and Figure 3-5 displays the 8-hour ozone design values for the ozone monitoring sites for all years with available data. As noted earlier, the fourth-highest 8-hour average ozone concentration for each year is used to calculate the design value and assess compliance with the ozone NAAQS.

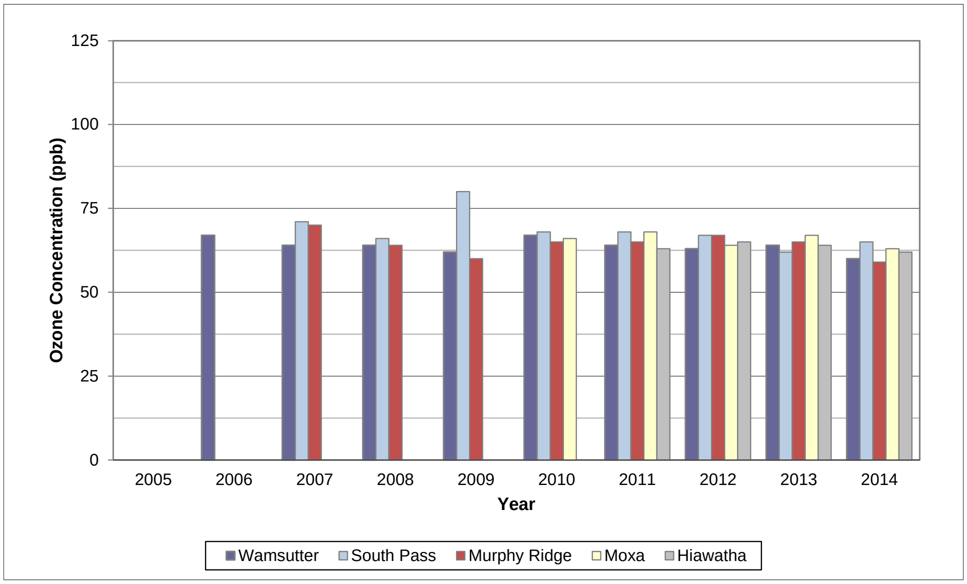
The design values displayed in Figure 3-5 are based on three years of data. Overall, the data indicate a slight downward trend design value for all sites. Only the trend for South Pass is statistically significant.

Figure 3-4. Fourth Highest 8-Hour Average Ozone Concentration (ppb) for Monitoring Sites in Southwestern Wyoming

a) Sublette County Monitoring Sites



b) Sweetwater, Fremont and Uinta County Monitoring Sites

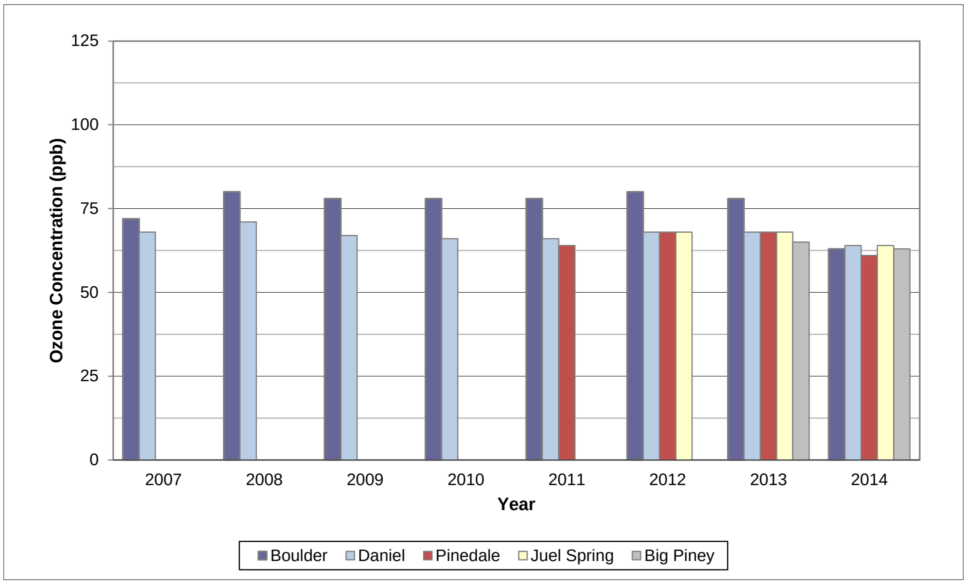


Source: EPA 2014c.

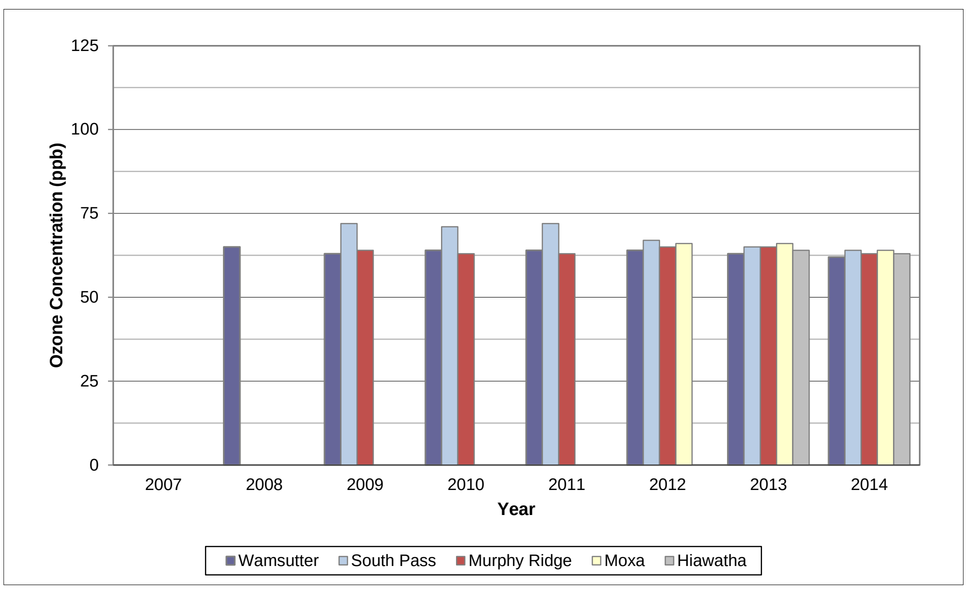
Note: The NAAQS for 8-hour average ozone concentration is 70 ppb.

Figure 3-5. 8-Hour Ozone Design Values (ppb) for Monitoring Sites in Southwestern Wyoming

a) Sublette County Monitoring Sites



b) Sweetwater, Fremont and Uinta County Monitoring Sites



Source: EPA 2014c.

Note: The NAAQS for 8-hour average ozone concentration is 70 ppb.

3.2.5.4 Sulfur Dioxide

SO_2 is currently measured at the Moxa Arch site (in Sweetwater County), which was established in 2010. The 99th percentile daily maximum 1-hour SO_2 values are 16, 20, and 16 parts per billion (ppb) for 2012, 2013 and 2014, respectively. The 1-hour SO_2 NAAQS sets a limit of 75 ppb for the three-year average of the 99th percentile daily maximum 1-hour value. Based on these data, the Federal and state ambient air quality standards for SO_2 (as listed in Table 3-1) is met. Thus, SO_2 does not appear to be a pollutant of concern for the analysis area. Note, however, that SO_2 monitoring is limited to one site. Prior to the establishment of the Moxa Arch site, SO_2 data were measured at the Wamsutter site, also located in Sweetwater County, and data from both sites may be used for background information for the Project Area.

3.2.5.5 Nitrogen Dioxide

NO_2 is currently measured at nine monitoring sites within the three-county area as well as two additional sites just outside of the area. Relevant NAAQS for NO_2 include: (1) the 1-hour NO_2 NAAQS, which requires the three-year average of the 98th percentile daily maximum 1-hour NO_2 concentration to be less than 100 ppb; and (2) the annual NO_2 NAAQS, which requires the annual average NO_2 concentration to be less than 53 ppb. All nine sites have sufficient data to calculate one or more three-year average 1-hour NO_2 values, and these are listed in Table 3-12.

The highest design values occur at the Boulder, Pinedale and Wamsutter monitoring sites. NO_2 concentrations are well below the 1-hour NAAQS for all sites. The low values ensure compliance with the annual NO_2 NAAQS. Data from the Daniel South site are expected to be most representative of background concentrations for the Project Area.

Table 3-12. Design Values for 2010-2012 through 2012-2014 for NO_2 Monitoring Sites in Southwestern Wyoming Compared with the NAAQS

Site Name	ID	County	3-Year Average 98th percentile 1-Hour NO_2 (ppb)			NAAQS (ppb)
			2010-2012	*2011-2013*	*2012-2014*	
Big Piney	56-035-0099	Sublette	11	10	9	100
Boulder	56-035-0099	Sublette	37	30	18	100
Daniel South	56-035-0100	Sublette	5	4	4	100
Juel Spring	56-035-0700	Sublette	13	12	11	100
Pinedale	56-035-0101	Sublette	30	24	21	100
Moxa Arch	56-037-0300	Sweetwater	19	22	20	100
Wamsutter	56-037-0020	Sweetwater	38	37	35	100
South Pass	56-013-0099	Fremont	5	4	4	100
Murphy Ridge	56-041-0101	Uinta	12	12	12	100

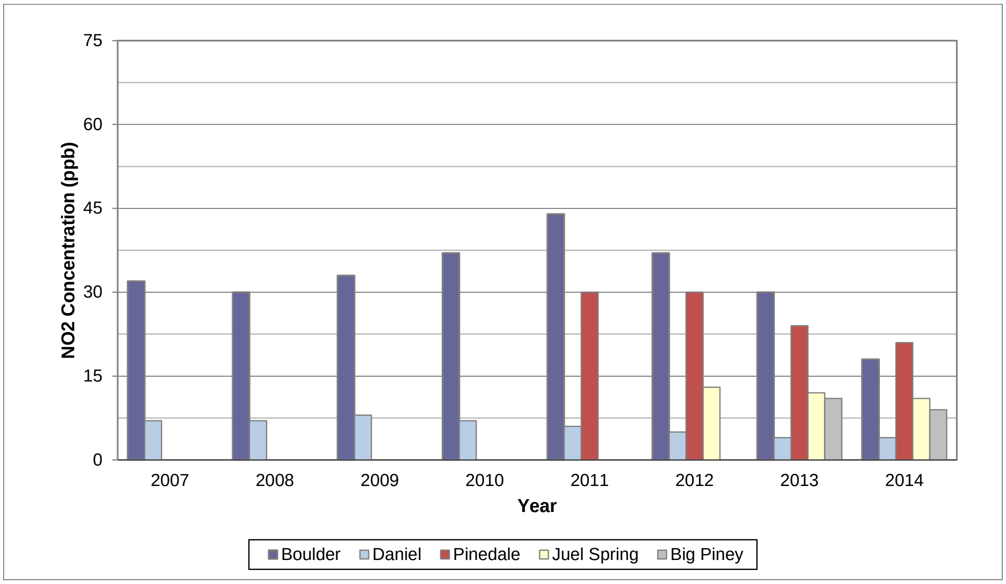
Source: EPA 2014c.

NAAQS National Ambient Air Quality Standards
NO_2 nitrogen dioxide
$\mu g/m^3$ micrograms per cubic meter

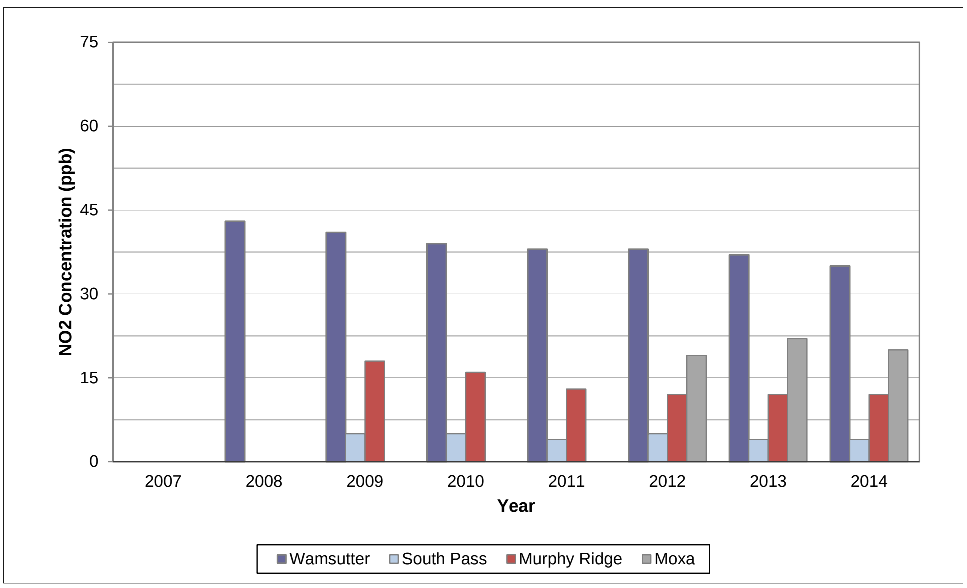
Figure 3-6 displays the three-year average of the 98th percentile daily maximum 1-hour NO_2 concentration for the NO_2 monitoring sites for all years with available data.

Figure 3-6. 1-Hour NO_2 Design Values (ppb) for Monitoring Sites in Southwestern Wyoming

a) Sublette County Monitoring Sites



b) Sweetwater, Fremont and Uinta County Monitoring Sites



Source: EPA 2014c.

Note: The NAAQS for 1-hour NO_2 is 100 ppb.

The design values displayed in Figure 3-6 are based on three years of data. Overall, the data indicate a downward trend for the Pinedale, and South Pass, sites, and a slight downward trend for the Boulder, Daniel, Juel Spring, Big Piney, and Wamsutter sites. Only the downward trend for South Pass is statistically significant.

3.2.5.6 Carbon Monoxide

CO is not routinely monitored within the region. CO was measured at the Murphy Ridge site (in Uinta County) during 2008. Based on these measurements, the daily maximum 1-hour CO value was 996 $\mu g/m^3$ and the daily maximum 8-hour average CO value was 790 $\mu g/m^3$. These values are well below the NAAQS limits of 40,000 and 10,000 $\mu g/m^3$, respectively. Thus, CO does not appear to be a pollutant of concern for the analysis area. However, CO monitoring is limited to one site; data from the Murphy Ridge site will be used for background information for the Project Area.

The 2011 NEI indicates that CO emissions in the analysis area are primarily from area (mostly oil and gas related) and on-road mobile sources. CO concentrations are expected to be greatest near anthropogenic CO sources such as oil and gas development areas, population centers, and roadways, but CO is not a primary air quality concern for the analysis area.

3.2.5.7 Lead

Lead is not routinely monitored and is not a primary air quality concern for the analysis area.

3.2.5.8 Particulate Matter

PM_{10} and $PM_{2.5}$ are pollutants of concern within the analysis area encompassing the Project Area. At the regional scale, it is expected that fugitive dust sources are the dominant contributors to PM_{10} and $PM_{2.5}$ concentrations. Fugitive dust is likely to occur naturally across the analysis area, especially during high-wind events. Post-burn vegetative conditions associated with wildfires are also sources of fugitive dust. At the local level, concentrations are expected to be highest near towns, unpaved roads that experience high volumes of traffic, areas with depleted vegetative cover, and areas downwind of anthropogenic sources of precursor emissions such as SO_2 and NO_2 that may react to form secondary $PM_{2.5}$.

Recent PM_{10} data are available for seven monitoring sites within the region encompassing the Project Area. Under the PM_{10} NAAQS, the maximum 24-hour average PM_{10} concentration cannot exceed 150 $\mu g/m^3$ more than once per year on average over three years. The WDEQ also requires the annual PM_{10} concentration to be less than 50 $\mu g/m^3$. Maximum 24-hour PM_{10} concentrations for monitoring sites within the area are listed in Table 3-13.

PM_{10} concentrations exceeded 150 $\mu g/m^3$ for one of the three years at the Big Piney, Moxa Arch and Wamsutter sites. Thus, while there are no violations of the PM_{10} NAAQS for sites near the Project Area, PM_{10} is an air quality concern for the analysis area. Monitored exceedances may be influenced by events such as wildfires or local sources such as the proximity of Interstate 80 to the Wamsutter monitoring station. Data from the Daniel South site will be used to represent background $PM_{2.5}$ concentrations for the Project Area.

Table 3-13. Maximum 24-Hour PM_{10} Concentrations for Monitoring Sites in Southwestern Wyoming Compared with the NAAQS

Site Name	ID	County	Maximum 24-Hour Average PM_{10} (μg/m³)			NAAQS (μg/m³)
			2012	*2013*	*2014*	
Big Piney	56-035-0099	Sublette	190	59	--	150
Boulder	56-035-0099	Sublette	68	41	31	150
Daniel	56-035-0100	Sublette	72	41	26	150
Moxa Arch	56-037-0300	Sweetwater	152	79	67	150
Wamsutter	56-037-0020	Sweetwater	72	193	41	150
South Pass	56-013-0099	Fremont	49	34	76	150
Murphy Ridge	56-041-0101	Uinta	53	43	39	150

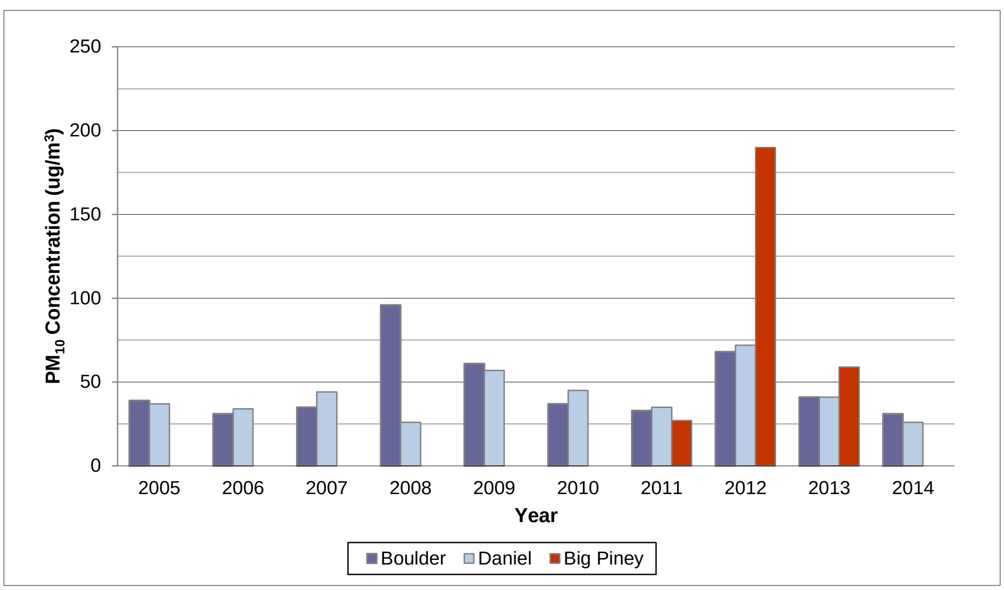
Source: EPA 2014c.

NAAQS National Ambient Air Quality Standards
PM_{10} Coarse Particulate Matter
μg/m³ micrograms per cubic meter

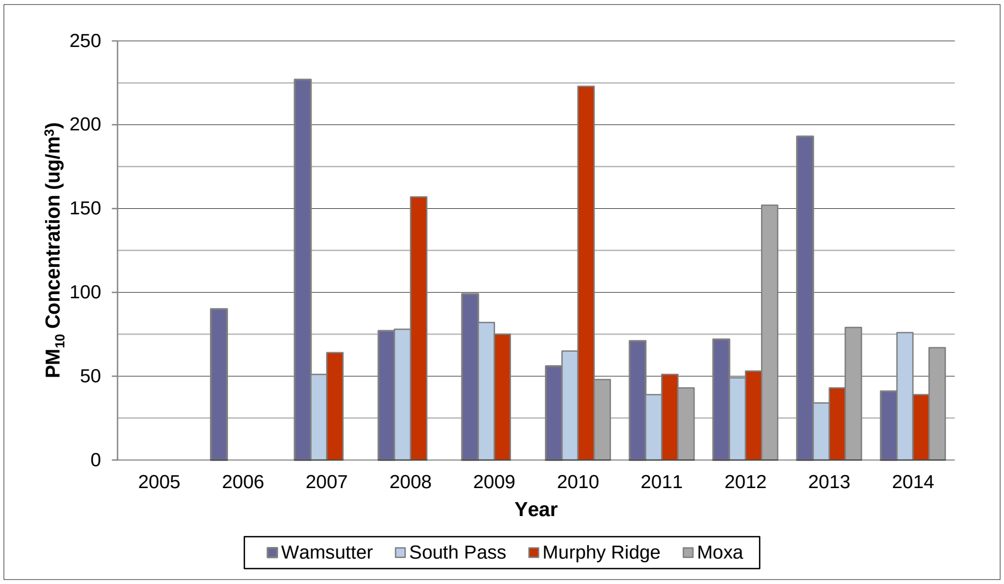
Figure 3-7 displays the maximum 24-hour PM_{10} concentration for these sites for all years with available data.

Figure 3-7. Maximum 24-Hour PM_{10} Design Values (μg/m³) for Monitoring Sites in Southwestern Wyoming

a) Sublette County Monitoring Sites



b) Sweetwater, Fremont and Uinta County Monitoring Sites



Source: EPA 2014c.

Note: The NAAQS for 24-hour PM_{10} is 150 µg/m³.

The data indicate no discernible trend in maximum 24-hour PM_{10} for any of the sites. None of the trends are statistically significant.

Recent $PM_{2.5}$ data are available for two monitoring sites within the analysis area encompassing the Project Area. The NAAQS for $PM_{2.5}$ include: (1) the 24-hour $PM_{2.5}$ NAAQS, which requires the three-year average of the 98th percentile 24-hour average $PM_{2.5}$ concentration to be less than 35 µg/m³; and (2) the annual $PM_{2.5}$ NAAQS, which requires the three-year average of the annual average $PM_{2.5}$ concentration to be less than 12 µg/m³. The 24-hour $PM_{2.5}$ design values are listed in Table 3-14 and the annual $PM_{2.5}$ design values are listed in Table 3-15.

Table 3-14. 24-Hour $PM_{2.5}$ Design Values for 2010-2012 through 2012-2014 for Monitoring Sites in Southwestern Wyoming Compared with the NAAQS

Site Name	ID	County	3-Year Average 98th percentile 24-Hour $PM_{2.5}$ (µg/m³)			NAAQS (µg/m³)
			2010-2012	*2011-2013*	*2012-2014*	
Big Piney	56-035-0099	Sublette	--	23.3	--	35
Pinedale	56-035-0101	Sublette	16.0	17.0	17.3	35

Source: EPA 2014c.

NAAQS National Ambient Air Quality Standards
$PM_{2.5}$ Fine particulate matter
µg/m³ micrograms per cubic meter

The 24-hour $PM_{2.5}$ design values are below the NAAQS for both sites.

Table 3-15. Annual $PM_{2.5}$ Design Values for 2010-2012 through 2012-2014 for Monitoring Sites in Southwestern Wyoming Compared with the NAAQS

Site Name	ID	County	3-Year Average 98thpercentile 24-Hour $PM_{2.5}$ (µg/m³)			NAAQS (µg/m³)
			2010-2012	*2011-2013*	*2012-2014*	
Big Piney	56-035-0099	Sublette	--	4.3	--	12
Pinedale	56-035-0101	Sublette	5.1	5.6	5.8	12

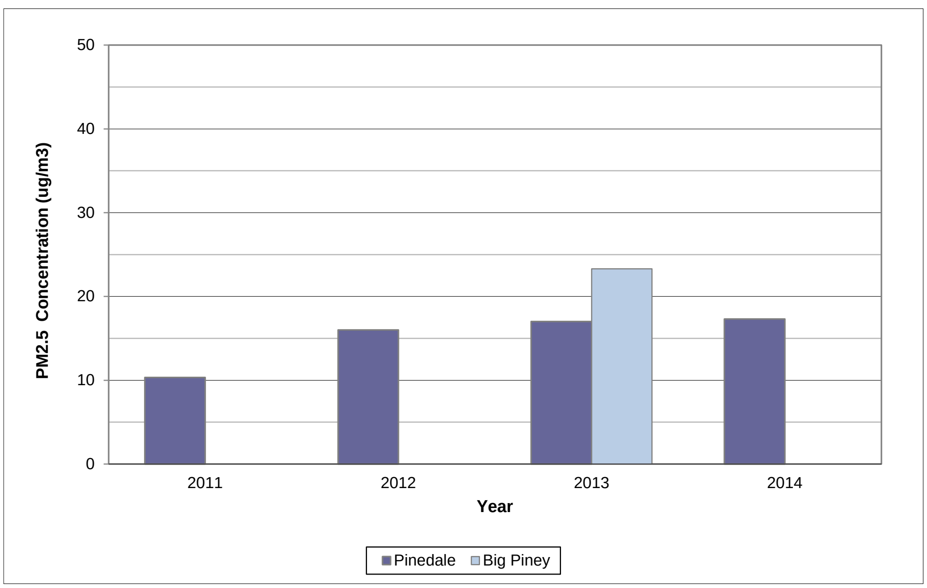
Source: EPA 2014c.

NAAQS National Ambient Air Quality Standards
$PM_{2.5}$ Fine particulate matter
µg/m³ micrograms per cubic meter

The annual $PM_{2.5}$ design values are also below the NAAQS for both sites.

Figure 3-8 displays the 98th percentile 24-hour $PM2_{2.5}$ concentration and Figure 3-9 displays the annual average concentration for each three three-year period with available data. The design values are based on three years of data.

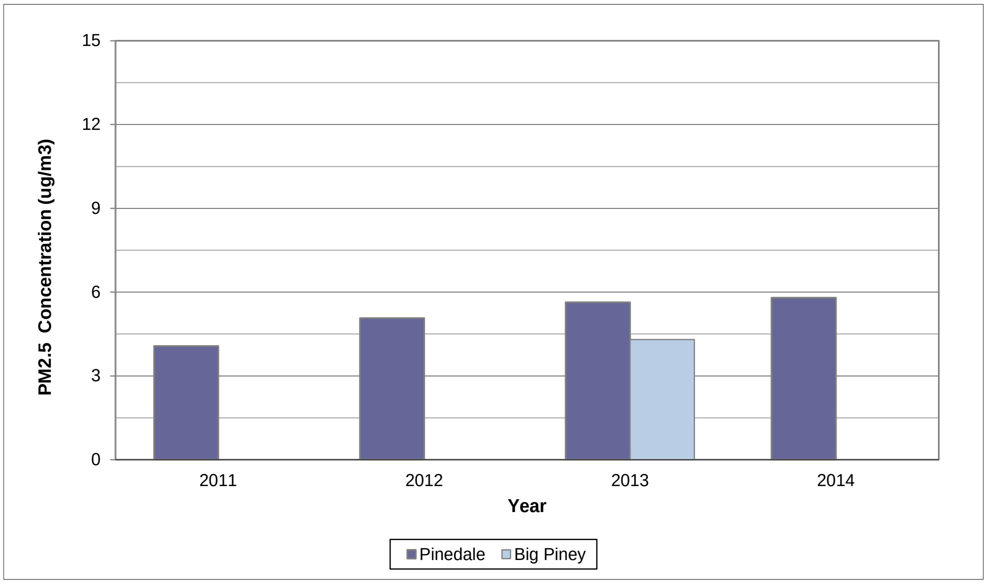
Figure 3-8. 24-Hour $PM_{2.5}$ Design Values (µg/m³) for Monitoring Sites in Southwestern Wyoming



Source: EPA 2014c.

Note: The NAAQS for 24-hour PM2.5 is 35 µg/m³.

Figure 3-9. Annual Average $PM_{2.5}$ Values (µg/m^3) for Monitoring Sites in Southwestern Wyoming



Source: EPA 2014c.

Note: The NAAQS for annual average $PM_{2.5}$ is 12 µg/m^3.

For both the 24-hour and annual metrics, the data indicate a slight upward trend in $PM_{2.5}$ for the Pinedale site.

3.2.5.9 Visibility

The regional haze rule promulgated by EPA in 1999 requires states to establish Reasonable Progress Goals for improving visibility with the overall goal of attaining natural visibility conditions for Class I areas by 2064. Table 3-16 compares visibility in deciviews for the two IMPROVE monitoring sites in Sublette County for 2014 with the natural visibility conditions established by EPA for the Bridger Wilderness Area. The 2014 data indicate that natural background goals are achieved for the 20 percent best days for both sites. However, the deciview values for the 20 percent worst days and for all days are greater than natural background.

Table 3-16. Summary of Visibility Conditions (Deciviews) for 2014 for IMPROVE Sites in Southwestern Wyoming Compared with Natural Visibility Conditions

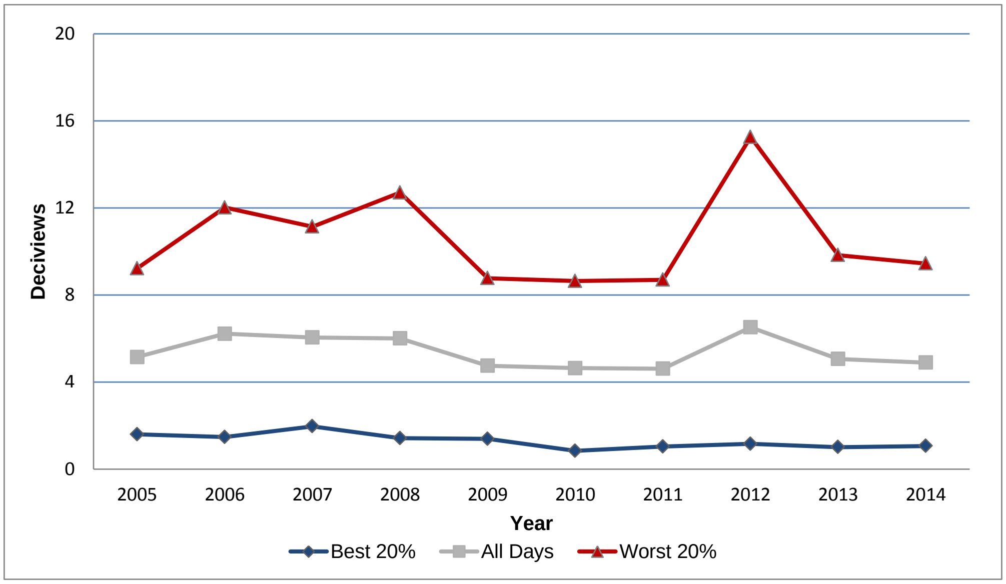
Site	20% Best Days (dv)		20% Worst Days (dv)		All Days (dv)	
	IMPROVE	*Natural*	*IMPROVE*	*Natural*	*IMPROVE*	*Natural*
Bridger Wilderness (BRID1)	1.1	2.0	9.4	7.1	4.9	4.5
Boulder Lake (BOLA1)	1.4	2.0	9.1	7.1	4.9	4.5

Sources: VIEWS 2014; EPA 2003a.

dv deciviews
IMPROVE Interagency Monitoring of Protected Visual Environments
% percent

Figure 3-10 and Figure 3-11 display annual average visibility in deciviews for the 20 percent best days, 20 percent worst days, and all days for each year during the period 2005-2014 for the Bridger Wilderness Area and Boulder Lake IMPROVE sites.

Figure 3-10. Annual Average Visibility (Deciviews) for the Bridger Wilderness IMPROVE Site

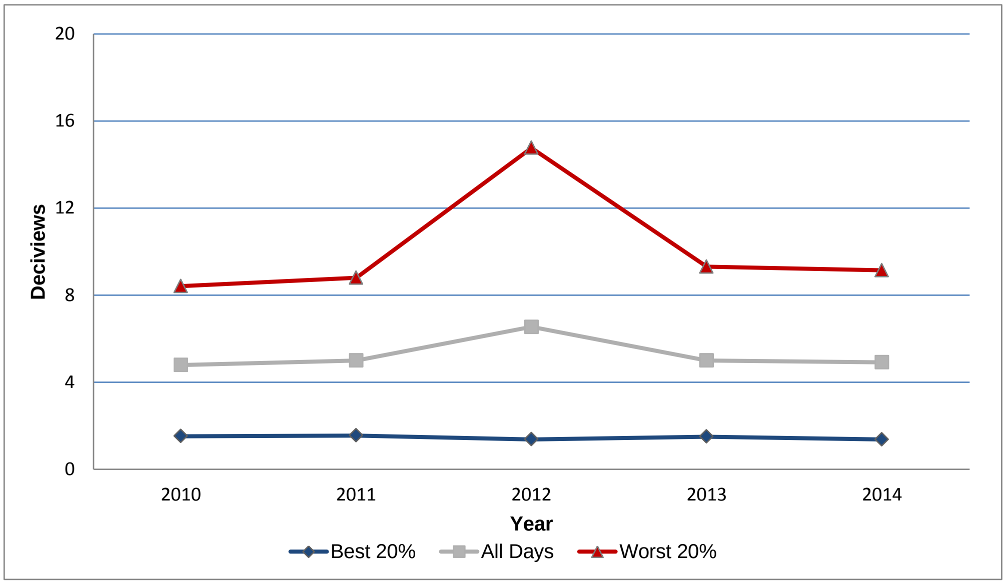


Source: VIEWS 2014.

IMPROVE Interagency Monitoring of Protected Visual Environments

The data for Bridger Wilderness indicate a slight downward trend (improved visibility) for the 20 percent best days during the 2005-2014 period. Only the trend for the 20 percent best days is statistically significant. For the other two categories of days, the data are quite variable and it is difficult to distinguish a trend. Visibility for 2012 is especially poor, compared to most other years. This is likely due to wildfires that occurred in several surrounding states in 2012.

Figure 3-11. Annual Average Visibility (Deciviews) for the Boulder Lake IMPROVE Site



Source: VIEWS 2014.

IMPROVE Interagency Monitoring of Protected Visual Environments

Data collection for Boulder Lake began in mid-2009. The data for 2010 through 2014 show no apparent trend in visibility for any of the categories of days. There is an increase in deciviews (i.e., poorer visibility) for 2012, compared to the other years.

3.2.5.10 HAPs

Many VOCs are hazardous air pollutants and are associated with anthropogenic sources. The 2011 NEI and 2009 and later WDEQ emissions inventories indicate that VOC emissions within the analysis area are primarily from area sources associated with oil and gas development activities. Thus, HAPs concentrations are expected to be greatest near oil and gas development sources and are a potential air quality concern for the analysis area.

HAPs are not routinely monitored within the analysis area. However, WDEQ conducted HAPs monitoring for several sites from February 2009 until March 2010. Table 3-17 summarizes observed HAPs concentrations for the Boulder, Daniel South, and Pinedale monitoring sites. Measurements were taken every six days and the values represent averages for the entire monitoring period.

Table 3-17. Example HAPs Concentrations (μg/m³) for Sublette County, Wyoming

Site Name	Annual Average HAP Concentration (μg/m³)					
	Benzene	*Ethylbenzene*	*Formaldehyde*	*Hexane*	*Toluene*	*Xylene*
Boulder	2.12	0.77	0.99	1.29	6.42	4.46
Daniel South	1.25	0.52	1.37	0.81	4.30	2.76
Pinedale	2.13	1.00	1.59	1.47	6.50	6.38

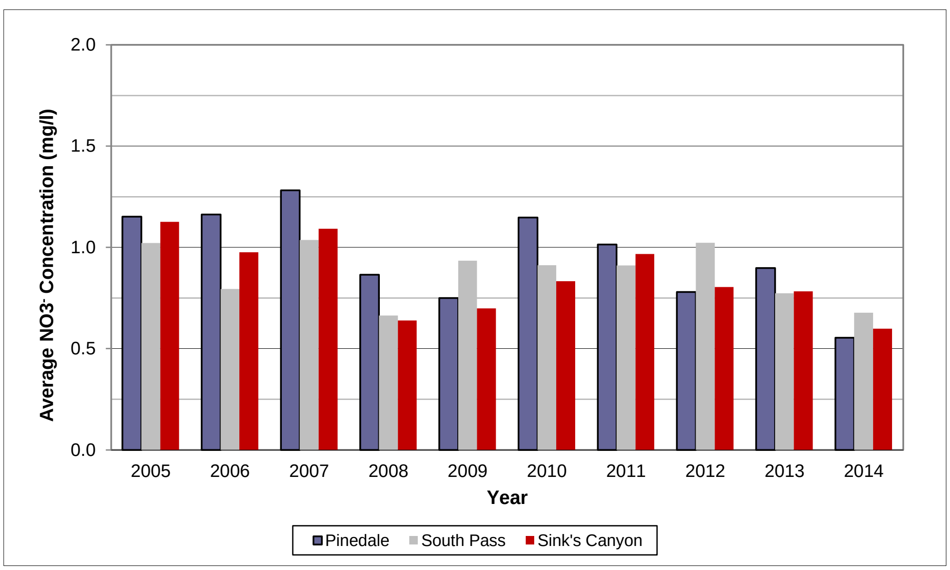
Source: ARS 2010.

μg/m³ micrograms per cubic meter

3.2.5.11 Deposition

Atmospheric deposition of air pollutants can increase the acidity of soils and water resources. Atmospheric deposition is measured at one NADP (wet deposition) and one CASTNet (dry deposition) site in Pinedale (Sublette County) and two NADP sites in Fremont County. Wet deposition is characterized by the concentration of nitrate ion ($NO3^-$), sulfate ion ($SO4^{--}$), and ammonium ion ($NH4^+$) in precipitation samples. Figures 3-12 (a) through (c) displays annual average concentration data for nitrate, sulfate, and ammonium ions from precipitation samples for each year during the period 2005-2014 for the NADP sites. For each year, the data represent the average concentration based on all sampling periods.

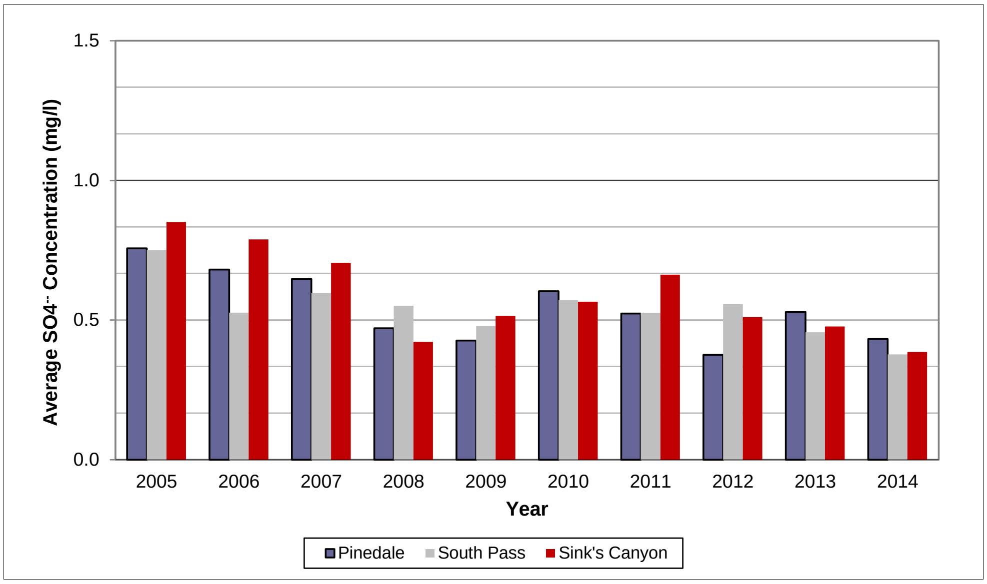
Figure 3-12a. Annual Average Concentration in Wet Deposition (mg/L) for NADP Monitoring Sites at Pinedale, South Pass, and Sink's Canyon: Nitrate Ion Concentration



Source: VIEWS 2014.

mg/L milligrams per liter
NADP National Atmospheric Deposition Program

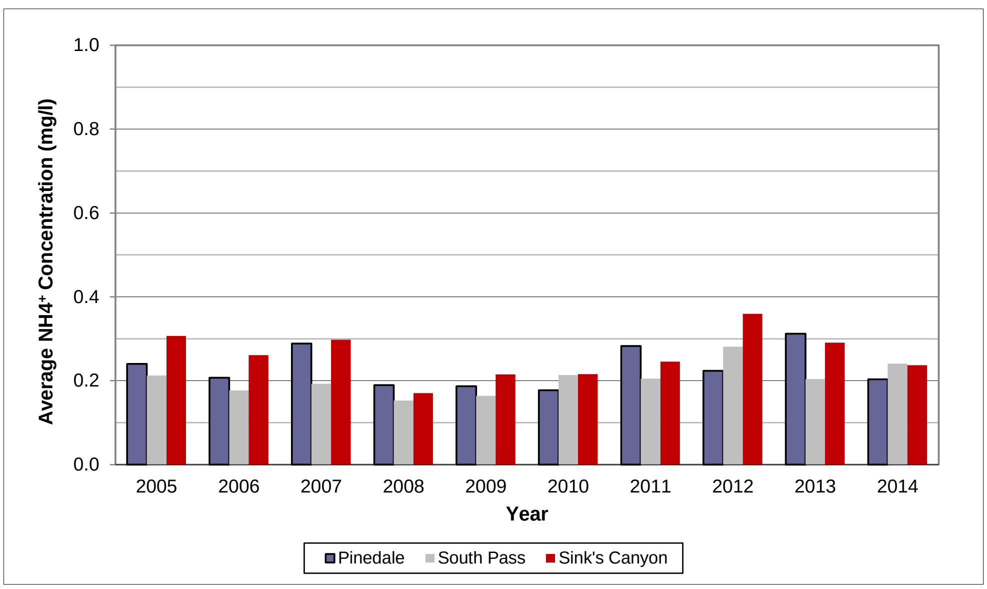
Figure 3-12b. Annual Average Concentration in Wet Deposition (mg/L) for NADP Monitoring Sites at Pinedale, South Pass, and Sink's Canyon: Sulfate Ion Concentration



Source: VIEWS 2014.

mg/L	milligrams per liter
NADP	National Atmospheric Deposition Program

Figure 3-12c. Annual Average Concentration in Wet Deposition (mg/L) for NADP Monitoring Sites at Pinedale, South Pass, and Sink's Canyon: Ammonium Ion Concentration



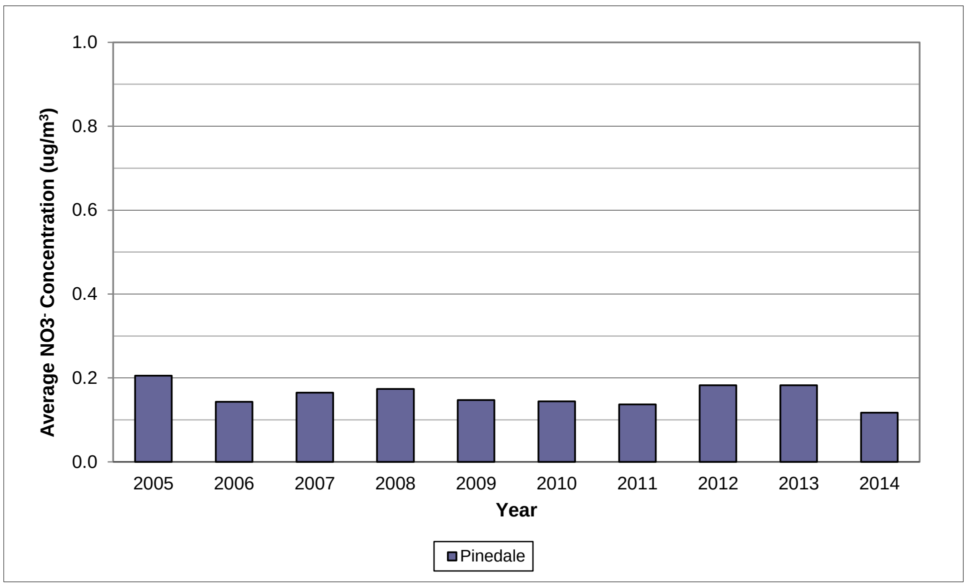
Source: VIEWS 2014.

mg/L	milligrams per liter
NADP	National Atmospheric Deposition Program

The data indicate a decrease over time for nitrate and sulfate ions for all three sites in precipitation samples during this period. There is no discernible trend in ammonium ions. For Pinedale and Sink's Canyon, the downward trends are statistically significant for nitrate and sulfate. For South Pass, the downward trend is statistically significant for sulfate.

Figure 3-13 (a) through (c) displays annual average concentration data for nitrate, sulfate, and ammonium ions for each year during the period 2005-2014 for the Pinedale CASTNet site. The concentration measurements are used to estimate dry deposition. For each year, the data represent the average concentration based on all sampling periods. Units are $\mu g/m^3$.

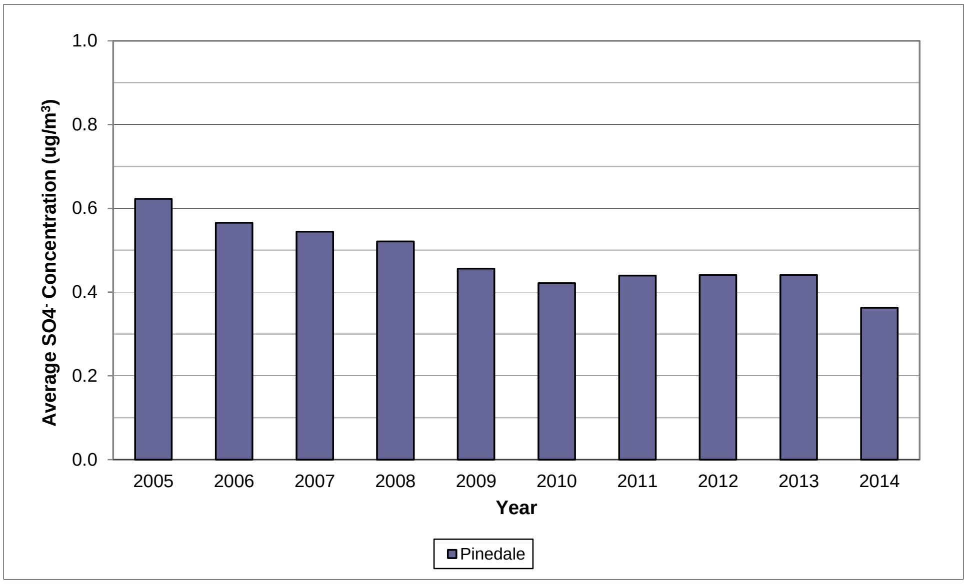
Figure 3-13a. Annual Average Concentration ($\mu g/m^3$) for the CASTNet Monitoring Site at Pinedale: Nitrate Ion Concentration



Source: VIEWS 2014.

$\mu g/m^3$	micrograms per cubic meter
CASTNet	Clean Air Status and Trends Network

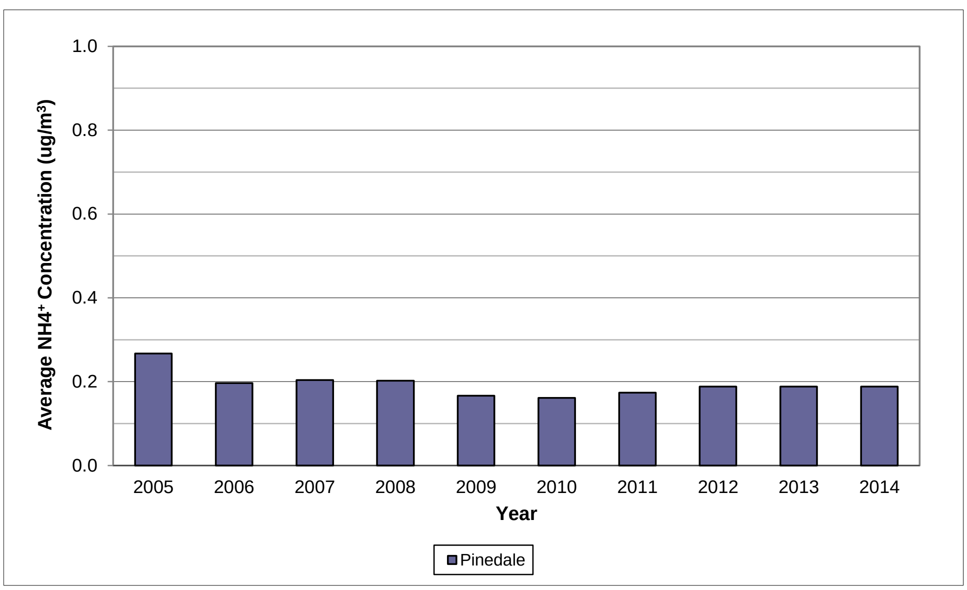
Figure 3-13b. Annual Average Concentration (µg/m³) for the CASTNet Monitoring Site at Pinedale: Sulfate Ion Concentration



Source: VIEWS 2014.

µg/m³	micrograms per cubic meter
CASTNet	Clean Air Status and Trends Network

Figure 3-13c. Annual Average Concentration (µg/m³) for the CASTNet Monitoring Site at Pinedale: Ammonium Ion Concentration



Source: VIEWS 2014.

µg/m³	micrograms per cubic meter
CASTNet	Clean Air Status and Trends Network

The concentration data that are used to estimate dry deposition indicate a decrease over time for all three pollutant species in air samples taken during this period. The downward trend is slight for nitrate ions and ammonium ions and is more pronounced (and statistically significant) for the sulfate ion concentrations.

3.3 Climate Change

3.3.1 Overview

Throughout southwestern Wyoming, a number of resources could be affected by alterations in future weather and land use conditions resulting from possible changes in the overall climate of the region. Meteorological data collected throughout the world during the last 50 years show strong indications of a warming planet. Other environmental data collected from oceans, wetlands, forests, and the polar regions (associated with ice pack extent, thickness, and melting) corroborate the global warming trend. It is well known that certain gases in the atmosphere allow short-wave radiation from sunlight (visible light, ultraviolet, near infrared) through the atmosphere. These gases include CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulfur hexafluoride (SF_6), VOCs, water vapor, and other trace gases. When the sun's radiation strikes Earth's surface, heat is generated in the form of infrared radiation. These same gases act to absorb longer wave infrared radiation, resulting in a warming of the atmosphere. This phenomenon is known as the "greenhouse effect," because these gases, referred to as greenhouse gases (GHGs), act to trap heat in the atmosphere in a similar manner as a greenhouse.

Throughout Earth's history, the proportions of the major constituents of the atmosphere (oxygen and nitrogen, which make up 99 percent of the atmosphere) have changed somewhat due to natural and geogenic processes. The concentrations of minor constituents such as CO_2, CH_4, N_2O, and water vapor have also varied somewhat throughout history. Since the advent of the Industrial Revolution in the 1700s, fossil fuels (coal, oil, and natural gas) have been used for heat and power generation throughout the world. This has resulted in increases in the concentrations of GHGs, compared to pre-industrial concentrations, as estimated using long-term historical records of ice-core samples. During the last 50 years, the rate of this increase in GHG concentrations, especially CO_2, has shown a dramatic upward trend, likely due to the increased burning of fossil fuels brought on by larger populations demanding more energy throughout the world, especially in Asia and other newly developing countries. The increases in CO_2 are due to the use of fossil fuels and certain changes in land use. The major human activities that cause increases in CH_4 are coal mining and releases of natural gas from oil and gas operations, and the major human activities that cause increases in both CH_4 and N_2O include animal manure management, agricultural soil management, sewage treatment, and combustion of fossil fuels in stationary and mobile sources (IPCC 2014).

3.3.2 Indicators

In the air quality analysis area, most GHG emissions, primarily in the form of CO_2, result from the combustion of fossil fuels for oil and gas drilling and production operations and transportation. Energy demand, which is the main driver for natural gas development, is influenced by regional and national population growth, economic development, and seasonal weather conditions. CH_4 emissions also result from the development of fossil fuel resources, landfills, and agricultural and livestock activities.

3.3.3 Current Conditions

Throughout the Mountain West, including southwestern Wyoming and the Project Area, numerous types of activities and actions result in GHG emissions, with the largest contributor being the combustion of fossil fuels in power plants; on-road and off-road vehicles; drilling engines, pumps, and compressors used in oil and natural development; and construction equipment. In addition to direct GHG emissions from these activities, indirect GHG emissions and other factors potentially contributing to climate change include electricity generated outside the analysis area, land-use changes (e.g., converting forested areas to agricultural use), and soil erosion.

3.3.4 Trends

According to climate change researchers, the effects of climate change are expected to vary by region, season, and time of day. Computer model forecasts indicate that increases in temperature will not be evenly or equally distributed, but are likely to be accentuated at higher latitudes. Warming during winter is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. Within a given region, increasing temperatures also could affect the amount of water vapor in the atmosphere, the timing and amount of precipitation, the intensity of storm systems, snow melt, and soil moisture. All of these factors can affect climate, day-to-day weather conditions, plant physiology, and air quality in the Project Area.

Based on research compiled for the International Panel on Climate Change Fifth Assessment Report, (IPCC 2014) potential effects of climate change on resources in the affected environment are likely to be varied. Within North America, the report specifically forecasts that: warming in western mountains is projected to cause decreased snowpack, more winter flooding and reduced summer flows, exacerbating competition for over-allocated water resources; in the early decades of the century, moderate climate change is projected to increase aggregate yields of rain-fed agriculture by 5 to 20 percent, but with important variability among regions; major challenges are projected for crops that are near the warm end of their suitable range or which depend on highly utilized water resources; cities that currently experience heat waves are expected to be further challenged by an increased number, intensity and duration of heat waves during the course of the century, with potential for adverse health impacts; and coastal communities and habitats will be increasingly stressed by climate change impacts interacting with development and pollution.

Specific modeling and/or assessments of the potential effects for the NPL Project and for the State of Wyoming currently do not exist; however, there are downscaled models that have been applied, such as the Wyoming Basin Rapid Ecoregional Assessment (USGS 2015dhttp://nca2009.globalchange.gov/great-plains) and the 2014 National Climate Assessment (GCRP 2014)http://nca2009.globalchange.gov/great-plains.

In 2015, the Wyoming Basin Rapid Ecoregional Assessment presented the results of the climate change analysis for this ecoregion. The analysis presented estimates of expected changes in environmental factors (e.g., precipitation, temperature, etc.) based on information derived from multiple global climate models (GCM). The analysis used data for a current or baseline period (1961 to 1990) and provided a series of expected patterns for specific future time periods (e.g., 2046 – 2060).

The general annual average precipitation pattern for the Wyoming Basin ecoregion (Figure 3-14) shows increasing precipitation from the northwest to the southeast, with the Grand Teton and Yellowstone areas receiving the most rainfall and the mid-basin areas (including the Bighorn Basin and parts of Southeast Wyoming including the Project Area) receiving the least.

The mean annual temperature for existing climate pattern in the Wyoming Basin is presented on Figure 3-15. The historical data indicate that the Bighorn Basin area of the Wyoming Basin is generally warmer than the rest of the ecoregion.

Figure 3-14. Current (1961-1990) Total Annual Precipitation (millimeters)

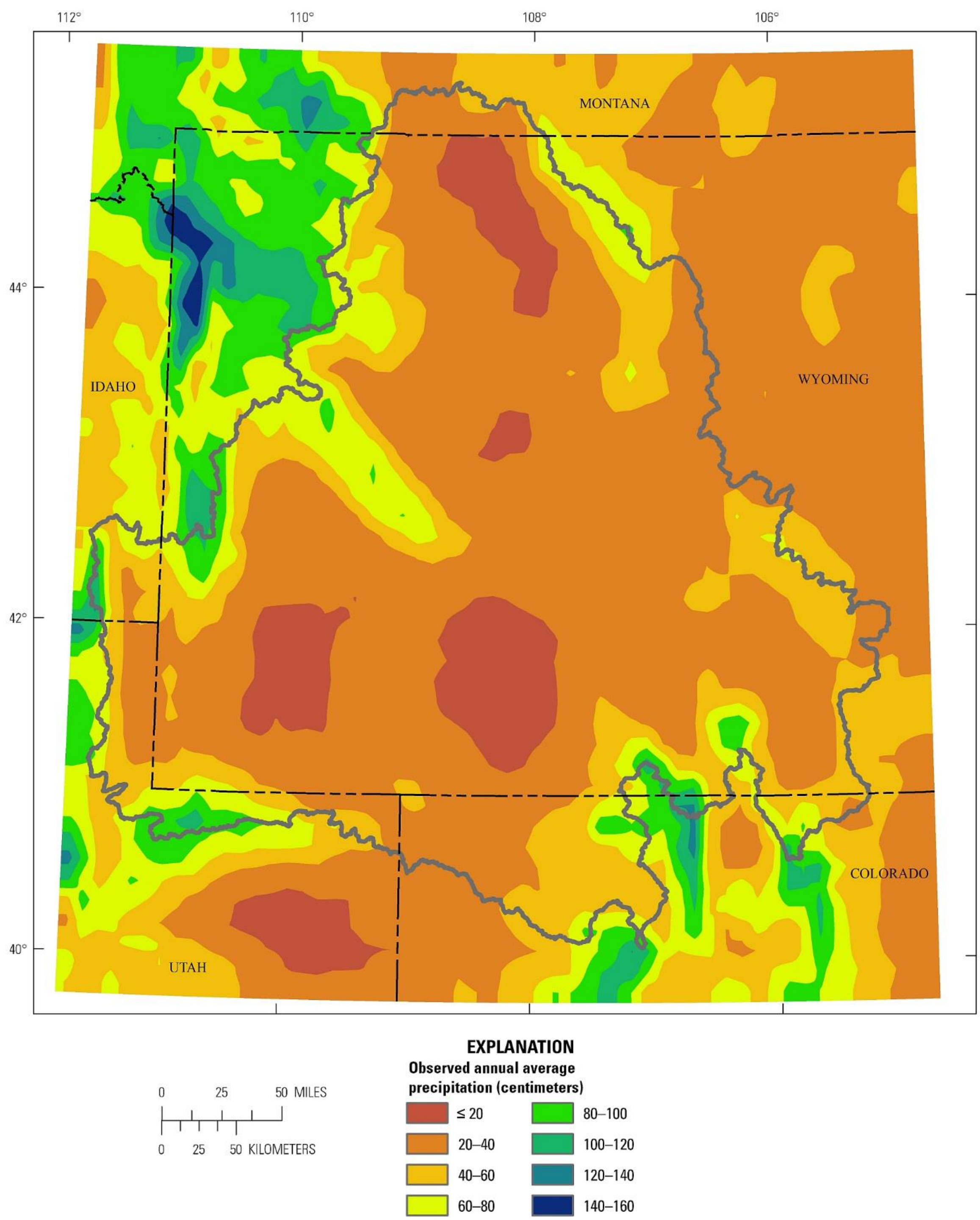
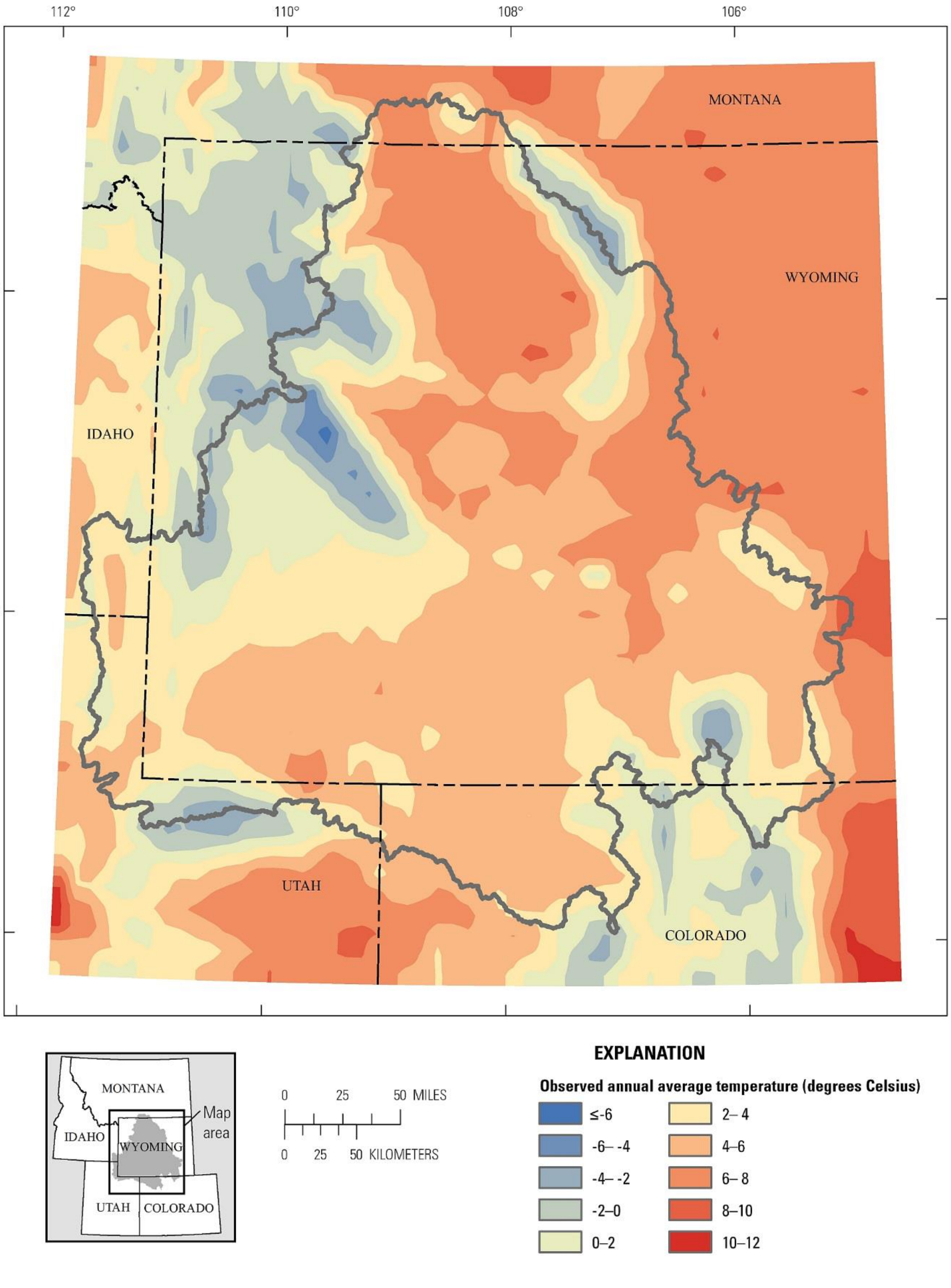


Figure 3-15. Current (1961-1990) Mean Annual Temperature (°C)



The REA for the Wyoming Basin shows that all GCMs expect increased warming by 2030 and further warming by 2060. There was disagreement on the expected changes in precipitation amongst the models but the analysis did indicate an overall expectation for the future of wetter winters and drier summers.

All of North America is likely to experience an increase in average temperature during the next 100 years, and annual mean warming is likely to exceed global mean warming in most areas (IPCC 2014). Temperatures in the Project Area are projected to increase substantially by the end of this century (GCRP 2009). Summer temperatures in the Project Area are expected to increase between approximately 7°F and 10+°F by 2080 to 2099. Overall, temperature in the region that includes the Project Area is projected to increase between 2.5°F to more than 13°F compared to the 1960 to 1979 baseline, depending on future GHG emissions (GCRP 2009). This range of temperature increase reflects the current uncertainty in climate change modeling and represents the likely range of model projections, although lower or higher outcomes are possible.

Increasing temperatures in the Project Area are likely to contribute to increased evaporation, drought frequencies, and declining water quantity. The warming of lakes and rivers will adversely affect the thermal structure and water quality of hydrological systems, which will add additional stress to water resources in the region (IPCC 2014). The Project Area depends on temperature-sensitive springtime snowpack to meet demand for water from municipal, industrial, agricultural, recreational uses and BLM-authorized activities. The U.S. Geological Survey (USGS) notes that mountain ecosystems in the western U.S. are particularly sensitive to climate change, especially in the higher elevations, where much of the snowpack occurs, which have experienced three times the global average temperature increase over the past century. Higher temperatures are causing more winter precipitation to fall as rain rather than snow, which contributes to earlier snowmelt. Additional declines in snowmelt associated with climate change are projected, which would reduce the amount of water available during summer (GCRP 2009). Rapid spring snowmelt due to sudden and unseasonal temperature increases can also lead to greater erosive events and unstable soil conditions.

Increases in average summer temperatures and earlier spring snowmelt in the Project Area are expected to increase the risk of wildfires by increasing summer moisture deficits (GCRP 2009). Studies have shown that earlier snowmelts can lead to a longer dry season, which increases the incidence of catastrophic fire (Westerling et al. 2006). Together with historic changes in land use, climate change is anticipated to increase the occurrence of wildfire throughout the western U.S. The latest GCRP assessment (GCRP 2013) predicts that temperatures and precipitation over the region will continue to increase, especially if GHG emissions remain high. In addition, the assessment predicts that the frequency of extreme weather events such as heat waves, droughts, and heavy rainfall will also increase and may affect water resources, forests and wilderness areas, agricultural and ranching activities, and human health.

There is evidence that recent warming is impacting terrestrial and aquatic biological systems, with higher temperatures leading to earlier timing of spring events such as leaf-unfolding, bird migration, and egg-laying (IPCC 2014). The range of many plant and animal species has shifted poleward and to higher elevation, as the climate of these species' traditional habitat changes. As future changes in climate are projected to be even greater than those in the recent past, there will likely be even larger range shifts in the coming decades (Lawler et al., 2009). Warming temperatures are also linked to earlier "greening" of vegetation in the spring and longer thermal growing seasons (IPCC 2014). In aquatic habitats, increases in algal abundance in high-altitude lakes have been linked to warmer temperatures, while range changes and earlier fish migrations in rivers have also been observed. Climate change is likely to combine with other human-induced stress to further increase the vulnerability of ecosystems to other pests, invasive species, and loss of native species. Climate change is likely to affect breeding patterns, water and food supply, and habitat availability to some degree. Sensitive species in the Project Area, such as the Greater Sage-Grouse, which are already stressed by declining habitat, increased development and other factors, could experience additional pressures as a result of climate change.

More frequent flooding events, erosion, wildfires and hotter temperatures all pose increased threats to cultural and paleontological sites and artifacts. Heat from wildfires, suppression activities and equipment, as well as greater ambient daytime heat can damage sensitive cultural resources. Similarly, flooding and erosion can wash away artifacts and damage cultural and paleontological sites. However, these same events may also uncover and lead to discoveries of new cultural and paleontological localities.

Climate change also poses challenges for many resource uses on BLM-administered land. Increased temperatures, drought and evaporation may reduce seasonal water supplies for livestock and could impact forage availability. However, in non-drought years, longer growing seasons resulting from thermal increases may increase forage availability throughout the year. Shifts in wildlife habitat due to climate change may influence hunting and fishing activities, and early snowmelt may impact winter and water-based recreational activities. Drought and resulting stress on vegetation is likely to increase the frequency and intensity of mountain bark beetle and other insect infestations, which further increases the risk of fire and reduces the potential for sale of forest products on BLM-administered lands.

A variety of activities in the Project Area currently generate GHGs. Fuels combustion, industrial processes and any number of other activities on public lands result in direct emissions of GHGs. Direct emissions in the Project Area include those related to current and ongoing oil and gas and other minerals development, fire events, motorized vehicle use (e.g., off-highway vehicles), livestock grazing, facilities development, and other fugitive emissions. Indirect GHG emissions in the Project Area include the demand for electricity generated outside the area. Contributions to climate change also result from land use changes (conversion of land to less reflective surfaces that absorb heat, such as concrete or pavement), and soil erosion (which can reduce snow's solar reflectivity and contribute to faster snowmelt).

Climate change science and projections of climate change is a continually growing and emerging science. Additional and recent information on climate change and regional projections of climate change for the Project Area can be found through the U.S. Global Change Research Program (http://www.globalchange.gov/) and the Intergovernmental Panel on Climate Change (http://www.ipcc.ch/).

Given the broad spatial influence of climate change which requires response at the landscape-level, the U.S. Department of the Interior (DOI) also established Landscape Conservation Cooperatives which are management-science partnerships that help to inform management actions addressing climate change across landscapes. These Cooperatives are formed and directed by land, water, wildlife and cultural resource managers and interested public and private organizations, designed to increase the scope of climate change response beyond federal lands.

The Carbon Storage Project is a federal initiative implemented to develop carbon sequestration methodologies for geological (i.e., underground) and biological (e.g., forests and rangelands) carbon storage. The project is a collaboration of federal agency and external stakeholders to enhance carbon storage in geologic formations and in plants and soils in an environmentally responsible manner. The Carbon Footprint Project is a project to develop a unified GHG emission reduction program for the DOI, including setting a baseline and reduction goal for the Department's GHG emissions and energy use.

In addition to DOI's efforts to address this issue, the EPA has undertaken a number of regulatory initiatives in recent years to reduce GHG emissions. For over 20 years, the EPA has developed approaches and strategies for reducing GHG emissions from natural gas operations through its Natural Gas Star Program (EPA 2014b). This program has provided recommendations for capturing or reducing fugitive emissions of VOCs, including hazardous air pollutants (HAP), as well as GHG's such as methane. In 2009, a finding was made under the Clean Air Act identifying the key constituent gases that threaten public health and welfare and contribute to climate change. An initiative was developed for mobile sources by setting engine and fuel standards to cut GHGs and fuel use for new motor vehicles, and the implementation of a renewable fuel standard aimed at decreasing oil imports and reducing GHGs. Another initiative addresses stationary sources to limit GHGs for power plants and other large industrial facilities. The EPA also initiated a national GHG emissions reporting program for large emitters. In 2012, EPA finalized the New Source Performance Standards (NSPS) regulations (40 CFR, Part 60, Subpart OOOO) to reduce pollution from the oil and natural gas industry, which is expected to result in substantial reductions in VOC emissions, air toxins, and methane (CH_4), an important GHG (EPA 2012a). In 2015, the EPA proposed to extend the NSPS regulations (40 CFR Part 60, Subpart OOOOa) to mandate control requirements for hydraulically fractured oil wells (80 FR 56579). In addition to requiring reduced emission completions (or "green completions") of oil wells, the rules also mandate that developers find and repair leaks, limit emissions from new and modified pneumatic pumps, and limit emissions from several types of equipment used at natural gas transmission compressor stations and at gas storage facilities, including compressors and pneumatic controllers. In 2016, the EPA published final updates to NSPS for "new, reconstructed and modified oil and gas sources" aimed at further reducing emissions of VOC's and methane (81 FR 35622).

While federal climate initiatives and rulemakings described above continue, a number of recent federal measures related to climate change were rescinded or are under review in accordance with the publication of EO 13783 in March 2017. The stated intent of EO 13783 is "to promote clean and safe development of our Nation's vast energy resources, while at the same time avoiding regulatory burdens that unnecessarily encumber energy production, constrain economic growth, and prevent job creation" (82 FR 16093). Climate change-related actions, reports, and guidance rescinded by EO 13783 include, but are not limited to, EO 13653, *Preparing the United States for the Impacts of Climate Change* (78 FR 66817); the Presidential Memorandum of November 3, 2015 (Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment); the Report of the Executive Office of the President of June 2013 (The President's Climate Action Plan); the Report of the Executive Office of the President of March 2014 (Climate Action Plan Strategy to Reduce Methane Emissions); CEQ's *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (81 FR 51866); and reports issued by the Interagency Working Group on Social Cost of Greenhouse Gases. DOI Secretarial Order 3349, issued on March 29, 2017, provided specific direction to DOI agencies to implement EO 13783. As instructed in by Secretarial Order 3349, the BLM and other DOI agencies are to review existing climate change policies and take appropriate measures to relieve the burden that such existing agency actions may have on the development and use of the Nation's energy resources.

3.4 Cultural Resources

3.4.1 Overview

Cultural resources include prehistoric and historic archaeological districts, sites, buildings, structures, or objects created or modified by human activity. Cultural resources also include Traditional Cultural Properties (TCPs), which is a property that is eligible for inclusion in the National Register of Historic Places (NRHP) based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community. Cultural resources may also involve historic properties, traditional use areas, and sacred resource areas. Further, cultural resources are finite, nonrenewable resources that cannot be returned to their original states once they have been altered, damaged, or removed. Cultural resources are managed pursuant to the National Historic Preservation Act of 1966 (NHPA) and the Archaeological Resources Protection Act of 1979 (ARPA), among other statutes. This section discusses the known cultural resource conditions in the Project Area and outlines the regulatory framework relevant to the management of those resources. The analysis area for cultural resources is the Project Area, historic properties, and historic trails where views of the NPL Project may affect the integrity of the setting and landscape of the historic properties, including portions of the Sublette Cutoff of the California NHTs and the North Sublette Meadow Spring Variant of the Sublette Cutoff.

3.4.2 Laws, Ordinances, Regulations, and Standards

3.4.2.1 Regulations Governing the Management of Archaeological Resources and Historic Properties on Federal Land

3.4.2.1.1 The National Historic Preservation Act

Provisions of the NHPA codified at 54 U.S.C. 306108 (also known as Section 106 NHPA and previously codified at 16 U.S.C. 470f) and the BLM Wyoming and Wyoming SHPO State Protocol (BLM and SHPO 2014) require federal agencies that license or fund projects to consider the undertaking's effects on historic properties. The NHPA defines a historic property as a cultural resource (prehistoric or historic district, site, building, structure, or object) that is included in the National Register of Historic Places (NRHP) or eligible for inclusion in the NRHP (not included in the NRHP but meets the NRHP criteria for inclusion). In order for a cultural resource to be considered a historic property, it must meet the following criteria for inclusion in the NRHP as outlined by the National Park Service:

1. Associated with events that have made a significant contribution to the broad patterns of our history; or
2. Associated with the lives of persons significant in our past; or
3. Embodies the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
4. Has yielded, or may be likely to yield, information important in prehistory or history.

The quality of significance in American history, architecture, archaeology, engineering, and/or culture must be present in districts, sites, buildings, and structures considered eligible for the NRHP. Objects must possess integrity of design, setting, materials, workmanship, feeling, and association. Among other criteria considerations, a property that has achieved significance within the last 50 years is not considered eligible for inclusion in the NRHP unless certain exceptional conditions are met.

3.4.2.1.2 36 Code of Federal Regulations Part 800

To clarify the responsibilities of federal agencies to comply with the NHPA, the Advisory Council on Historic Preservation (ACHP) has issued 36 Code of Federal Regulations (CFR) Part 800: Protection of Historic Properties. These regulations guide the implementation of 54 U.S.C. 306108, identify the participants in the compliance process, define key terms, and delineate the process of review and consultation.

A national Programmatic Agreement (PA) was entered into by the BLM, the ACHP, and the National Conference of State Historic Preservation Officers (NCSHPO) on March 26, 1997; the PA was revised in February 2012. This agreement, allowed under 36 CFR 800.14(a), establishes a framework and mechanism by which BLM carries out its responsibilities under the NHPA with respect to the ACHP's role in preservation activities under 54 U.S.C. 306108, 54 U.S.C. 306107, and 54 U.S.C. 306121, and defines the State Historic Preservation Officer's (SHPO) role under 54 U.S.C. 302303. The PA recognizes that BLM has well-developed internal guidance in its 8100 Manual series and an experienced, professional staff capable of assuming more historic preservation responsibility without case-by-case ACHP and SHPO review. The BLM national PA represents a shared commitment to emphasize planning and managing cultural resources on the public lands while streamlining and simplifying procedures and reducing paperwork for consultation with the ACHP and SHPO, as set forth in 36 CFR Part 800. Under the PA, BLM follows its own procedures, as outlined in the PA and the 8100 Manual series, for consulting with the ACHP and SHPOs in compliance with 54 U.S.C. 306108, rather than the procedures in 36 CFR Part 800, for the majority of undertakings.

3.4.2.1.3 Wyoming BLM and State Historic Preservation Office State Protocol

In 2014, the Wyoming BLM and the Wyoming SHPO signed an updated State Protocol that defines the manner in which the Wyoming SHPO and Wyoming BLM will interact and cooperate under the national PA described above (BLM and SHPO 2014). The goal of the BLM national PA and the Wyoming State Protocol is to forge a more meaningful and productive historic preservation partnership between the Wyoming BLM and SHPO that will enhance the management of historic properties under the Wyoming BLM's jurisdiction. The State Protocol outlines a balanced consultation process between the BLM and SHPO and is focused on avoiding adverse effects to eligible sites and provides guidelines for the development of avoidance, minimization and mitigation measures where effects to sites are unavoidable. The document also contains guidelines for the evaluation of settings associated with the integrity of eligible sites.

3.4.2.1.4 Antiquities Act of 1906

The Antiquities Act of 1906 was enacted with the primary goal of protecting cultural resources in the United States. As such, it prohibits appropriation, excavation, injury, or destruction of "any historic or prehistoric ruin or monument, or any object of antiquity" located on lands owned or controlled by the Federal government, without permission of the secretary of the Federal department with jurisdiction. It also establishes criminal penalties, including fines or imprisonment, for these acts, and sets forth a permit requirement for collection of antiquities on Federally-owned lands.

3.4.2.1.5 Historic Sites Act of 1935

The Historic Sites Act of 1935 declares that it is a national policy to preserve, for public use, historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the United States.

3.4.2.1.6 Archaeological Resources Protection Act of 1979

The ARPA governs the excavation of archaeological sites on Federal and Native American lands and the removal and disposition of archaeological collections from those sites. It clarifies requirements of the Federal Land Policy and Management Act (FLPMA) of 1976 for managing the disturbance of archaeological sites, features, and objects on Federal lands. ARPA prohibits unauthorized excavation on Federal and Indian lands, establishes standards for permissible excavation, prescribes civil and criminal penalties, requires agencies to identify archaeological sites, and encourages cooperation between federal agencies and private individuals. To ensure compliance, federal agencies may require project proponents to acquire an ARPA permit.

3.4.2.1.7 National Trails System Act of 1968

The National Trail System Act of 1968 authorized creation of a national trail system comprising National Recreation Trails and National Scenic Trails. The National Parks and Recreation Act of 1978 (Public Law 95-625) amended the National Trails System Act, calling for the establishment of National Historic Trails (NHTs). NHTs may only be designated by an act of Congress and are administered by federal agencies, although part of their entire land base may be owned and managed by others. NHTs are designated to protect the remains of significant overland or water routes that reflect the history of the nation.

3.4.2.1.8 Reservoir Salvage Act of 1960 (as amended)

The Reservoir Salvage Act of 1960 requires federal agencies building, or permitting the building of, reservoirs to notify the Secretary of the Interior when such activities might destroy important archaeological, historic, or scientific data. The Secretary of the Interior is authorized to conduct appropriate investigations to protect those data. The act also authorizes agencies to spend up to one percent of their construction funds on the protection of historic and archaeological resources. This is the first act to recognize that archaeological sites are important for their data content and to provide a source of funding for collecting archaeological data. In 1974, the Reservoir Salvage Act was amended by the Archaeological and Historic Preservation Act to extend the provisions of the 1960 act to all Federal construction activities and all federally licensed or assisted activities that cause loss of scientific, prehistoric, or archaeological data.

3.4.2.1.9 Archaeological and Historic Preservation Act of 1974

The Archaeological and Historic Preservation Act (AHPA) provides for the preservation of historic American sites, buildings, objects, and antiquities of national significance by specifically providing for the preservation of historical and archaeological data (including relics and specimens) that may otherwise be irreparably lost or destroyed as a result of any alteration of the terrain caused by any Federal construction project or Federally licensed activity or program. It requires the federal agency to notify the Secretary of the Interior if a project threatens the loss or destruction of significant historic or archaeological data. The lead Federal agency's 54 U.S.C. 306108 compliance process provides essentially the same protection.

3.4.2.1.10 Section 4(f) of the U.S. Department of Transportation Act of 1966

Section 4(f) of the U.S. Department of Transportation Act provides special protection to public recreational lands and facilities, including local parks and school facilities that are open and available to the general public for recreational purposes, as well as significant cultural resources and natural wildlife refuges. Federally funded transportation improvement projects are prohibited from encroaching on Section 4(f) lands unless it can be demonstrated that no prudent or feasible alternative exists.

3.4.2.2 Acts Governing the Protection of Native American Cultural Resources

3.4.2.2.1 American Indian Religious Freedom Act of 1978

The American Indian Religious Freedom Act (AIRFA) protects and preserves Native Americans' rights of freedom to believe, express, and exercise traditional religions. If a place of Native American religious significance may be affected by an undertaking, AIRFA promotes Federal consultation with Native American religious practitioners. This consultation can be conducted in concert with consultation required by 54 U.S.C. 306108. In carrying out its responsibilities under 54 U.S.C. 306108, a Federal agency shall consult with any tribe that attaches religious or cultural significance to any such properties (36 CFR 800.2).

3.4.2.2.2 Native American Graves Protection and Repatriation Act of 1990

For activities on Federal lands, the Native American Graves Protection and Repatriation Act (NAGPRA) requires consultation with appropriate Native American tribes prior to the intentional excavation or removal of human remains and objects of cultural patrimony. For activities on Native American lands, NAGPRA requires the consent of the tribe prior to the removal of cultural items. The law also provides for the repatriation of such items from federal agencies and federally assisted museums and other repositories. Amendments to the NHPA in 1992 strengthened NAGPRA by encouraging protection of Native American cultural items and properties of religious or cultural importance to Native American tribes (54 U.S.C. 306131). The NHPA amendment (54 U.S.C. 306102) stipulates that a Federal agency's procedures for compliance with 54 U.S.C. 306108 provide for the disposition of Native American cultural items from Federal or tribal land in a manner consistent with Section 3(c) of the NAGPRA.

3.4.2.3 Executive Orders Directing the Management of Cultural Resources on Federal Properties

3.4.2.3.1 Executive Order 11593 (1971), Protection and Enhancement of the Cultural Environment

Executive Order (EO) 11593 requires federal agencies to direct their policies, plans, and programs in such a way that federally owned historic properties (as defined under 54 U.S.C. 306108) are preserved, restored, and maintained. EO 11593 obligates agencies to conduct adequate surveys to locate any and all sites of historic value on Federally owned or Federally controlled properties and provide for maintenance of, and future planning for, historic properties.

3.4.2.3.2 Executive Order 12072 (1978), Federal Space Management

EO 12072 requires all federal agencies that have a mission requirement to locate in an urban area to give first consideration to establishing federal facilities in central business areas, and/or adjacent areas of similar character, to use them to make downtowns attractive places to work, conserve existing resources, and encourage redevelopment. It also directs federal agencies to consider opportunities for providing cultural, educational, recreational, or commercial activities within the proposed facility.

3.4.2.3.3 Executive Order 13006 (1996), Locating Federal Facilities on Historic Properties in Our Nation's Central Cities (61 FR 26071)

EO 13006 requires all federal agencies that have a mission requirement to locate in an urban area to give first consideration to establishing Federal facilities in historic buildings and districts within central business areas. It also directs federal agencies to remove regulatory barriers, review their policies, and build new partnerships with the goal of enhancing participation in the National Historic Preservation program.

3.4.2.3.4 Executive Order 13007 (1996), Protection and Preservation of Native American Sacred Sites

EO 13007 was issued by President Clinton on May 24, 1996, directing federal agencies, to the extent practicable and allowed by law, to allow Native Americans to worship at sacred sites located on Federal property and to avoid adversely affecting the physical integrity of such sites.

3.4.2.3.5 Executive Order 13175 (2000), Consultation and Coordination with Indian Tribal Governments

EO 13175 was issued by President Clinton on November 6, 2000, directing federal agencies to coordinate and consult with Indian tribal governments whose interests might be directly and substantially affected by activities on federally administered lands.

3.4.2.3.6 Executive Order 13287 (2003), Preserve America

EO 13287 was issued by President G.W. Bush on March 3, 2003, directing federal agencies to actively advance the protection, enhancement, and contemporary use of the historic properties owned by the Federal government. It also encouraged agencies to establish partnerships with state, tribal, and local governments and the private sector to use these resources for economic development (e.g., tourism) and other public benefits.

3.4.3 Pre-existing Disturbances

The Project Area encompasses 140,859 acres and is completely within Sublette County, Wyoming, directly north of the Sweetwater County line and situated between U.S. Highway 191 to the east and the Green River to the west. State Highway 351 roughly bounds the northern portion of the Project Area. Pre-existing disturbances include earth moving activities that impact the integrity of cultural resources. Activities such as the construction and use of primary and secondary roads, fence lines, miscellaneous infrastructure, and utility installation and upkeep directly impact surface and subsurface deposits and increase soil erosion. These activities may have affected the integrity of both recorded and unrecorded resources by displacing artifacts and damaging features.

3.4.4 Cultural History

Human occupation near the Project Area can be traced back to the Paleo-Indian Period, at least 9695 years before present (BP). Unless otherwise noted, all information in the subsections below comes from the NPL Class I Existing Inventory Report (McKetta et al. 2011).

3.4.4.1 Early Prehistoric Period

3.4.4.1.1 Paleo-Indian Period (12000 BP to 8500 BP)

The Paleo-Indian Period is defined by tool technologies and subsistence strategies focused on large game hunting. A cool, wet climate and lush grasslands during this period supported an abundance of megafauna such as mammoth, camel, ancient bison (*Bison antiquus* or *Bison occidentalis*), and the North American horse. Game kill sites dating to the Paleo-Indian period have been identified in the Wyoming Basin, but are not as common as those found in the Northwest and in other regions. Three large kill sites in the Wyoming Basin include the Finley site (48SW05), the Pine Spring site (48SW101), and the Deadman Wash site (48SW1455), all of which are outside of the Project Area. However, the presence of these sites within the Wyoming Basin increases the likelihood of encountering these types of sites within the Project Area. The Finley site, near Eden, Wyoming, contained an ancient bison processing area and probable kill site. The site was radiocarbon dated to 9000 BP. The Pine Spring site is a stratified site containing an Agate Basin occupation dating to 9695 BP. This site included Agate Basin projectile point variants, Scottsbluff and Eden points, and a predominance of bighorn sheep bone. The Deadman Wash site, a stratified multicomponent site on stabilized sand dunes next to a spring, has yielded hafted knives and a Scottsbluff projectile point from its earliest levels. Radiocarbon dates place this site at approximately 8000 BP.

There are far fewer Paleo-Indian sites found in Wyoming than in other areas of the Northwest Plains. It is unclear whether this is due to poor site preservation or an actual difference in subsistence patterns and population sizes. One possibility is that a climatic trend of warming and drying during the Paleo-Indian period led to environmental changes in the basin area earlier than in the northwest region, which would have resulted in a lower availability of large game and a greater reliance on alternative food sources. The use of a wider range of subsistence strategies becomes more apparent during the Archaic period.

3.4.4.1.2 Archaic Period (8500 BP to 1800 BP)

The Archaic Period is marked by a change in subsistence strategies, whereby populations were less reliant on large game hunting and more reliant on generalized exploitation of plant foods and smaller animals. This change in subsistence is attributed to broad climatic shifts and decreased availability of large game. Fluctuating temperatures during this period increased seasonality. Populations reacted to climatic shifts by migrating seasonally to exploit resources across several ecological zones, including the basin interior, the foothills, and the mountains.

In the Wyoming Basin, the Archaic period is separated into two sub-periods: Early Archaic and Late Archaic. The two are defined by separate tool kits and subsistence strategies. A third, distinct subsistence strategy called the McKean Complex temporally overlaps both the Early and Late Archaic Periods.

Early Archaic sites have been identified within eolian deposits on stabilized dunes in the JIDPA northeast of the Project Area. The Early Archaic is divided into two phases: the Great Divide Phase and the Opal Phase. The Great Divide Phase of the Early Archaic dates to approximately 8500 BP to 6500 BP. During this Phase, subsistence strategies are transitional and contain Paleo-Indian elements. The Opal Phase of the Early Archaic dates from approximately 6500 BP to 4300 BP. Tool types include large side-notched and corner-notched projectile points and a side-notched lithic knife called the altithermal knife. More housepits are found during the Opal Phase than in the Great Divide Phase, and these housepits exhibit greater variation in size and internal features. Slab-lined hearths and ground stone implements for plant processing are also more numerous.

The Late Archaic, which extends from approximately 4300 BP to 1800 BP, has been divided temporally into two phases: the Pine Springs Phase and the Deadman Wash Phase. The subsistence pattern during the Late Archaic is similar to the Early Archaic, but with a higher reliance on bison.

Material culture associated with the Pine Springs Phase (4300 BP to 2800 BP) includes housepits and ground stone. Hearths with fire-cracked rock and midden dating to around 4180 BP have been excavated within the Wyoming Basin. Notably, the number of fire-cracked rock hearth features and ground stone artifacts dating to this phase decreased in frequency over time, possibly reflecting lower population density, a decrease in reliance on plant resources, and/or poor site preservation.

There are fewer sites associated with the Deadman Wash Phase (2800 BP to 1800 BP) than with the Pine Springs Phase. The hunting reflected in the faunal record indicates that there was an uptake in the exploitation of bison and pronghorn during this phase. Artifacts associated with this Phase include medium-sized, corner-notched projectile points, such as the Elko Point derived from the Great Basin and the Pelican Lake point derived from the Northwestern Plains.

3.4.4.1.3 McKean Complex (5000 BP to 2500 BP)

The McKean Complex temporally overlaps the end of the Early Archaic and the beginning of the Late Archaic. However, the subsistence strategies of the McKean complex are different than those seen in either Early or Late Archaic sites in the region. McKean Complex sites appear to represent an occasional presence of plains peoples in the Wyoming Basin. Their subsistence relied heavily on bison, and their sites can be identified by the presence of McKean complex projectile points.

3.4.4.2 Late Prehistoric Period (1800 BP to 250 BP)

Seasonal Late Prehistoric Period movement patterns remained similar to those of the Archaic period, but populations increased. The Late Prehistoric Period is divided temporally into two phases: the Uinta Phase and the Firehole Phase.

The Uinta Phase is marked by the appearance of large, semi-subterranean housepits designed for winter use and lightly constructed surface structures designed for warmer months. In addition to technological innovations in house design, Uinta Phase cultural material suggests interaction with outside groups; for example, projectile points and other artifacts common to the Uinta Phase are also typical to the Fremont cultural groups in the Great Basin. This interaction may have been the result of new groups entering the Wyoming Basin. The increased population within the Wyoming Basin during the Uinta Phase led to intensive exploitation of all resources. Plant exploitation increased, bison hunting intensified, and artifacts associated with fishing have been identified. The Stewart Flat site on Fremont Lake north of the Project Area has a Uinta Phase component that contains fish bones.

The Firehole Phase (650 BP to 250 BP) is distinguished from the Uinta Phase by a decrease in population and technological changes. Ethnographic data indicates that the Shoshone were established in the Wyoming Basin by the end of the Firehole Phase. Linguistic analysis suggests that the Shoshone, who spoke a variant of the Numic language, reached the Wyoming Basin sometime after 1000 BP. Archaeologically, the spread of the Numic language is referred to as the Numic Expansion and is accompanied by changes in material culture. The cultural materials identified as diagnostic of the Numic/Shoshonean occupation in the Wyoming Basin are Desert Side-notched (Tri-notched) and Cottonwood Triangular arrow points, Shoshone knives, Intermountain Ware and Skull Point Gray Wares, Steatite vessels and pipes, cribbed log structures, wickiups, conical log lodges, brush shelters, sheep/pronghorn traps, and rock art with the shield-bearing warrior image.

Thompson and Pastor (1995) caution against viewing the Firehole Phase as representing Shoshone/Numic peoples spreading into the Wyoming Basin and displacing the indigenous inhabitants. In hunter-gatherer societies, social systems are relatively open and fluid, with groups of people moving around frequently and interacting often with those groups around them. Additionally, a one-to-one relationship between ethnic groups and cultural materials cannot be assumed or definitively demonstrated in the Wyoming Basin archaeological record. Diffusion of cultural and technological ideas is suggested as the primary reason for the changes in Firehole Phase cultural materials. Regardless of the mechanism of the socio-cultural change that is reflected in the archaeological record, ethnographic information indicates that, by the end of the Late Prehistoric period, the only inhabitants of the Wyoming Basin were Numic speakers such as the Shoshone and, occasionally, the Ute Tribes.

3.4.4.3 Proto-historic Period (250 BP to 150 BP/AD 1700 to 1800)

The Proto-historic period begins with the introduction of European trade goods into the region and terminates with Europeans and European-Americans entering the region for the fur trade. The introduction of horses, iron, steel, copper, and glass goods in the material record distinguishes the Proto-historic period from the Firehole Phase.

The Shoshone occupied the Green River Valley in the Wyoming Basin during this period and made seasonal rounds throughout the basin interiors, plains, and mountains. The Shoshone in the Wyoming Basin exploited a large variety of animals including buffalo, elk, deer, pronghorn, rabbit, sage hen, trout, grayling, and whitefish. Plant resources included a wide variety of berries and edible roots with greens, leaves, honey plants, gilia, cinquefoil, and sunflower seeds. The limited available grass in the Wyoming Basin restricted the number of horses the Shoshone could maintain and prevented them from exploiting buffalo to the degree that plains peoples did.

3.4.4.4 Historic Period (AD 1800 to 1962)

The Euroamerican history of this area begins in October, 1812 when Robert Stuart, a returning Astorian passed through the region searching for a southern pass across the Rocky Mountains that was easier than the Montana route of Lewis and Clark a decade earlier. Stuart's journal describes his friendly encounter with Shoshone Indians with whom he traded for an old horse. These Native Americans were described as living in pine pole lodges in the vicinity of modern day Big Sandy (Rollins 1995). Stuart was following an "Indian travois trail" that he described as a road coursing along the foothills of the Wind River Range. It is probable that part of this trail was used in the 1830's when Captain L.E. Bonneville brought wagons to the 1832 (and later) Rendezvous. European and Euro-American presence in the region during the Historic Period was largely confined to trappers and fur traders. In 1832, Benjamin Bonneville built Fort Bonneville on the Green River and established an emigration route to cross South Pass. Other trails followed, including the Overland Trail, the Lander Road, the Oregon-California-Mormon Pioneer-Pony Express Trail (Emigrant Trail), the Cherokee Trail, and the Sublette Cutoff.

The Sublette Cutoff (48SW1841), established by William Sublette in 1832 (Map 8), passed east-west outside of the southern edge of the Project Area. The Sublette Cutoff was a variant of the California NHT that led from "the parting of the ways" to Fort Hall and was the shortest and quickest route to the Green River, crossing 45 miles of the Little Colorado Desert between the Big Sandy and Green Rivers. The North Sublette Meadow Spring Variant of the Sublette Cutoff crosses through the southern half of the Project Area (Map 8) and has been noted in several sources, including the AD1896 BLM General Land Office (GLO) Plat Map. The North Sublette Meadow Spring Variant has been recorded and evaluated (Bartlett 2012) and is considered eligible for listing in the NRHP. The variant leads from the Sublette Cutoff north into the Project Area to North Sublette Meadow Spring (Map 8). This spring was used historically by emigrants traveling along the Sublette Cutoff.

Shoshonean populations were devastated by disease introduced by European migration and their territory and resources were under extreme pressure during the Historic Period. In 1868, the Wind River Indian Reservation was established and the Shoshone settled in the Wind River Basin, to the north of the GRB. This ended the aboriginal occupation in the GRB that had maintained a stable subsistence strategy based on a pattern of seasonal rounds that lasted for over 8,000 years.

By the 1850s stagecoaches were operating along many of the trails passing through the Wyoming Basin, and in 1860 the Pony Express began making mail runs through the region. The first transcontinental telegraph was completed in 1861. The Union Pacific Railroad, as part of the transcontinental railroad, laid tracks through Wyoming in 1867 to 1869; these railroad tracks passed through the southern portion of the Wyoming Basin and did not traverse the Project Area. However, the arrival of the railroad did promulgate the first wave of settlement by U.S. citizens in the region. Throughout the Territorial Era, Wyoming's population grew to such an extent that it was granted statehood in 1890.

The railroad also brought coal mining and ranching to the region. Collectively, livestock associations aided in alleviating livestock pressure on rangeland by instituting a new, coordinated effort of seasonally drifting cattle through the UGRB. This practice, known as the Green River Drift (48SU7311/48SU7312), occurred along the Upper Green River north of the Project Area (Map 8).

3.4.4.5 Contemporary Native American Culture

The Project Area was used historically by several Native American groups, and limited use continues at present. The federally recognized Tribes that are recorded to have used the Project Area include the Eastern Shoshone Tribe of the Wind River Reservation, the Northern Arapaho Tribe of the Wind River Reservation, the Ute Tribe of the Uintah and Ouray Reservation, and the Shoshone Bannock Tribe. Historic and current land use by these Native American groups is visible through the presence of culturally sensitive sites. Within the Project Area, four sites have been previously identified as culturally sensitive by the Eastern Shoshone Tribe or the Ute Tribe of the Uintah and Ouray Reservation (Molenaar and Pulsipher 2011).

3.4.5 Known Cultural Resources in the Analysis Area

3.4.5.1 Cultural Resources Records Searches

In July 2011, Cultural Resources Analysts, Inc. (CRA) prepared a review of known cultural resources within the Project Area (McKetta et al. 2011). The review included records searches at the BLM PFO, the BLM RSFO, and the Wyoming State Historic Preservation Office. Results of the records searches indicate that 283 previous cultural resource studies have been conducted within the Project Area and 674 archaeological sites and 544 isolates have been previously identified and recorded. Results of these records searches also indicate that approximately 12.2 percent of the Project Area has been subject to Class III cultural resources inventories that meet current BLM survey standards (McKetta et al. 2011). The highest density of survey coverage is centered along the Project Area Boundary adjacent to the JIDPA, where there are large areas of 100 percent survey coverage. Areas not previously surveyed are mostly located on the west side and southeast corner of the Project Area.

Of the 674 archaeological sites identified, 661 site records were obtained and analyzed. No information regarding the other 12 sites was located. Of the 661 sites, 598 are prehistoric, 11 are historic, and 52 have both historic and prehistoric components. Of the isolates, 509 are prehistoric, 33 are historic, and two have both historic and prehistoric components. Additionally, a Class III cultural resources inventory was completed for the North Sublette Meadow Spring Variant of the Sublette Cutoff, raising the number of identified cultural resources in the Project Area to 662.

In 2009 and 2010 Class III cultural resource inventories were conducted on 640 acres of the western portion of the Teakettle Dune Field (SWCA 2010). The inventory identified 6 previously recorded sites, 39 newly recorded sites, and 11 isolated cultural resources. All 45 cultural sites were recommended as eligible for the NRHP and none of the 11 isolated cultural resources were eligible for the NRHP. Refer to Section 3.4.5.2.1 (*Teakettle Dune Field*) for more information on this area.

As depicted in Table 3-18, 169 sites are recommended or determined eligible for inclusion in the NRHP. Of the 169 sites, 64 have been determined eligible by the BLM with SHPO concurrence and 105 are recommended eligible with no SHPO or agency concurrence, 280 sites have been recommended or determined not eligible, 104 are documented as "needs data," and 159 have not been evaluated for NRHP eligibility.

Table 3-18. Eligibility Status of Known Cultural Sites in the Project Area

Eligibility	Count	Total
Eligible with SHPO Concurrence	64	169
Recommended Eligible	105	
Not Eligible with SHPO Concurrence	194	280
Recommended Not Eligible	86	
Needs Data with SHPO Concurrence	102	104
Recommended Needs Data and Unevaluated	161	

Source: McKetta et al. 2011; SWCA 2010.

SHPO State Historic Preservation Officer

No sheltered sites or structural sites have been located to date in the analysis area. Few cultural resource surveys have been conducted in this area, and future surveys in this area have the potential to encounter sheltered sites.

No rock art sites have been identified in the analysis area to date, but one rock art site has been identified less than one mile from the analysis area boundary near Alkali Creek.

Due to the limited extent of previous cultural resource surveys in the Project Area, it is not possible to predict the extent of cultural resources in the analysis area. Cultural resource surveys would be conducted at the site-specific level during APD permitting. The historic land use of the analysis area played a significant role in the history of the American west, leaving telling evidence of European-American emigrant trails, early roads, ranching, and shepherding. While only four of the 64 known historic period sites consist of features extending beyond scattered artifacts as part of multicomponent sites, one historic period site—the North Sublette Meadow Spring Variant of the Sublette Cutoff—is eligible for listing on the NRHP. Additional Class III inventory of the analysis area will likely result in the recordation of additional historic period sites.

3.4.5.2 Significant Sites

Several prehistoric archaeological sites within the Project Area are especially significant or have the potential to be eligible for inclusion in the NRHP and may require special or additional protection and management. These sites contain unusual data or large quantities of features or artifacts, or may contain significant or extensive intact, buried cultural deposits.

This does not imply that these resources are the only sites in the Project Area that may require special consideration as less than 13 percent of the Project Area has been surveyed for cultural resources. Other sites in the area likely contain significant cultural material that is not demonstrated in the previous recordings and may be identified during site-specific surveys prior to development. In addition, special consideration should be given to the management of the 64 sites in the analysis area that are officially eligible for inclusion in the NRHP. Though not discussed herein, the management and protection of officially eligible sites is essential. Another 105 sites that may be of archaeological concern are recommended eligible for NRHP nomination. There are 161 sites that are documented as “needs data or unevaluated”; these sites require additional recordation and research to determine their significance and/or eligibility. Two notable resources, the North Sublette Meadow Spring Variant of the Sublette Cutoff and the Teakettle Dune Field occur in the Project Area (Map 8) and are described below. Two other notable resources, the Lander Cutoff of the Oregon and California NHTs and the Green River Drift are located north of the Project Area (Map 8), and are also described below.

3.4.5.2.1 Teakettle Dune Field

The Teakettle Dune Field is an approximate 4,000 acre dune field along the BLM PFO and RSFO boundary in the eastern portion of the Project Area that BLM archaeologists have identified as having a dense occurrence of prehistoric archaeological sites and features, notably camps and lithic scatters in eolian deposits. The extent of the dune field and corresponding archaeological materials have presented an appearance and consistency suggestive of an archaeological district (SWCA 2010). Geophysical exploration of areas surrounding hydrocarbon mineral prospects led to the identification of the Teakettle Dune Field as an extensive archaeological area, and planning for development of the NPL Project led to investigation of the Teakettle Dune Field as an archaeological district.

The Teakettle Dune Field is composed of a series of dune hummocks and swales. Dune hummocks, particularly in the western, upwind portion of the Teakettle Dune Field, are stabilized by vegetation and reworked primarily by alluvial erosion. Archeological materials are most likely to be exposed in localized blowouts, de-vegetated surfaces, and eroding margins that are most common in the eastern portion of the dune field; however, stable, inactive portions of the dune field could be reactivated by vegetation removal and soil disturbance (Drucker 2015). The occurrence of prehistoric material across this area is dense averaging 1 cultural site or isolate per every 11 acres. Hearths or fire-altered rock are present at all but three (6 percent) of the sites.

The depositional environment and the range of cultural material in the Teakettle Dune Field have the potential to support buried archaeological strata of a sufficient abundance and diversity for research directed at exploring how this dune environment was being used and why the area was selected during certain periods in time (SWCA 2010). In 2009 and 2010, a Class III cultural resource inventory was conducted on 640 acres of the western portion of the Teakettle Dune Field (SWCA 2010). The inventory identified 6 previously recorded sites, 39 newly recorded sites, and 11 isolated cultural resources. All 45 cultural sites were recommended as eligible for the NRHP and none of the 11 isolated cultural resources were eligible for the NRHP. Most sites contain primarily prehistoric cultural material affiliated with the middle Paleoindian (Cody) to Late Prehistoric (Firehole) periods. The dunes retain cultural material reflecting multiple activity occupations indicative of extended and/or repeatedly occupied camps.

Previous inventories have identified 24 previously recorded archaeological and historic sites within the vicinity of the Teakettle Dune Field. Of the 24 sites, 20 exhibit either habitation or hearth characteristics. Of these sites, 19 sites have been classified during previous recordings as open camp sites. Of the total 24 sites, two were previously agency-determined eligible for NRHP nomination, and two are field-recommended eligible. Five are agency-determined not eligible, one is field-recommended not eligible for NRHP nomination, and 14 are of unevaluated status. All except one of the sites are prehistoric, while the exception contains both a prehistoric component and an historic debris scatter (SWCA 2010).

The source of sand in the Teakettle Dune Field has not been well studied; however, research on the source of sand in the Killpecker Dune Field (Ahlbrandt 1974), located approximately 20 miles south of the NPL Project Area, may provide some insight on the source of sand in the Teakettle Dune Field. Several lines of evidence indicate that the source of sand in the Killpecker Dune Field is the Laney Member of the Green River Formation (Ahlbrandt 1974). The Laney Member of the Green River Formation is widespread in the area surrounding the Teakettle Dune Field (Map 9); however, more research would be needed to confirm the Laney Member as the source of sand in the Teakettle Dune Field.

3.4.5.2.2 The North Sublette Meadow Spring Variant of the Sublette Cutoff

The Sublette Cutoff, a branch of the California NHT, travels in an approximate east-west direction directly south of the southern boundary of the Project Area, just below the Sublette/Sweetwater county line (Map 8). The Sublette Cutoff was one of the earliest shortcuts for the Oregon and California Trails and provided an east-west connection between South Pass and Bear River, avoiding the southern loop of the Trails to Fort Bridger and saving approximately 70 miles or about three days travel time (BLM 2012b). The North Sublette Meadow Spring Variant, a variant of the Sublette Cutoff, runs east-west through the southern portion of the Project Area en route to and from North Sublette Meadow Spring (Juel Spring), which is immediately adjacent to the southeastern boundary of the Project Area (Map 8). The North Sublette Meadow Spring Variant is eligible for listing in the NRHP. Additional historic resources associated with travel on the California NHT may be found in association with this variant. Refer to Section 3.16 (*Special Designations*) for more information on the Sublette Cutoff.

BLM Manual 6280 (*Management Of National Scenic And Historic Trails And Trails Under Study Or Recommended As Suitable For Congressional Designation*) requires a viewshed analysis and a trail inventory to be conducted as part of the EIS process if a trail management corridor has not been established in the BLM RMP. In accordance with the 6280 manual, the BLM conducted a viewshed analysis that is depicted on Map 8 and is used in the impacts analysis in Chapter 4 (*Environmental Consequences*). The BLM also conducted a Class III Cultural Resource inventory and assessment for the North Sublette Meadow Spring Variant (Bartlett 2012) which identified and recorded remnants for the trail, described the existing environment associated with the trail, a description of historic and current uses, a description of the historic and cultural setting of the trail, and management recommendations. Per the notification requirements in Section 5.C in the BLM Manual 6280, the BLM notified appropriate parties and invited parties to participate in the Programmatic Agreement (PA) process. Based on uncertainty in the level of delineation and development in the NHT area, and thus uncertainty as to the level and amount of adverse impacts to NHTs, it would be difficult to determine an appropriate amount of mitigation at this point in the process. As a result, the PA group decided to not proceed with developing a PA as part of the NPL Project EIS process, but to develop a mitigation measure, with consulting party input, and include the mitigation in Chapter 4 Cultural Resource section. Refer to Section 5.3.1.1 (*Programmatic Agreement for the Sublette Cutoff of the California NHT and the North Sublette Meadow Spring Variant of the Sublette Cutoff*) for more information on the PA and results.

3.4.5.2.3 Lander Cutoff of the Oregon and California National Historic Trail

The Lander Cutoff, a branch of the Oregon and California NHTs, stretches from South Pass, Wyoming to Fort Hall, Idaho, travelling in an east-west direction approximately six miles north of Project Area at its closest point, just north of Highway 351 (Map 8). The Lander Cutoff was the first congressionally funded road west of the Mississippi and was used by wagon trains as a cutoff from the Oregon Trail to the California gold fields (BLM 2008a). After 1860, emigrant traffic on the Sublette Cutoff shifted to the Lander Cutoff, which featured plentiful water and grass, more timber and fuel, and river crossings that did not require ferries (McKetta et al. 2011). The Lander Cutoff is used by recreationists and other visitors that are interested in touring historic features (BLM 2008a) and participating in backcountry recreational opportunities. Along the Lander Cutoff, recreational and interpretive sites inform visitors about the fur trapping era, western explorers, and area settlement (BLM 2008a).

3.4.5.2.4 Green River Drift

The Green River Drift trail was listed on the NRHP as a Traditional Cultural Property in November of 2013 due to its cultural significance in the Green River Ranch History. The Green River Drift is a linear corridor that generally follows the upper Green River and crosses the BLM Pinedale Field Office and Bridger Teton National Forest. The Green River Drift is located approximately 5 miles from the boundary of the Project Area at its closest point (Map 8).

3.4.6 Threats to Resources

The Project Area contains both significant and non-significant sites that may be directly and/or indirectly impacted by this development. There are four major threats to cultural resources in the Project Area:

future energy development, illegal artifact collection and vandalism, improper livestock grazing, and environmental factors.

There is high potential for planned oil and gas development to adversely impact sites in the Project Area. The construction of well pads, access roads, and pipelines all involve surface- and subsurface-disturbing activities. The high site density of the Project Area indicates that significant and non-significant sites may be impacted by this development. As exemplified by development of the adjacent JIDPA, buried sites are common and discovery situations are likely without thorough up-front investigations. A secondary impact of oil and gas development on cultural resources is public and company personnel use of the roads created in support of development for the purposes of illegal artifact collection and site vandalism. Many archaeological sites are known to the public, and illegal artifact collection is still a common activity in many areas. This becomes more prevalent as roads are created into areas that previously had less access. Environmental factors also impact sites. Many parts of the Project Area have eolian deposits, such as the Teakettle Dune Field, or other unstable soils that are easily eroded by wind and water.

3.4.7 Native American Consultation

The United States has a special legal relationship with Indian tribal governments, as set forth in the U.S. Constitution, treaties, statutes, regulations, Executive Orders, and court decisions. In recognition of this unique relationship, the BLM consults with tribes on a government-to-government basis regarding NHPA, NEPA, treaty rights, sacred sites, and broader Trust responsibilities. In April of 2011, the BLM mailed tribal consultation letters to potentially affected tribes, formally initiating government-to-government consultation regarding the NPL Project. The tribal consultation letters provided an overview of the NPL Project; requested consultation and invited input on the NPL Project; provided contact information to submit any questions, concerns, or comments on the NPL Project; and offered the opportunity for a project site visit. Subsequent to mailing the tribal consultation letters, BLM cultural resource specialists followed up with tribes through telephone calls to establish contact and offer meetings with the BLM to discuss the NPL Project. The BLM contacted the following tribes through mailing consultation letters and subsequent phone calls:

- Eastern Shoshone Tribe
- Northern Arapaho Tribe
- Shoshone-Bannock Tribes of Fort Hall
- Ute Tribe of the Uinta and Ouray Reservation

During EIS development, the BLM also invited tribes to participate in the alternatives development workshops, the cumulative effects workshop, and the preferred alternative workshop. Consultations with tribes that have an interest in the NPL Project is ongoing throughout the EIS process, consistent with applicable regulation and guidance, including the NHPA. Consultations with the Wyoming SHPO pursuant to compliance with the NHPA were also coordinated with tribal consultation, as appropriate.

3.5 Wildland Fire and Fuels Management

3.5.1 Overview

The Project Area lies within the Mesa South Desert Fire Management Unit (FMU) in the BLM PFO and the Big Sandy and Steamboat Mountain FMU in the BLM RSFO, as identified in the High Desert District

Fire Management Plan (FMP) (BLM 2011c). Wildland fire response management is coordinated across jurisdictional boundaries through FMPs, which assist in developing the appropriate response to wildland fires to meet the BLM's Resource Management Plan (RMP) objectives in designated FMUs. The BLM's management focus in the Project Area is on fire prevention, fire suppression, and fuel reduction through suitable means.

Wildland fire frequency in the vicinity of the Project Area is low, with the risk of fire increasing during dry seasons and times of prolonged drought. Human activity has altered the fire regime in many vegetation communities throughout the West, increasing wildland fire frequency and/or intensity in many areas, though this trend has not been documented in the Project Area or its vicinity.

The analysis area for fire and fuels is the Project Area.

3.5.2 Laws, Ordinances, Regulations, and Standards

Title 1 of the Healthy Forest Restoration Act of 2003 requires identification and mapping of the fire regimes and fire regime condition classes on BLM-administered lands at risk of wildfire and insect or disease epidemics. A *fire regime* is defined as the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (DOI et al. 2010). The five natural fire regime groups are classified based on the average number of years between fires (fire frequency or mean fire interval), combined with characteristic fire severity reflecting percent replacement of dominant overstory vegetation (BLM 2011c). Fire regime group II includes shrub communities that experience a fire return interval of 0 to 35 years at a stand-replacement severity. Fire regime group III consists of the shrubland and mixed conifer communities that have a fire return interval of 35 to 100+ years and experience mixed-severity fires (BLM 2011c). The Fire Regime Group (FRG) system classifies existing ecosystem conditions to determine priority areas for treatment. This system provides a measure of the existing vegetation community's degree of departure from the historic fire regime. Area-specific FRG classification has not been completed in the Project Area.

In December 2014, the DOI released Policy Memorandum 2014-005 establishing DOI wildland fire management planning guidance as it relates to Fire Management Plans (FMPs) (DOI 2014). This framework clarifies direction for fire management planning and provides a format for fire management plans that reflects the future direction of DOI fire planning, which includes coordination across administrative boundaries.

3.5.3 Fire Ecology

Fire ecology is the study of the ecological and historical role of fire and its effects on the environment, ecosystems, animals, and vegetation communities (USFWS 2012a). Occurring within the Wyoming Basin ecoregion on hilly rolling plains, mesas, plateaus, valley bottoms, and benches, the sagebrush-steppe vegetation community is the predominant vegetation community throughout the Project Area (Chapman et al. 2004). Most of the Project Area comprises a mix of Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*) and sagebrush-steppe vegetation, which includes mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), rabbitbrush (*Chrysothamnus* spp.), winterfat (*Krascheninnikovia lanata*), snowberry (*Symphoricarpos occidentalis*), and antelope bitterbrush (*Purshia tridentata*). Refer to Section 3.18 (*Vegetation*) for more information.

Sagebrush covers most of the Project Area and has a natural fire regime of stand-replacing or mixed fire severity (FRG II and III). The historical fire return interval for Wyoming big sagebrush is 10 to 70 years (Howard 1999). However, uncertainty persists around the nature of historical fire patterns in sagebrush communities, particularly in Wyoming big sagebrush, and a high degree of variability in fire frequency has likely occurred (Zouhar et al. 2008; Baker 2006). Depending on the species of sagebrush and other site-specific characteristics, fire return intervals from 10 to over 300 years have been reported (Zouhar et al. 2008). In general, fire events substantially reduce sagebrush cover, and some varieties of sagebrush, including Wyoming big sagebrush, can take up to 150 years to reestablish (Braun 1998; Baker 2006).

Much of the sagebrush habitat throughout the West has been lost or modified during the past several decades as a result of altered fire regimes, conversion to agricultural and urban uses, improper grazing, and the encroachment of weeds and woody species such as juniper and Douglas-fir (BLM 2007b). European settlement and impacts in sagebrush-dominated regions brought about changes in many of these areas, including an increase in sagebrush density, introduction of nonnative species such as cheatgrass, and reduced numbers of certain native grasses and forbs (Tisdale and Hironaka 1981). Cheatgrass, a nonnative species that dominates many Wyoming big sagebrush communities throughout the West, enhances the likelihood of fire ignition and spread and has altered the fire regime in Wyoming big sagebrush communities that it has invaded (Howard 1999). Wildland fires in sagebrush communities have increased in number and intensity compared with historical levels in some parts of the West, but this has not been a particular issue identified in the BLM PFO (BLM 2008a).

3.5.4 Fire Management

The majority of the Project Area in the BLM PFO is within the Mesa South Desert FMU. The fire management objectives of this FMU are to "improve forage availability in the uplands, to maintain or improve wildlife habitat and livestock forage, to sustain aspen communities by reducing conifer and sagebrush encroachment, to protect cultural resources, to limit hazardous fuels in and around the wildland urban interface, to protect and manage for wilderness characteristics and values where appropriate, and to return to a natural fire regime" (BLM 2011c). Part of the Project Area in the RSFO is within the Big Sandy and Steamboat Mountain FMU. The fire management objectives for this FMU are to reduce conifer and sagebrush encroachment into aspen and mountain shrub communities, improve habitat for big game and Sage-Grouse, maintain or enhance habitat for special status species, improve forage for livestock and wild horses, and protect public and private priority by reducing hazardous fuels near urban and industrial interface areas (BLM 2011c).

BLM fire management practices include suppression, using wildland fires for resource benefit, prescribed fire, and mechanical and chemical fuels reduction efforts to manage vegetation and fuels. Response to wildland fires can range from immediate full initial attack suppression to monitoring a fire's progress, as documented in the FMP. The BLM uses specific criteria to determine when an unplanned ignition is managed to meet resource objectives or when it becomes a wildland fire suppression situation.

As indicated in the BLM PFO Approved RMP and ROD, the Project Area lies in an industrial interface area (BLM 2008a). The focus in these types of areas is on fuel reduction, fire prevention, and fire suppression (BLM 2008a). In the wildland industrial interface, the BLM uses fuels reduction methods best suited to the area to reduce the risk of catastrophic fire to these areas (BLM 2008a). The focus on fire management in the RSFO is also on appropriate response to wildland fires, including suppression when human health and safety or structural property is threatened (BLM 1997a).

3.5.5 Fire History near the Project Area

Wildfire hazard varies depending on the vegetative community, seasonal drought conditions, and plant growth stages in these fuel types. From 1999 to 2008, approximately five fires occurred within the Mesa South Desert FMU, accounting for a total of 5.4 acres. Most fires are lightning-caused, with ignitions also resulting from recreational users and industrial operations. Fire is more common in the Big Sandy and Steamboat Mountain FMU, with 59 fires totaling approximately 4,331 acres having occurred from 1998 through 2008, the majority from lightning strikes but also possibly from recreational users and industrial operations (BLM 2011c).

3.5.6 Wildfire Hazards

Potential wildfire hazards from the NPL Project would be low to moderate throughout most of the year, but could have the potential to be high or extreme at times. Fire danger is likely to be higher during the summer months, but would also depend on vegetation and climatic conditions. During the spring, grasses, sagebrush, and other brush species have high fuel moistures and are relatively resistant to ignition and fire spread. Later in the season when grasses are cured and during years of drought conditions, the risk that a fire will ignite and grow is much greater. Weather and topography also play a significant role, as low relative humidity, high winds, and steep slopes can cause a fire to spread at a fast rate once ignited.

Communities most at risk of wildfires in the vicinity of the Project Area are primarily associated with the towns of Big Piney and Marbleton, as well as locations and facilities along the Green River.

3.6 Geology and Mineral Resources

3.6.1 Overview

The Project Area is surrounded by extensive basin areas that are flanked by mountain ranges on all sides. The Project Area has some potential for seismic activity, although substantially less than the more geologically active areas to the west. The primary mineral occurrence and development potential within the Project Area is associated with natural gas and aggregates. The analysis area for geology and mineral resources is the Project Area.

3.6.2 Laws, Ordinances, Regulations, and Standards

Refer to Section 1.6 (*Regulatory Setting*) for Laws, Ordinances, Regulations, and Standards (LORS) applicable to mineral resources and their extraction.

3.6.3 Local Geology

3.6.3.1 Regional Setting

The Project Area is in the Greater GRB, a watershed bounded on the northeast by the Wind River Uplift and Sweetwater Uplift, to the east by the Rawlins Uplift and Sierra Madre-Park Uplift, to the south by the Uinta Uplift, and to the west by the Overthrust Belt. The structural GRB is a smaller basin that resides within the Greater GRB. The GRB was formed during the Laramide and Sevier orogenies, when regional compressive stresses folded and faulted the Precambrian basement. This folding and faulting created both subsidence and uplift, forming the surrounding structural basins and mountain ranges. The uplifted areas were then eroded, and those sediments were deposited in the newly formed structural basins. Since the Eocene and end of the Laramide Orogeny, the GRB and its sediments have experienced minimal faulting, volcanism, and/or erosion (Geomatrix 2008).

3.6.3.2 Surficial Geology

This section describes the depositional processes and characteristics of sediments and landforms that overlie bedrock formations in the Project Area. Alluvial, eolian, and slope are the three dominant depositional geomorphic processes operating in the Project Area (Taddie et al. 2011). Approximately 76 percent of the surficial geology within the Project Area is dominated by residuum and is characterized by relatively broad and flat upland surfaces and relatively steep slopes in areas of badland development. The upland surfaces are relatively old, with surficial mapping units comprising bedrock, regolith, and residuum. Areas dominated by slopewash comprise approximately 12 percent of the surficial geology in the Project Area. Locations of significant slopewash accumulation include colluvial aprons occurring at the base of relatively steep slopes, as well as alluvial fans. Accumulation is most common along the margins of low order drainages, but also occurs locally in upland settings (Taddie et al. 2011).

Surficial mapping units dominated by eolian sand comprise approximately 10 percent of the Project Area. An area of eolian sand is present in the southeastern part of the Project Area, occurring as both dunes and sheets. Localized eolian deposition is also common on older upland surfaces in areas dominated by residuum and bedrock. Areas mapped as being dominated by alluvium make up only approximately 3 percent of the Project Area. Alluvium accumulation generally occurs in areas of relatively low order ephemeral and intermittent streams, mostly situated along the northern and western margin of the Project Area adjacent to the Green River, and include Alkali Creek, North Alkali Draw, Granite Wash, and their tributaries.

3.6.3.3 Bedrock Geology

In 2011, a field survey was conducted within and adjacent to the Project Area to identify bedrock geological formations present in the area and their relationships (Winterfeld 2011). Based on the results of the field survey, bedrock geological formations with exposures in the Project Area include, with general certainty, the Wasatch Formation and the Laney Member of the Green River Formation, which are both associated with the Early Eocene age. Outcrops that may belong to the Bridger Formation were mapped in the southern parts of the Project Area. The outcrops are likely associated with the Bridger Formation because they lie stratigraphically above the outcrops of the Laney Member. While the outcrops could possibly be rocks of a younger tongue of the Wasatch Formation, both Bradley (1964) and Roehler (1991a-b, 1992a-c, 1993) observed similar exposures of the Bridger Formation in the southern parts of the Project Area, and in a similar stratigraphic position east of U.S. Highway 187. The distribution of the Wasatch, Green River, and Bridger formations are depicted on Map 9. Refer to the NPL *Geological and Paleontological Resources Technical Memorandum* for additional information on previous geological mapping in the Project Area and methods and results of bedrock mapping for the Project Area (Winterfeld 2011).

In comparison to nearby fields, such as the JIDPA, that have experienced extensive oil and gas development, less is known about the depth and distribution of geologic formations underlying the NPL Project Area. Figure 3-16 shows a general stratigraphic profile of the Greater GRB. Figure 3-17 shows a geologic cross-section of the three primary zones of interest in the Project Area; the depth and thickness of these formations were interpreted from geophysical logs, driller's logs, and local knowledge.

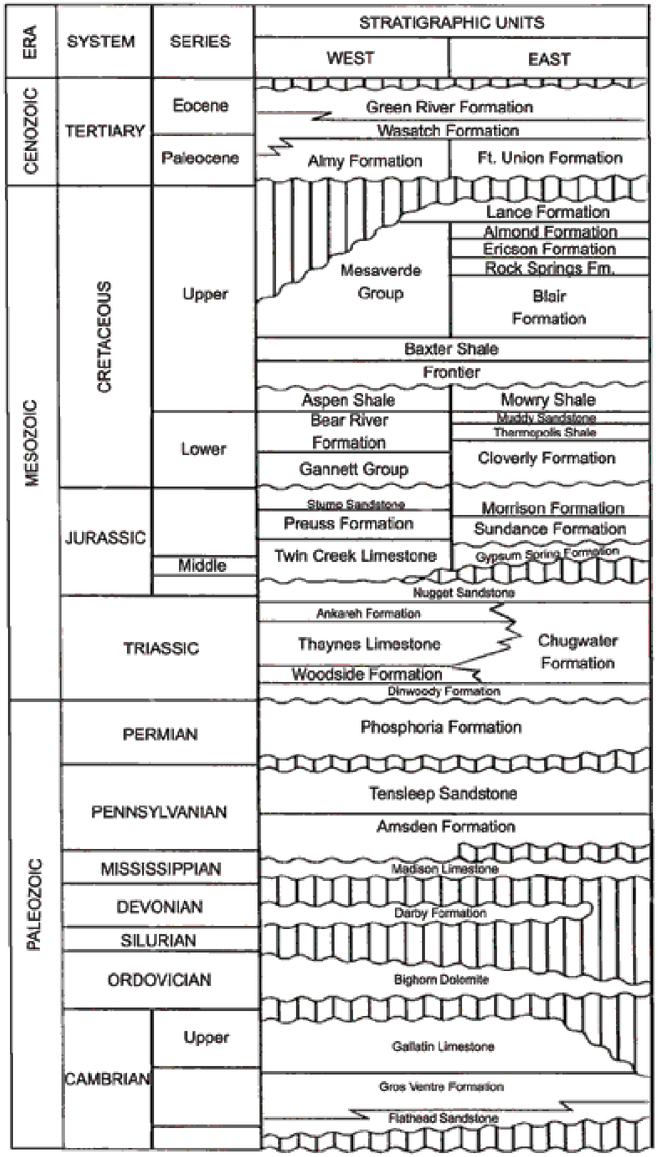
The geologic formations described below, from youngest (shallowest) to oldest (deepest), are known to bear oil and gas or other minerals of interest, are likely to be encountered by wellbores associated with the Proposed Action, or have been identified as potential target injection zone. Section 3.20 (*Water Resources*) contains additional details on the water-bearing properties of formations in the Project Area, while Section 3.6.5 (*Mineral Resources*) provides additional information on mineral occurrence and development potential.

- **Bridger Formation**—Although the Bridger Formation has not been previously mapped in the Project Area, small outcrops or volcanic rich rocks that lie topographically and stratigraphically above rocks of the Laney Member may belong to the formation. These outcrops, scattered throughout the southern and eastern regions of the Project Area, previously connected southward with more expansive exposures of the Bridger Formation in the Blue Forest area north of the Green River.
- **Green River Formation**—The Green River Formation within the Project Area includes only rocks of the Laney Member (Tgl), which is the most widespread unit exposed in the area. Exposures are generally poor, with the rocks of this member forming extensive and heavily vegetated flats. Oil shale beds are found in the LaClede Bed of the Laney Member (Johnson et al. 2011). These units were deposited as sediments in and around Lake Gosiute, which covered much of southwestern Wyoming during the Eocene (BLM 2012i). Thicker deposits are likely to occur in the more central areas of the Greater GRB (Winterfeld 2011).
- **Wasatch Formation**—Rocks of the Wasatch Formation are restricted chiefly to the northernmost, westernmost, and easternmost parts of the Project Area. Exposures of the formation form the flanks of bluffs in these areas. Within the Project Area, the Wasatch Formation is composed of two distinctive units: a lower unit, the Alkali Creek Member (Twa); and an upper unit, an unnamed variegated (variably colored) member (Twu). The Wasatch Formation is dominated by sandstones, conglomerates, carbonaceous shales, and coal (BLM 2012i), and is similar in composition to the underlying Fort Union Formation. These two formations are considered a continuous aquifer due to the absence of a confining unit between them (Martin 1996). The Wasatch Formation ranges in thickness from approximately 3,300 feet at the south end of the cross section to approximately 4,200 feet in the JIDPA (Figure 3-17). The sandstone layers in the JIDPA at depths of less than 1,000 feet are the source of fresh water for drilling and completion operations. These same zones are also proposed as water sources for the NPL Project.
- **Fort Union Formation**—The Paleocene age Fort Union Formation lies above the Lance and is approximately 4,000 feet thick in the Project Area. The Fort Union Formation is composed predominantly of fluvial sandstones, sandy shales, and siltstones interbedded with channel sands, lignite, and coal. The lower 2/3 of the upper Fort Union Formation contains abundant porous sandstones with high permeability, which are currently used in the JIDPA for disposal of produced water. The well logs in the Project Area show the upper Fort Union consists of a series of shales, silts, and sands with a composite thickness of approximately 1,000 feet. Although a common coal-bearing formation, the Fort Union lacks abundant coal in this area of the GRB (ENSR and Booz Allen and Hamilton 2003).
- **Lance Formation**—The Lance Pool, comprising the Lance Formation and the upper portions of the Mesaverde Group, is the primary target for gas production for the Proposed Action. The

total depth of the Lance Pool and other potentially productive formations that may be identified during exploration and testing range from about 6,500 feet to 13,500 feet. The late Cretaceous Lance Formation underlies the Fort Union Formation and rests on top of the Fox Hills Formation and the Mesaverde Group (BLM 2012i). This formation consists of brown and gray sandstone and shale beds interbedded with thin coal and carbonaceous shale beds. The top of the Lance formation becomes deeper to the north and the target gas producing interval also thickens to the north. The Lance is estimated to be approximately 2,500 feet thick (Warner 2000).

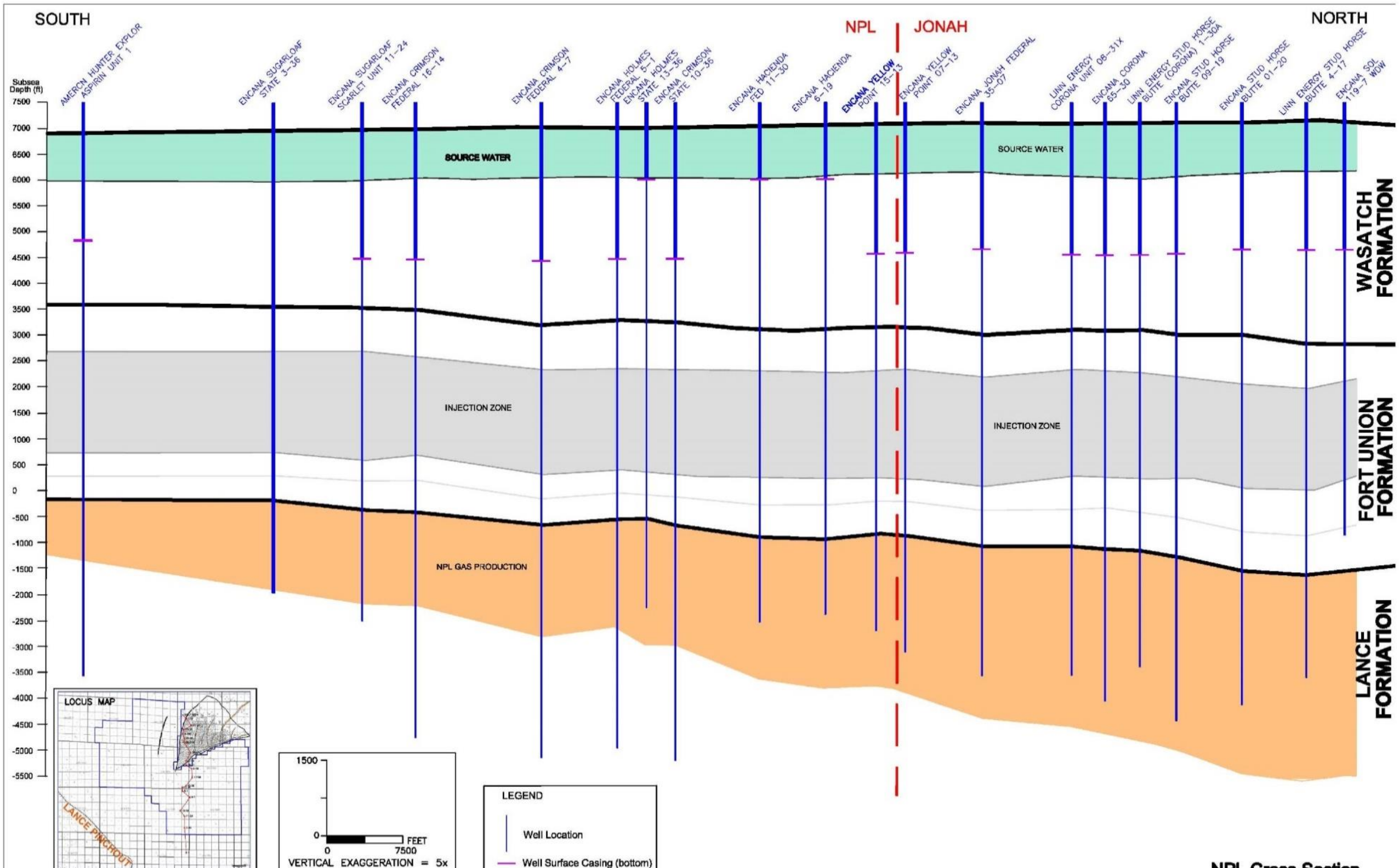
- **Mesaverde Group**—In the Greater GRB, the Mesaverde Group consists of Upper Cretaceous sandstone, carbonaceous shale, and coal (USGS 2012). Coal deposits are likely limited to the Mesaverde Group (ENSR and Booz Allen and Hamilton 2003), which includes the Almond, Ericson, Rock Springs, and Blair formations. Gas production has been reported from the Mesaverde Group in the Project Area.

Figure 3-16. Stratigraphic Profile of the Green River Basin



Source: ENSR and Booz Allen and Hamilton 2003.

Figure 3-17. South-North Geologic Cross Section through the NPL Project Area



Source: Modified from "Encana S–N Cross Section by DP DuBois", 2013

3.6.4 Geologic Hazards

3.6.4.1 Earthquakes and Active Faults

All of Wyoming is seismically active, and the western quarter of the state is more active than the eastern three quarters (Case 1997). An earthquake in the Project Area could have an estimated peak acceleration of 16 to 20 percent gravity at an estimated 2,500-year recurrence interval (2 percent probability of exceedance in 50 years) (Case 2000). Earthquakes with an acceleration of 16 to 18 percent gravity are equivalent to earthquakes with intensities of VI to VII on the modified Mercalli scale. Intensity VI earthquakes typically result in slight damage to structures, including fallen plaster and chimney damage, and may move some heavy furniture. Intensity VII earthquakes cause negligible to slight damage in well-designed buildings, slight to considerable damage in ordinary structures, and considerable to great damage in poorly built structures. In the western quarter of Wyoming, an intensity V earthquake (windows broken, plaster cracked, objects overturned) can be expected to occur about every 1.5 years (Case 1997). In contrast to the modified Mercalli scale of earthquake intensity, the Richter scale measures earthquake magnitude (Table 3-19).

The available data on structural geologic features within the NPL Project Area is sparse, but indicates that there are few geologic structural features outside of the bounding faults on the Jonah field that border the Project Area. The structural styles presented in the publicly available literature for the JIDPA and Pinedale areas show fault patterns that affect only strata below the lower Eocene strata and do not extend upward into the Wasatch (Montgomery and Robinson 1997). The closest known faults to the Project Area that have been recurrently active over the last 20 million years are the Leckie fault and the Continental fault system, which run northeast and southeast of the Project Area, respectively (Case 1997). These faults have been recurrently active over the last 20 million years, but have shown no evidence of recent activity in Quaternary times (Case 1997). Of 12 active fault systems analyzed in the *Basic Seismological Characterization for Sublette County, Wyoming*, five were determined capable of generating peak horizontal accelerations of 1.5 percent gravity or greater at either Big Piney and/or Big Sandy, Wyoming (Table 3-19) (Case et al. 2002). Big Piney is approximately 18 miles northwest of the Project Area and Big Sandy lies approximately 24 miles northeast of the Project Area. Since most active faults in the region are west of the Project Area, the severity of earthquake events would generally be expected to decrease from west to east across the Project Area.

The Grey's River fault system, west of the Project Area, is an active fault system in Lincoln County on the western side of the Wyoming Range. This north-south-trending normal fault has shown evidence of late-Holocene movement (Jones and McCalpin 1992; McCalpin 1993). The most recent events on the fault occurred in approximately 2000 and 5000 BP. The Grey's River fault system could generate a magnitude 7.0 to 7.5 earthquake (Wyoming Office of Homeland Security 2014). A magnitude 7.1 earthquake could generate peak horizontal accelerations of approximately 8.2 percent gravity at Big Piney and approximately 2.8 percent gravity at Big Sandy (Campbell 1987), corresponding to an intensity V earthquake at Big Piney and an intensity IV earthquake at Big Sandy. Light or no damage would be expected to occur within the Project Area from an event of this size. Many exposed active faults in Western Wyoming, including the Grey's River, Rock Creek, Star Valley, Teton, and Bear River fault systems are capable of generating magnitude 7.0 to 7.5 earthquakes and are thought to be overdue for reactivation (Wyoming Office of Homeland Security 2014). However, actual recurrence intervals are subject to extreme variation from predicted values (Case et al. 2002).

Table 3-19. Active Faults with Potential to Damage Structures in the Project Area

Fault System	Maximum Earthquake Magnitude (Richter scale)	Estimated Peak Horizontal Acceleration		Recurrence Interval (years)	Last Confirmed Event (years before present)
		Big Piney, WY	*Big Sandy, WY*		
South Granite Mountain (Crooks Gap fault segment)	6.7	<1.5	1.9	unknown	no evidence of late-Quaternary movement
Rock Creek	6.9–7.2	5.4	2.1	600–1,500 (variable)	3,600 ±300
Grey's River	7.1	8.2	2.8	2,970–3,400 (variable)	1,910–2,110
Star Valley	7.5	6.0	2.6	2,500–6,000	5,500
Teton	6.9–7.5	2.2	1.6	800–3,600	4,800–7,000

Source: Case et al. 2002.

WY Wyoming

Additional earthquake potential exists from random, or floating, earthquakes, which may occur in areas where active faults are buried and have no surface expression. Two sources estimated the maximum magnitude (Richter scale) of floating earthquakes in regions including the Project Area as 6.1 (Algermissen et al. 1982) and 6.0 to 6.5 (Geomatrix 1988), respectively.

Historical earthquake activity in Sublette County has occurred in a north-south-trending belt between Pinedale and Calpet (WSGS 2012). Eighteen earthquakes with magnitudes of 2.5 or greater, or intensities of III or greater, were recorded in Sublette County before 1997 (Case et al. 2002). Two recorded earthquakes were identified in close proximity to the Project Area: (1) an earthquake with a magnitude of 3.0 occurred in 1949 with an epicenter in the northwestern corner of Township 29, Range 110 West (WSGS 2012); and (2) an earthquake with a 3.3 magnitude occurred within the area in 1978 with an epicenter in the northern portion of Township 29 North, Range 108 West (Case et al. 2002).

3.6.4.2 Induced Seismicity

Induced seismicity refers to earthquakes or tremors caused by human activities. Although the ability to differentiate between induced and natural seismicity is limited at this time, the occurrence of unusual seismicity patterns in relation to the injection or extraction of fluids below the ground surface have been observed in hydrocarbon fields throughout the world (Suckale 2009). Additionally, induced earthquakes are suspected to be responsible for an overall increase in earthquake activity observed in the central and eastern U.S. since 2001, which has been concentrated primarily in the vicinity of active injection/disposal wells in Arkansas, Colorado, Kansas, Ohio, Oklahoma, New Mexico, and Texas (Ellsworth 2013; Petersen et al. 2016).

Researchers investigating the potential for induced seismic events due to hydraulic fracturing or produced water disposal have posited that (1) hydraulic fracturing methods used for shale gas recovery do not pose a high risk for inducing felt seismic events; and (2) subsurface disposal of water poses some risk for induced seismicity, but few events have been documented relative to the large number of disposal wells in operation (Ellsworth 2013; National Research Council 2013). Furthermore, induced earthquakes observed to date typically have lower maximum magnitudes and occur at shallower average depths of rupture than natural earthquakes (Petersen et al. 2016). However, some suspected induced earthquakes have been reported to cause considerable damage, including a magnitude 5.7 earthquake in November 2011 in central Oklahoma that destroyed 14 homes and caused other damage and injuries (Keranen et al. 2013).

Although research on the causes of induced seismicity is still emerging, several commonalities have been identified in the majority of cases in which seismicity has been attributed to the use of injection/disposal wells (National Research Council 2013):

- Located within approximately 0 to 5 miles of active seismic areas and fault zones.
- Injection of hundreds to thousands of barrels of fluid per day into rock formations thousands of feet below ground surface.
- Wells requiring pumping (pressurization) to dispose of the fluids versus wells that take fluid by means of gravity only.
- Fluid injection into relatively competent rock formations (not unconsolidated formations) and/or in formations that within a few thousand feet of basement rock.
- Sudden occurrence of many small earthquakes (swarms), generally less than magnitude 2, in the area immediately around a well or well field (within a few miles). However, a few earthquakes of up to magnitude 5 have also been reported (Kim 2013).

Despite widespread oil and gas development and use of subsurface water disposal wells in Wyoming, these activities do not appear to have induced notable seismicity activity to date. A 2014 study by the Wyoming State Geological Survey that evaluated six sites of potential induced seismicity concluded that "in five of the sites the earthquakes that occurred were most likely the result of natural causes and unrelated to injection or disposal well activities" and found "no definitive correlation between injection well activity and seismic events" at the sixth site (Larsen and Wittke 2014).

In 2016, the USGS published a one-year seismic hazard forecast for the central and eastern U.S. that, for the first time, modeled hazards from both natural and induced earthquakes (Petersen et al. 2016). The report mapped earthquake hazard based on seismicity patterns, earthquake rates, and ground shaking data. The hazard model predicted a threefold or greater increase in earthquake hazard in some areas of previously-observed induced earthquakes compared to the 2014 USGS National Seismic Hazard Maps, which did not estimate hazards from induced earthquakes. Model results indicated that portions of Oklahoma, Kansas, Colorado, New Mexico, Texas, and Arkansas as at risk for induced earthquakes strong enough to cause damage. However, the report indicated a less than 1 percent chance of an earthquake causing damage at any location in the study area in 2016 (Petersen et al. 2016). Additionally, the report forecasted a peak ground acceleration (with 1% chance of exceedance) throughout the study area corresponding to intensity IV or V on the Modified Mercalli Intensity scale, which can be easily felt and overturn unstable objects, but do not typically damage structures. Earthquake hazards for the study area remained at essentially the same levels in an updated one-year seismic hazard forecast for natural and induced earthquakes released in 2017 (Petersen et al. 2017).

While the USGS seismic hazard reports are informative for the general purposes of assessing seismic hazard in the NPL Project Area, several limitations should be considered. First, the reports assess seismic hazards over a one-year period, whereas the anticipated life of the project is 40 years. Secondly, the reports normalize seismic hazard based on the chance of damage. Therefore, areas with the highest chance of damage are locations where deep disposal occurs near population centers and fault zones. Finally, the large-scale of the seismic hazard maps, which cover the eastern and central U.S., are too course to evaluate local variability in hazard levels at the scale of the Project Area. Despite these limitations, the hazard reports do not provide any evidence of imminent hazard due to induced earthquakes in Wyoming, including within the region encompassing the Project Area.

The Project Area currently contains a single Class II underground injection well used for deep disposal of formation fluids (WOGCC 2015). Class II injection wells are prevalent in the adjacent JIDPA, with most injecting formation fluids into the Fort Union Formation. No seismic events have been documented in association with the operation of existing injection wells in the adjacent JIDPA and to date, there is no definitive evidence of injection-induced earthquakes occurring in the State of Wyoming. The Wyoming State Geological Survey monitors all seismic activity in the state and will conduct an investigation if they find areas with high or unusual seismic activity in the location of active injection and disposal wells (Larsen and Wittke 2014).

3.6.4.3 Other Geologic Hazards

Other geologic hazards identified in the Project Area include eolian sand deposits and colluvial aprons. Eolian processes have formed dunes and sheets in the southeastern part of the Project Area. These areas, which include the Teakettle Dune Field (SWCA Environmental Consultants 2010), are highly unstable and pose hazards for development. Areas of stable eolian deposits that border active dune fields may become active again if disturbance occurs in the absence of proper stabilization and revegetation.

Federal Emergency Management Agency (FEMA) flood maps identify 2,755 acres of land within a 100-year flood zone (FEMA Flood Zone A) along drainages throughout the Project Area (FEMA 2012) (Map 29).

No landslides were identified within the Project Area (WSGS 2012).

3.6.5 Mineral Resources

3.6.5.1 Mineral Development

The Project Area lies immediately south and west of the existing JIDPA, east of the Riley Ridge Natural Gas Development Project, and south of the Pinedale Anticline field. Major development of the adjacent Jonah gas field (which includes the JIDPA) began in 1992, with production increasing to a peak of 411,969 MMCF of gas in 2008 (WOGCC 2015). The Wyoming Oil and Gas Conservation Commission (WOGCC) reports a cumulative production volume of 4,463 BCF from 2,049 completed gas wells over the lifetime of the JIDPA gas field. As of October 2015, there were still 2,002 producing gas wells in the JIDPA; however, drilling activity has declined as gas resources are depleted and continued production of the field becomes less economical.

In comparison to the JIDPA, development of oil and gas resources in the Project Area has occurred at a considerably slower pace. The first well in the Project Area was drilled in 1953 and there has been an average of 3 new wells drilled per year since 1997 (WOGCC 2015). Approximately 85 wells have been drilled in the Project Area to support oil and gas development (Map 3). Table 3-20 summarizes the status of wells associated with oil and gas production in the Project Area. Although wells drilled in the Project Area are predominantly gas producers, production of approximately 183,245 bbls of oil has been recorded from wells within the Project Area.

Table 3-20. Status of Oil and Gas Wells and Drilling Permits within the Project Area

Well/Permit Status	Well Type			Total
	Oil	*Gas*	*Disposal*	
Active Wells				
Producing Wells	0	55	0	55
Class II Underground Injection Control Well	-	-	1	1
Water Supply Wells for Oil and Gas Operations	-	-	-	10
Inactive Wells				
Dry/junked/abandoned Wells	0	19	0	19
Total				**85**

Source: WOGCC 2015.

Wells drilled in the Project Area have an average depth of 10,567 feet, with a minimum depth of 4,530 feet and maximum depth of 18,000 feet (WOGCC 2015). The Lance and Mesaverde Formations were the target bottom formation for approximately 40 percent of these wells. Other formations with recorded gas production in the Project Area include the Blair, Ericson, Jonah, Rock Springs, Wardell, and Yellowpoint Formations (Table 3-21).

Table 3-21. Well Depth and Gas Production by Bottom Formation within the Project Area

Bottom Formation	Number of Wells[1]	Well Depth (feet)			Cumulative Gas Production 1953–2012 (MMCF)[2]
		Minimum	*Maximum*	*Average*	
Aspen	1	15,832	15,832	15,832	0
Blair	1	12,437	12,437	12,437	429
Dakota	1	18,000	18,000	18,000	0
Ericson	10	8,945	13,405	11,093	2,267
Frontier	1	16,812	16,812	16,812	0
Hilliard	1	12,422	12,422	12,422	0
Jonah	3	9,546	9,707	9,634	836
Lance	13	8,625	12,081	9,990	7,866
Mesaverde	18	8,425	11,428	9,930	7,310
Morrison	1	17,700	17,700	17,700	0
Mowry	1	16,986	16,986	16,986	0
Rock Springs	6	8,829	12,208	10,902	679
Wardell	5	9,310	10,216	9,830	1,764
Yellowpoint	10	9,340	10,003	9,776	5,453
Formation Not Identified	6	4,530	10,300	8,879	0
Grand Total	**78**	**4,530**	**18,000**	**10,567**	**26,604**

Source: WOGCC 2015.

Table 3-21. Well Depth and Gas Production by Bottom Formation within the Project Area

Bottom Formation	Number of Wells[1]	Well Depth (feet)			Cumulative Gas Production 1953–2012 (MMCF)[2]
		Minimum	*Maximum*	*Average*	

[1]Does not include the one disposal well identified in Table 3-20.
[2]Gas production as reported in the WOGCC database. For wells with no reported production, the database draws no distinction as to whether the wells are non-producing or data is unavailable.

MMCF Million Cubic Feet

3.6.5.2 Mineral Potential

As indicated by previous and ongoing natural gas development, the Project Area generally has moderate to very high potential for conventional gas development (BLM 2008a). Although coal seams are known to exist in the general area, the potential for coal bed development is low due to the thin profile of underlying coal beds and the thickness of the overburden (ENSR and Booz Allen and Hamilton 2003). In addition, the U.S. Bureau of Mines identifies the Project Area as within a low potential area for exploitable coal resources (U.S. Bureau of Mines 1990). Despite these limitations, future coal development could occur in the vicinity of the Project Area due to the potential growth of unconventional coal development opportunities, such as coal-to-liquids and underground gasification, and the expansion of non-traditional market opportunities (BLM 2012i). The greatest potential for coal development exists southeast of the Project Area, near the existing Jim Bridger and Black Butte coal mines.

A recent U.S. Geological Survey (USGS) assessment of in-place oil shale resources in the Eocene Green River Formation identified the presence of oil shale-bearing rocks throughout the southern portion of the Project Area, with a predicted yield of less than 5,000 million barrels per township (Johnson et al. 2011). Despite the presence of oil shale, development is not anticipated in the Project Area due to the lack of economically feasible recovery methods, low predicted yields in comparison to nearby areas, and the lower grade of oil shale deposits in the GRB relative to two other basins that contain Green River Formation oil shale (Johnson et al. 2011). Recent reports of possible oil shale testing activities and a Drilling Notification received by the Wyoming DEQ for a proposed oil shale well on private lands in the vicinity of White Mountain, south of the Project Area, suggest that interest in the exploration and development of these oil shale deposits may be increasing (BLM 2012i). Due to the limitations discussed above; however, minimal to no oil shale development is anticipated to occur within the Project Area.

No locatable mineral claims (lode claims) were identified within the Project Area as of October 2012 (BLM 2012c). Saleable minerals such as aggregates (sand and gravel), decorative stone, and petrified wood have been identified within the BLM PFO and are presumed to be variably present throughout the Project Area (ENSR and Booz Allen and Hamilton 2003).

3.7 Hazardous Materials and Solid Waste

3.7.1 Overview

A hazardous material is any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce (49 CFR 172, Table

172.101); this includes hazardous substances and hazardous wastes. A hazardous substance is any element, compound, mixture, solution, or substance defined as such under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and listed in 40 CFR 302.

Wastes can be divided into hazardous, non-hazardous, and universal wastes. Hazardous wastes are Federally regulated under the Resource Conservation and Recovery Act (RCRA) Subtitle C (EPA 2012b); however, certain oil and gas exploration and production wastes are exempt from Federal hazardous waste regulations (EPA 2002).

The RCRA program in Wyoming is delegated to the Hazardous and Solid Waste Division of the WDEQ. Certain types of materials (e.g., used oil), while they may contain potentially hazardous constituents, are specifically exempted from regulation as hazardous wastes. Additional wastes that otherwise might be classified as hazardous are managed as universal wastes and are exempt from hazardous waste regulation as long as those materials are handled in ways specifically defined by regulations.

The analysis area for hazardous materials and solid waste (hazardous and non-hazardous) is the Project Area, where development would require the use of hazardous chemicals and materials as well as generate hazardous and non-hazardous solid wastes. In addition, the analysis area includes the transportation route to hazardous waste treatment and disposal facilities (Map 10).

3.7.2 Laws, Ordinances, Regulations, and Standards

3.7.2.1 LORS Applicable to Wastes Generated at the Project Area

Table 3-22 lists and summarizes the applicable LORS related to management and transportation of hazardous and nonhazardous wastes. Hazardous wastes that would be generated during construction and operation in the Project Area are discussed in Appendix F (*Hazardous and Non-Hazardous Materials Management Summary*).

Table 3-22. LORS Applicable to Hazardous and Non-hazardous Wastes Generated in the Project Area

LORS	Requirements/Applicability	Administering Agency
Federal		
Comprehensive Environmental Response, Compensation, and Liability Act 42 U.S.C. 103	Excludes certain applicable products from the definition of hazardous substances as follows: *"hazardous substance" is defined to "not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). The same definition is applied to terms pollutant and contaminant in section 101(33).* To be excluded, substances must be petroleum or a fraction of petroleum and not specified by other Federal laws such as the Clean Air Act or Solid Waste Disposal Act. This includes hazardous substances that are indigenous to petroleum as well as materials routinely added during refining, but not materials added outside the normal refining process.	Environmental Protection Agency Region VIII, Wyoming Department of Environmental Quality
Resource Conservation and Recovery Act 42 U.S.C. §6901 et seq. (1976); 40 CFR § 260, 261, 262; HWRR Ch. 1, 2, 8. Hazardous Waste Management, Identification and Listing of Hazardous Wastes, Standards Applicable to Generators of Hazardous Wastes	Requires the hazardous waste generator to obtain an Environmental Protection Agency Identification (EPA ID) number and register annually with the WDEQ to accumulate and store hazardous waste for no more than 90 days, as well as ship hazardous waste under a manifest to a licensed disposal site. Requires the generator to identify and profile hazardous waste, store hazardous waste in appropriate containers, label containers stored on site and transported to the disposal site(s), and train operators in hazardous waste management.	Environmental Protection Agency Region VIII, Wyoming Department of Environmental Quality
Resource Conservation and Recovery Act 42 U.S.C. §6901 et seq. (1976); 49 U.S.C. §5101; 40 CFR §263; HWRR Ch. 9. Solid and Hazardous Waste Transportation	Requires hazardous waste generators to use registered transporters of hazardous waste with EPA ID numbers, requires manifests to accompany waste shipments, and requires proper cleanup of any hazardous waste discharges.	Environmental Protection Agency Region VIII, Wyoming Department of Environmental Quality, and Wyoming Department of Transportation
40 CFR § 273; HWRR Ch. 14. Standards for Universal Waste Management	Requires management and employee training, and requires proper disposal of universal waste including batteries and fluorescent lamps.	Environmental Protection Agency Region VIII, Wyoming Department of Environmental Quality
Used Oil Solid Waste Disposal Act, as amended (42 U.S.C. § 6905, 6912[a], 6921 through 6927, 6930, 6934, and 6974) and Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. § 9601[37] and 9614[c]). (40 CFR § 279), HWRR Ch. 12. Standards for Management of Specific HW and	Requires generators of used oil to prevent spills and to correctly label, store, transport, and dispose of or recycle used oil.	Environmental Protection Agency Region VIII, Wyoming Department of Environmental Quality

Table 3-22. LORS Applicable to Hazardous and Non-hazardous Wastes Generated in the Project Area

LORS	Requirements/Applicability	Administering Agency
HW Management Facilities/Used Oil		
EPA Exemption of Oil and Gas Exploration and Production Wastes from Federal Hazardous Waste Regulations, October 2002	This publication provides an understanding of the exemption of certain oil and gas exploration and production wastes from regulation as hazardous wastes under Subtitle C of the RCRA.	U.S. Environmental Protection Agency
BLM Instruction Memorandum WY-2012-007: Management of Oil Gas Exploration and Production Pits	This Instruction Memorandum provides the minimum standards for management of pits authorized by the BLM on Federal and/or Indian oil and gas leases for exploration and production activities. Pits covered by this IM include (but are not limited to): reserve, completion, flare, oil-base mud, drill cuttings, emergency, workover, and production pits.	Bureau of Land Management
BLM Notice to Lessees and Operator of Onshore Federal and Indian Oil and Gas Leases (NTL-3A)	This Instruction Memorandum describes the reporting requirements for operators of onshore Federal and Indian oil and gas leases in the event of a spill, discharge, or other undesirable event.	Bureau of Land Management
State		
WOGCC Rules and Regulations Ch. 2, 3, 4, and 5 (Ch. 2, Section 6; Ch. 3, Section 2, 39; Ch. 4, Section 1, 4, 13)	Describes rules promulgated to prevent waste and to conserve oil and gas in the State of Wyoming. Intended to protect human health and the environment through the utilization of methods designed to avoid contamination of the soils, groundwater, and surface water at a drilling or producing location. Rules include general rules; operational rules; drilling rules; environmental rules, including underground injection control program rules for enhanced recovery and disposal projects; and rules of practice and procedure before the Wyoming Oil and Gas Conservation Commission.	Wyoming Oil and Gas Conservation Commission
Wyoming Environmental Quality Act, Article 3 Water Quality. W.S. 35-11-301	Specifies restrictions for construction and operation of oil field waste disposal facilities.	Wyoming Department of Environmental Quality
Wyoming Water Quality Rules and Regulations, WWQRR Ch. 2 WYPDES Permitting Requirements	Describes permit regulations for discharges to Wyoming surface waters.	Wyoming Department of Environmental Quality
WWQRR Ch. 4 Regulations for Release of Oil and Hazardous Substances into Waters of the State	Describes regulations for releases of oil and hazardous substances into waters of the State of Wyoming.	Wyoming Department of Environmental Quality
Wyoming Pollutant Discharge Elimination System: Point Sources; Clean Water Act, 33 U.S.C. § 1251, et seq.	Requires the facility to obtain coverage under the Wyoming Pollutant Discharge Elimination System (WYPDES) Discharge Permitting for Point Sources' Individual Permit to surface discharge produced water from oil and gas production unit discharges.	Wyoming Department of Environmental Quality

Table 3-22. LORS Applicable to Hazardous and Non-hazardous Wastes Generated in the Project Area

LORS	Requirements/Applicability	Administering Agency
Wyoming Pollutant Discharge Elimination System Program: Storm Water Program; Clean Water Act, 33 U.S.C. § 1251, et seq.	Requires that a facility with more than five acres of construction obtain coverage under the WYPDES Storm Water Program's Large Construction General Permit. Under this permit, the facility would implement approved Storm Water Pollution Prevention Plans for construction and for facility operation, and implement appropriate best management practices to, in part, avoid release of storm water contaminated with hazardous materials or wastes.	Wyoming Department of Environmental Quality
Wyoming Statute W.S. 35-11-501, Solid Waste Management	Describes solid waste management statutes for Wyoming.	Wyoming Department of Environmental Quality
Wyoming Solid Waste Rules, Ch. 6, 8, and 15	Describes rules for solid waste management in Wyoming, and regulations for transfer, treatment, and storage of non-hazardous solid wastes, special waste management standards, and solid waste management rules and regulations.	Wyoming Department of Environmental Quality

CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
EPA ID	Environmental Protection Agency Identification
HW	Hazardous waste
HWRR	Wyoming Hazardous Waste Rules and Regulations
LORS	Laws, Ordinances, Regulations, and Standards
RCRA	Resource Conservation and Recovery Act
U.S.C.	United States Code
W.S.	Wyoming Statute
WDEQ	Wyoming Department of Environmental Quality
WOGCC	Wyoming Oil and Gas Conservation Commission
WWQRR	Wyoming Water Quality Rules and Regulations
WYPDES	Wyoming Pollutant Discharge Elimination System

3.7.2.2 LORS Applicable to Hazardous Materials Utilized at the Project Area

Jonah Energy would use designated hazardous materials during construction and operation of the NPL Project. Table 3-23 summarizes the LORS that apply to management and transportation of those hazardous materials.

Table 3-23. LORS Applicable to Hazardous Materials Utilized in the Project Area

LORS	Requirements/Applicability	Administering Agency
Federal		
Emergency Planning and Community Right-to-Know Act, Section 302 (Public Law 99-499, 42 U.S.C. § 11022) Hazardous Chemical Reporting: Community Right-To-Know (40 CFR § 370)	Requires agency notification if extremely hazardous substances are stored in excess of Threshold Planning Quantities.	Wyoming State Emergency Response Commission, applicable Local Emergency Planning Committee, and the Wyoming State Fire Marshal

Table 3-23. LORS Applicable to Hazardous Materials Utilized in the Project Area

LORS	Requirements/Applicability	Administering Agency
Emergency Planning and Community Right-to-Know Act, Section 311, (Public Law 99-499, 42 U.S.C. § 11021) Hazardous Chemical Reporting: Community Right-To-Know (40 CFR § 370)	Requires either the Safety Data Sheets or a list of all hazardous materials be submitted to the Wyoming State Emergency Response Commission, Local Emergency Planning Committee, and local fire department.	Wyoming State Emergency Response Commission, applicable Local Emergency Planning Committee, and the Wyoming State Fire Marshal
Emergency Planning and Community Right-to-Know Act, Section 313, (Public Law 99-499, 42 U.S.C. § 11023) Toxic Chemical Release Reporting: Community Right-To-Know (40 CFR § 372)	Requires releases of hazardous materials be reported annually.	Environmental Protection Agency Region VIII, Wyoming Department of Environmental Quality, Wyoming State Emergency Response Commission, and the Wyoming State Fire Marshal
Hazardous Materials Transportation (49 CFR § 171-172)	Requires transporters of hazardous materials to properly label, manifest, package, and ship hazardous materials, and provide and maintain emergency response information during transportation and storage of hazardous materials.	Wyoming Department of Environmental Quality, Wyoming Department of Transportation, and Wyoming Highway Patrol
Hazard Communication Program (29 CFR § 1910.1200) Safety and Health for Construction (29 CFR § 1926.1 et seq.)	Requires employers to implement the Hazard Communication Program standard that gives workers the right to know the hazards and identities of chemicals in their workplaces (29 CFR § 1910.1200). Requires written procedures and protective equipment for employees working with hazardous materials.	U.S. Occupational Safety and Health Administration
Oil Pollution Prevention (40 CFR § 112)	Requires facilities that store petroleum products above ground in quantities greater than 1,320 gallons in 55-gallon or larger containers to prepare a Spill Prevention, Control, and Countermeasure (SPCC) Plan. A separate SPCC plan is required for construction if quantities of petroleum products stored on site during construction exceed quantities described above. If a discharge has the potential to cause substantial harm to the environment, a facility-specific response plan must be submitted.	Environmental Protection Agency Region VIII
State		
The International Fire Code, 2012 Edition including Appendix D, Appendix E, Appendix F, and Appendix G	Requires preparation of a hazardous material inventory statement and management plan.	Wyoming State Fire Marshal

CFR Code of Federal Regulations
LORS Laws, Ordinances, Regulations, and Standards
SPCC Spill prevention, control, and countermeasure
U.S.C. United States Code

3.7.3 Project Area Conditions

The Project Area is generally characterized by low rolling hills interspersed with buttes, rock outcrops, large draws, and deep canyons. Primary land uses in the general vicinity of the Project Area include livestock grazing, recreation, wildlife habitat, agriculture, and, increasingly, oil and gas development. There has been increased human activity in the area as development in the Project Area and adjacent oil and gas fields have increased, including the Pinedale Anticline to the north, the Riley Ridge and Big Piney/LaBarge Coordinated Activity Plan (CAP) to the west, and the JIDPA to the immediate northeast. The nearest populated areas are several miles west of the Project Area perimeter. Refer to Section 3.8 (*Land Use*) for additional information on land uses in and around the Project Area.

As of 2015, approximately 85 wells have been drilled within the Project Area to support oil and gas development, of which 55 are producing wells, 10 are water-supply wells, 1 is an injection well, and 19 have been plugged and abandoned. Small portions of the Project Area—only slivers, as of now, around the edges of the Project Area where the NPL Project and JIDPA boundaries meet—also lie within Intensively Developed Fields, which support more intensive oil and gas leasing and development compared to Traditional Leasing Areas as defined by the BLM PFO Approved RMP and ROD.

Hazardous materials and solid wastes present in the Project Area include those used and produced in association with previous and ongoing natural gas drilling, completion, and production. These substances and their current management protocol are described in Appendix F (*Hazardous and Non-Hazardous Materials Management Summary*).

3.7.4 Hazardous Waste Disposal Sites

Prior to the start of construction, Jonah Energy would submit site-specific applications including a Surface Use Plan of Operations, which would contain information describing waste containment and disposal associated with the site-specific well development. Waste generated during drilling and operations may be hauled to a government-approved disposal site or to the Jonah Energy-owned Biotreatment Facility (located in the JIDPA) for treatment, and flow-back water produced during well completion operations would be hauled to an approved water treatment/disposal facility. Most produced water would be disposed of via subsurface injection wells located near each Regional Gathering Facility (RGF), with smaller volumes being transported for treatment and reuse. Initially, produced water stored at the RGFs for treatment would be transported to the neighboring JIDPA water treatment/disposal facility, with additional facilities to be constructed if needed. Refer to Section 4.7 (*Hazardous Materials and Solid Waste*) for information on the types of hazardous wastes utilized or generated by the NPL Project.

Hazardous wastes generated in the Project Area would be transported off site to a permitted treatment, storage, or disposal (TSD) facility by a licensed shipper in accordance with the LORS. Hazardous wastes generated in the Project Area would generally be transported to an authorized off-site facility (e.g., the Big Piney/Marbleton Landfill and the R360 Environmental Solutions LaBarge Facility). The quantities of waste materials generated in the Project Area would not likely exceed the capacity of authorized off-site facilities, and hazardous wastes would not be transported out of state.

Hazardous wastes from the Project Area would generally be transported to the TSD facilities hazardous waste facilities identified on Map 10. Refer to Appendix F (*Hazardous and Non-Hazardous Materials Management Summary*) for additional information on hazardous materials management and disposal.

3.8 Land Use

3.8.1 Overview

The Project Area consists primarily of BLM-administered lands (96.3 percent) in the BLM PFO and RSFO. Use of the public lands contained therein is therefore highly influenced by BLM land management policies and actions. State and private landowners, as well as county governments, are also important stakeholders in land use decisions and planning processes affecting the Project Area. The analysis area for land use is the Project Area.

Primary land uses in the general vicinity of the Project Area include livestock grazing, recreation, wildlife habitat, agriculture, and, increasingly, oil and gas development. Since 1992, development of the extensive oil and gas fields adjacent to the Project Area—including the Pinedale Anticline to the north, the Riley Ridge and Big Piney/LaBarge CAP to the west, and the JIDPA to the immediate northeast—has greatly increased the level of human activity in the area and decreased the amount of land available for other uses. Prior to this surge in mineral exploration, the lands were primarily used for livestock grazing, with some areas frequented by recreationists searching for petrified wood or hunting for antelope and Sage-Grouse (BLM 2006a).

Thus far, the development of oil and gas resources within the Project Area has proceeded at a far slower pace than in surrounding fields. The Project Area therefore remains a largely rural and undeveloped expanse with occasional roads, energy production-related facilities, and utility corridors distributed across the landscape.

3.8.2 Laws, Ordinances, Regulations, and Standards

3.8.2.1 Federal Land Policy Management Act

The FLPMA mandates that the BLM manage public lands and their resource values on the basis of multiple use (43 U.S.C. 1701[a][7]). Oil and gas development and livestock grazing are the predominant uses of public lands within the Project Area, with recreation and agricultural uses occurring in adjacent and overlapping areas. Current land use patterns are consistent with Section 103 of the FLPMA (43 U.S.C. 1702[l]), which identifies mineral development as one of the principal uses of public lands. The development of Federal oil and gas leases, as well as associated right-of-way (ROW) applications and temporary use clearances, must be authorized for use by the BLM and are subject to the terms and conditions incorporated into the approved APD or ROW grant by the BLM. In order to maintain multiple-use management and meet resource management objectives, the BLM may apply a variety of surface use restrictions in some instances (e.g., visual resource management designations, closure/withdrawal, No Surface Occupancy, Controlled Surface Use, and seasonal limitations) to mineral development activities. The BLM administers livestock grazing permits within designated grazing allotments in accordance with the Taylor Grazing Act of 1934 (43 U.S.C. § 315-315r) and the Public Rangelands Improvement Act of 1978 (43 U.S.C. § 1901 et seq.).

3.8.2.2 BLM Resource Management Plans

The BLM PFO Approved RMP and Record of Decision (ROD) (BLM 2008a) and the BLM Green River Approved RMP and ROD (BLM 1997a) provide management objectives and actions for BLM-administered lands in portions of the Project Area that are within the jurisdiction of each respective field office. Refer to Section 1.6.3 (*Conformance with BLM Resource Management Plans*) for more information.

3.8.2.3 County Comprehensive Plans and Zoning Regulations

3.8.2.3.1 Sublette County

The Project Area is within Sublette County, Wyoming, and is therefore subject to the goals and policies of the Sublette County Comprehensive Plan (Sublette County 2003). The plan encourages cooperation between local, state, and Federal entities on land use planning issues affecting or occurring within the County's jurisdiction, and identifies specific goals and policies for residential, agricultural, commercial, industrial, and "fringe area" land uses. Collectively, these policies promote the continued growth and development of the County's land and resources in a manner that minimizes adverse impacts to public services and natural resources, and conserves agricultural and grazing lands. Refer to Section 1.6.4.1 (*Sublette County Comprehensive Plan*) for more information.

The Sublette County Planning and Zoning Board administers local land use and zoning regulations within the Project Area in accordance with the Comprehensive Plan. With the exception of a single 40-acre parcel zoned for Light Industrial (I-L) use, the entire Project Area exists within a Resource Conservation (RC) zoning district (Sublette County 2012), which is defined by the Sublette County Zoning and Development Regulations as "environmentally sensitive areas where development must be limited to prevent degradation of the areas" (Sublette County Zoning And Development Regulations Resolution of 1978, as amended, Chapter 2, Sections 1 and 3[n]). In addition to mining and mineral extraction, other authorized RC district land uses include fish hatcheries and wildlife preservation; grazing and agriculture; drainage and irrigation; soil and water conservation; forest management; and low-density residential development (lot sizes of two acres and larger). Land uses eligible for conditional approval within the RC district include worker camps, temporary camps, industrial transportation parking facilities, and sanitary landfills to support mineral development and transport.

3.8.2.3.2 Sweetwater County

Although the Project Area is entirely within Sublette County, Wyoming, its southern boundary is directly adjacent to the Sweetwater County line. The Sweetwater County Comprehensive Plan includes goals, objectives, and implementation strategies that serve as a framework for County decision makers as they consider future private and public land use and development decisions (Sweetwater County 2002). The Sweetwater County Comprehensive Plan includes goals and objectives specific to industrial uses, such as the NPL Project, including identifying and promoting areas that are appropriately zoned and adequately serviced for industrial uses; encouraging new industrial development adjacent to existing industry; and encouraging industrial development near available facilities, services, and resources. All development in Sweetwater County requires coordination and potential permitting with the following Sweetwater County Departments: Road and Bridge, Public Works, Health, Weed and Pest, Emergency Management, Fire, and Planning and Zoning.

In addition, the Sweetwater County Comprehensive Plan discourages the establishment of man camps and encourages workers to live within established communities where public facilities and services are readily available. If a man camp is necessary within Sweetwater County, the camp may be established by the Sweetwater County Conditional Use Permit Process.

3.8.2.4 Conservation District Plans and Policies

3.8.2.4.1 Sublette County Conservation District Long Range Plan

The Project Area is located within the Sublette County Conservation District. Conservation districts are local government units organized to provide for the development, conservation, and protection of natural resources in accordance with W.S. 11-16. In 2013, the Sublette County Conservation District developed a Long Range Plan for years 2014 to 2019 (Sublette County Conservation District 2013) that establishes objectives for planning and monitoring the District's progress with respect to the Sublette County Federal and State Land Use Policy (Sublette County 2009a). Specific objectives of the Long Range Plan with direct relevance to the NPL Project include, but are not limited to:

- Conduct soil surveys and developing Ecological Site Descriptions (ESDs) that would be applied to evaluate soil capabilities and suitability limitations for development and reclamation;
- monitor surface and groundwater quality; and
- participate in mineral development decisions that affect the interest and responsibilities of the District; and seek and participate in planning processes as a coordinating agency.

3.8.2.4.2 Sweetwater County Conservation District Land and Resource Use Plan and Policy

In 2011, the Sweetwater County Conservation District developed a Land and Resource Use Plan and Policy to identify goals, objectives, and policies to facilitate, protect, and preserve the utilization and conservation of natural resources; protect local values and customs; and provide for the public health, safety, and welfare of the County's citizens (Sweetwater County Conservation District 2011). Specific goals and objectives of the Long Range Plan with direct relevance to the NPL Project include, but are not limited to:

- Recognize the continued importance of mineral and energy development;
- monitor and evaluate the effects and impacts of local, state, and federal land management actions on the custom and culture of Sweetwater County; and
- ensure compliance with all existing local, state, and federal laws regarding oil, gas and mineral exploration and/or their production, so that the District's mandate to conserve rangeland, soil, and water resources are met.

The Plan also establishes a process for the District and associated Land and Resource Advisory Committee to coordinate in advance with government agencies regarding any proposed action that would impact land uses in the County.

3.8.3 Land Status/Prior Rights

The Project Area encompasses 140,859 acres, including approximately 135,655 acres of BLM-administered land (96.3 percent), 5,123 acres of land administered by the State of Wyoming (3.6 percent), and 81 acres of private lands (0.05 percent). The BLM administers approximately 132,461 acres of Federal mineral estate in the Project Area.

3.8.4 Existing Land Use

3.8.4.1 Oil and Gas Development

The drilling of gas wells in the Greater Big Piney-LaBarge Platform, JIDPA, and Pinedale Anticline drilling and production regions, which surround the Project Area, have resulted in increased demand for road, pipeline, and utility ROW corridors (BLM 2008a). As of 2015, approximately 79 wells had been drilled within the Project Area to support oil and gas development, of which 55 were producing wells and 19 have been plugged and abandoned (WOGCC 2015). Other oil and gas-related development in the Project Area includes pipelines, access roads, a compressor station, and the Jonah Workforce Facility (Map 3). Surface disturbance from existing development covers approximately 1,573 acres (1.1 percent) of the Project Area. The development, associated activity, and subsequent reclamation of these facilities have altered the character of the landscape. Refer to Section 2.3.1 (*Existing Development in the Project Area*) for more information on existing development and surface disturbance in the Project and refer to Section 3.6.5 (*Mineral Resources*) for additional information on mineral resources and development within the Project Area.

3.8.4.2 Livestock/Grazing Management

Cattle and sheep graze the BLM-administered lands within the Project Area, which includes portions of nine grazing allotments. Increased levels of human activity and the conversion of historical grazing areas with the development of oil and gas resources in the region have caused livestock mortality, changes in the quality and availability of forage and water, and shifts in traditional use patterns (BLM 2006a). The BLM administers livestock grazing on public lands in accordance with the Taylor Grazing Act, FLPMA, Public Rangelands Improvement Act, and Wyoming Standards and Guidelines for Livestock Grazing Management (BLM 1997b). The Sublette County Conservation District provides myriad services and programs to promote and support rangeland planning and health in Sublette County. The Sublette County Long Range Plan identifies the District’s objectives to assist livestock producers with range improvements, to participate in development-related reclamation and mitigation, and promote the use of ESDs in developing vegetation objectives (Sublette County Conservation District 2013). As of 2012, 31 livestock water wells have been drilled in the Project Area resulting in approximately 3 acres of long-term surface disturbance.

Refer to Section 3.10 (*Livestock Grazing*) for additional information on livestock grazing and range management in the Project Area.

3.8.4.3 Other Existing Land Uses

An increasing human population in the region has created additional demand for recreational uses of public lands, which could result in livestock displacement, increases in noxious weed infestation, and additional operations and management costs for public lands in some areas. Refer to Section 3.13 (*Recreation*) for additional information on recreation in the Project Area.

The development of well pads and supporting infrastructure, as well as the conversion of primitive two-track roads into a dense network of developed roads, has resulted in the fragmentation or loss of lands that historically served as wildlife habitat. Human activity, consisting of vehicular traffic on upgraded roads and noise from heavy equipment and drilling rigs, contributes to avoidance behaviors. Refer to Section 3.22 (*Wildlife and Fisheries*) for additional information on wildlife habitat and species in the Project Area.

Most agricultural areas in the region consist of irrigated hay meadows, with some dryland crops grown in upland areas (BLM 2008a).

3.9 Lands with Wilderness Characteristics

3.9.1 Overview

Lands with wilderness characteristics were not addressed by the BLM PFO Approved RMP and ROD or the BLM Green River Approved RMP and ROD. However, subsequent to the RMPs, the BLM has completed wilderness characteristics inventories within the Project Area in both the RSFO and PFO, in conformance with BLM Manuals 6310 and 6320. In the RSFO, the BLM inventoried five potential lands with wilderness characteristics units that intersect the Project Area including units WY040-2011-100, WY040-2011-103, WY040-2011-105, WY040-2011-107, and WY040-2011-134 (Map 12). The BLM RSFO determined that these units do not qualify as lands with wilderness characteristics.

In the PFO, the BLM has identified five lands with wilderness characteristics qualifying units that intersect the Project Area: WYD01-6300-202, WYD01-6300-203, WYD01-6300-204, WYD01-6300-205, and WYD01-6300-206 (Map 12). These five units contain a total of 97,230 BLM-administered acres that qualify as lands with wilderness characteristics (containing naturalness, outstanding opportunities for solitude, and primitive, unconfined forms of recreation). A total of 60,073 BLM-administered acres of these five units overlap the Project Area. Unit WYD01-6300-207 overlaps the central portion of the Project Area, but does not contain the qualities necessary to qualify as lands with wilderness characteristics (Map 12). Other small areas in the Project Area do not meet the size requirements for lands with wilderness characteristics (Map 12). The analysis area for lands with wilderness characteristics includes the Project Area and the full extent of lands with wilderness characteristics qualifying units that intersect the Project Area (Map 12).

3.9.2 Laws, Ordinances, Regulations, and Standards

Managing wilderness resources is part of the BLM's multiple-use mission. Section 201 of the FLPMA requires the BLM to maintain, on a continuing basis, an inventory of all public lands and their resources and other values, which includes wilderness characteristics. The primary function of an inventory is to determine the presence or absence of wilderness characteristics. BLM Manual 6310 contains guidance and general procedures for conducting an inventory of wilderness characteristics as defined in Section 2(c) of the Wilderness Act and incorporated into the FLPMA. In order for an area to qualify as lands with wilderness characteristics, it must possess sufficient size, naturalness, and outstanding opportunities for either solitude or primitive and unconfined recreation. In addition, it may also possess supplemental values. See BLM Manual 6310 (BLM 2012d) for more detailed information on BLM policy for wilderness characteristics and BLM Manual 6320 (BLM 2012e) for policy on considering lands with wilderness characteristics in BLM land use planning decisions.

3.9.3 Existing Conditions

The BLM has identified five lands with wilderness characteristics qualifying units that intersect the Project Area, including units WYD01-6300-202 (20,005 BLM-administered acres in the Project Area), WYD01-6300-203 (3,635 BLM-administered acres in the Project Area), WYD01-6300-204 (10,250 BLM-administered acres in the Project Area), WYD01-6300-205 (3,718 BLM-administered acres in the Project

Area), and WYD01-6300-206 (22,465 BLM-administered acres in the Project Area). These units comprise a total of 60,073 BLM-administered acres of lands with wilderness characteristics within the Project Area (Map 12).

3.9.3.1 Unit WYD01-6300-202

Lands with wilderness characteristics qualifying unit WYD01-6300-202 overlaps 20,005 BLM-administered acres in the Project Area in the PFO (Map 12). The east boundary of the unit is Burma Road (BLM Road 5406), private land, and a pipeline ROW (WYW-171677). The north boundary is an unnamed road and the western and south boundary is BLM Road 5404 and Wyoming State Lands (Map 12). The area has good quality scenery comprised of colorful buttes, occasional rock outcrops, and sagebrush covered plateaus. Sandy washes give way to steep barren slopes of the highly erosive soils. Sedimentary rock outcroppings and stabilized sand dunes are evident. Butte faces are generally steep and typical of erosional landscapes similar to badlands. Two primary drainages, Granite Creek and Alkali Draw, incise the higher plateau and buttes on the eastern side of the unit and progress to a more open basin with flat terrain and low rolling hills (BLM 2016a).

The primary human activities in the area are associated with livestock grazing and recreation. Ranchers commonly visit the area during the spring and early summer to manage livestock and maintain water sources and fencing. The recreating public generally visits during the summer. Recreational activities include, hunting for small and big game, antler gathering, rock hounding, sightseeing, horseback riding, photography and motorsports. The badlands type terrain in the unit is attractive to Off Highway Vehicle (OHV) enthusiasts. Some dispersed camping also occurs in conjunction with the OHV activities. As evidenced by BLM staff, and infrequent use of primitive routes, visitation in the area is deemed light (BLM 2016a).

Primary structures in the unit are livestock management structures including approximately 5 reservoirs and 6 water wells with associated holding tanks and or water distribution features such water troughs. Topographical screening reduces the visibility of structures in most areas, but several range improvements are either elevated on prominences or located in flat terrain and more visible. Thus these few features could attract the attention of the average person from a distance of a mile or more. Given the good topographical screening and diminutive size of features, these features are infrequently visible and minimally detract from the areas naturalness. Thus the area appears to be primarily affected by the forces of nature with the few human created features being substantially unnoticeable to the average visitor (BLM 2016a).

The majority of this unit appears natural and is composed of a large expanse of public land with few human created features. The area's size enhances visitor opportunities to avoid the sights, sounds, and evidence of other people. However, during the summer on weekends, a visitor may see or hear the sounds of recreational motorized vehicles; however, this use is infrequent. The area's low visitation, size, and topographical variation provide the visitor with outstanding opportunities to experience solitude (BLM 2016a).

The unit provides for activities that offer dispersed, undeveloped recreation which do not require facilities, motor vehicles, motorized equipment, or mechanized transport. The area is known to attract people interested in paleontological resources, scenery, horseback riding, photography sightseeing and wildlife viewing. Because of the area's expansive size and remote location there are outstanding opportunities to experience a degree of self-reliance and independence in a primitive outdoor setting (BLM 2016a).

The area contains numerous paleontological and historical resources. Notable wildlife resources are also present including Sage-Grouse lek, Sage-Grouse nesting and winter concentration habitat (Wyoming's largest concentration of wintering Sage-Grouse) and abundant nesting habitat for various species of raptors. The area is also categorized as crucial winter range for Pronghorn antelope and mule deer (BLM 2016a).

3.9.3.2 Unit WYD01-6300-203

Lands with wilderness characteristics qualifying unit WYD01-6300-203 overlaps 3,635 BLM-administered acres in the Project Area in the PFO (Map 12). The southern, eastern, and northern boundaries are pipeline ROWs and the western boundary is BLM Road 5406 and private and Wyoming state lands. The unit is comprised of rolling sagebrush hills, buttes, plateaus, rock outcroppings, and badlands. Livestock grazing, hunting, and driving for pleasure are the primary human uses and activities; other uses include recreational OHV use, wildlife viewing, dispersed camping, and antler collecting. A few single-track OHV trails are confined to a small area of badlands on the western edge of the unit; these trails are largely unnoticeable and do not substantially detract from the scenic quality of the landscape. Ranchers access the area generally during the summer to manage cattle and to maintain stock watering facilities and other range improvements (BLM 2013e).

Big game wildlife common to the area are mule deer and pronghorn antelope. Other animals utilizing this environment are rabbits, coyotes, reptiles, raptors. Sage-Grouse and numerous other bird species. The area provides crucial winter range for Pronghorn antelope. The area also contains Sage-Grouse Winter Concentration Areas and two Sage-Grouse leks.

The area appears to have been affected primarily by the forces of nature and human influence is substantially unnoticeable. The view shed is primarily pristine with few intrusions. A noticeable amount of OHV use in the form of single track trails is confined to a small area of badlands located on the western edge of the unit near private land on BLM Road 5406 (Burma Road). The routes are visible, but largely unnoticeable and do not substantially distract from the scenic quality of the landscape (BLM 2013e).

The unit provides visitors excellent opportunities to experience dispersed, undeveloped recreation which does not require facilities, motor vehicles, motorized equipment, or mechanized transport. The area is also known for paleontological resources, hunting, horseback riding, photography and wildlife viewing (BLM 2013e).

3.9.3.3 Unit WYD01-6300-204

Lands with wilderness characteristics qualifying unit WYD01-6300-204 overlaps 10,250 BLM-administered acres in the Project Area in the PFO (Map 12). The unit is bounded to the north by private land, to the west by BLM Road 5405, to the south by BLM Road 5401, and to the east by BLM Road 5404 and Wyoming state land. The topography consists of buttes, rock outcrops, badlands, plateaus, and deep, remote canyons (BLM 2013f).

The primary human uses of the area are livestock grazing and recreation. Recreational activities include hunting, antler gathering, rock-hounding, sightseeing, and photography. Recreational OHV use also occurs in the unit. Views within the unit are generally natural with few human-created features, which include range improvements, stock ponds, water developments, fences, and a scattering of primitive two-track roads. Visible OHV tracks are confined to a small area on the western edge of the unit near Milleson Draw; although noticeable from the Milleson Draw area, they do not detract from the naturalness of the landscape. There are also two plugged and abandoned gas wells in the unit. The well pads and roads have been reclaimed and remain largely unnoticeable to the casual viewer (BLM 2013f).

This unit offers visitors the opportunity to avoid the sights, sounds, and evidence of other people. The unit is of sufficient size and topographical variation to offer opportunities for outstanding solitude. The unit provides opportunities for activities that offer dispersed, undeveloped recreation which do not require facilities, motor vehicles, motorized equipment, or mechanized transport. The area is also known for paleontological resources, hunting, horseback riding, photography, and wildlife viewing. The majority of the unit is crucial winter range for mule deer and pronghorn antelope. The area also supports a high density of nesting raptors and overlaps Sage-Grouse Winter Concentration Area (BLM 2013f).

3.9.3.4 Unit WYD01-6300-205

Lands with wilderness characteristics qualifying unit WYD01-6300-205 overlaps 3,718 BLM-administered acres in the Project Area in the PFO (Map 12). The unit is bounded to the north by BLM Road 5401, to the east by Wyoming state land and BLM Road 5402, to the south by the PFO and RSFO field office boundaries and a constructed oil and gas road (BLM 2013g).

The topography in the unit consists of buttes, rock outcrops, badlands, plateaus, and canyons. Visitors view a landscape of canyons with contrasting vegetation and soils. A generally flat, sagebrush dominated plateau is typical of the landscape within a portion of the units eastern side. The unit appears to be infrequently visited (BLM 2013g).

The primary human uses of the area are livestock grazing and recreation. Ranchers access the area to manage livestock and maintain rangeland improvements. Seasonally occurring recreational activities include hunting, antler gathering, rock-hounding, sightseeing, and photography. The area is most easily accessible in the late spring, summer, and fall. Travel can be difficult during spring snowmelt or rainfall. Recreational OHV use is not apparent in the area. Visitation is low and occurs primarily during the big game hunting seasons and summer grazing season (BLM 2013g).

The area appears to have been affected primarily by the forces of nature and human influence is substantially unnoticeable. The view shed is generally pristine with few human-created features including range improvements, two reclaimed, plugged and abandoned well pads, and roads. Two functional water wells with troughs and/or stock ponds provide livestock with water in the eastern segment of the unit. A water well is located approximately two miles from the eastern side of the unit boundary is regularly visited during the grazing season (BLM 2013g).

A few lightly used two-track routes provide access to portions of the unit. In general, the routes are lightly traveled and not particularly noticeable to persons unfamiliar with the landscape. These features are substantially unnoticeable due to topographical screening and a low density of manmade features.

This unit offers visitors the opportunity to avoid the sights, sounds, and evidence of other people. The unit is of sufficient size and topographical variation to offer opportunities for outstanding solitude. The unit provides opportunities for visitors to experience activities that offer dispersed, undeveloped recreation which do not require facilities, motor vehicles, motorized equipment, or mechanized transport. The predominate area activities are rock hounding, hunting, trapping, horseback riding, photography, and wildlife watching. The majority of the unit contains crucial winter range for mule deer and pronghorn antelope. The area also supports a high density of nesting raptors and provides habitat for wintering Sage-Grouse (BLM 2013g).

3.9.3.5 Unit WYD01-6300-206

Lands with wilderness characteristics qualifying unit WYD01-6300-206 overlaps 22,465 BLM-administered acres in the Project Area in the PFO (Map 12). The unit is bounded to the north by BLM Road 5407 and Wyoming state land, to the east by a gas pipeline ROW and BLM Road 5407, to the south by the PFO and RSFO boundary fence, and to the west by BLM Road 5402 and Wyoming state land (BLM 2013h).

The topography in the unit consists of buttes rock outcrops, badlands, plateaus, flat open expanses, and shallow canyons. The area appears to have been affected primarily by the forces of nature and human influence is substantially unnoticeable. Visitors view a landscape of canyons with contrasting vegetation and soils. A generally flat, sagebrush, or saltbrush dominated plateau is typical of the landscape within the east-southeast portion of the unit. The unit appears to be infrequently visited (BLM 2013h).

The primary human uses of the area are livestock grazing and hunting. Ranchers access the area to manage livestock and maintain rangeland improvements. Seasonally occurring recreational activities include hunting, antler gathering, rock-hounding, sightseeing, and photography. The area is most easily accessible in the late spring, summer, and fall. Travel can be difficult during period's spring snowmelt or rainfall. Recreational OHV use is not apparent in the unit. Visitation is low and occurs primarily during the big game hunting and summer grazing season (BLM 2013h).

The unit contains no constructed and maintained roads; however, primitive routes to access several water wells appear heavily traveled. About 30 miles of primitive two-track routes provide access through the unit where topography allows. The majority of these routes appear lightly traveled, but a few routes appear to be heavily traveled. Routes in the unit are primarily used by grazing permittees and for access by hunters and those driving for pleasure. The majority of motorized travel occurs during the relatively dry summer months when the routes are accessible (BLM 2013h).

The view shed is generally pristine with few human-created features. There are about approximately 14 known range improvements, one reclaimed plugged and abandoned gas well pad, and a gas pipeline. Several functional water wells, with troughs and or stock ponds provide livestock with water in the northwest and eastern segments of the unit (BLM 2013h).

The unit offers visitors the opportunity to avoid the sights, sounds, and evidence of other people. The unit is of sufficient size and topographical variation to offer opportunities for outstanding solitude. The unit provides opportunities for visitors to experience activities that offer dispersed, undeveloped recreation which do not require facilities, motor vehicle, motorized equipment, or mechanized transport. The predominate area activities are rock hounding, hunting, trapping, horseback riding, photography, and wildlife watching. The majority of the unit is crucial winter range for mule deer and pronghorn antelope. The area also supports a high density of nesting raptors and provides habitat for wintering Sage-Grouse (BLM 2013h).

3.10 Livestock Grazing

3.10.1 Overview

Lands used for livestock grazing have high cultural and economic significance to Sublette County, which exports more than 31 million pounds of beef annually (Sublette County 2003). Livestock grazing occurs on BLM-administered and State lands throughout the Project Area, with BLM grazing permits and State leases distributed over nine grazing allotments. The BLM administers livestock grazing on public lands in accordance with the Taylor Grazing Act, FLPMA, Public Rangelands Improvement Act, and Wyoming Standards and Guidelines for Livestock Grazing Management (BLM 1997b). The Wyoming Office of State Lands and Investments administers grazing leases on State lands in accordance with Wyoming Statute (W.S.) 36-5-101, et seq. The analysis area for livestock grazing includes the full extent of the nine grazing allotments that intersect the Project Area (629,583 acres) (Map 11).

3.10.2 Laws, Ordinances, Regulations, and Standards

Congress, through the Taylor Grazing Act and FLPMA, has directed the BLM to authorize and administer livestock grazing on public lands in the sixteen western States. BLM Manual M-4100, *Grazing Administration*, sets forth the objectives, responsibilities, and policies for the management and administration of livestock grazing on BLM's public lands, exclusive of Alaska.

The following statutes, regulations, and orders authorize or are relevant to the BLM's grazing administration program:

- The Taylor Grazing Act of 1934, as amended, 43 U.S.C. 315 et seq.;
- The Federal Land Policy and Management Act of 1976, as amended, 43 U.S.C. 1701 et seq.;
- The Public Rangelands Improvement Act of 1978 (PRIA), 43 U.S.C. 1901 et seq.;
- Executive Orders 10046 of March 24, 1949; 10175 of October 25, 1950; 10234 of April 23, 1951; 10322 of January 26, 1952; 10787 of November 6, 1958; and 10890 of October 27, 1960. These executive orders transferred land acquired under the Bankhead-Jones Farm Tenant Act, 7 U.S.C. 1010, to the Secretary of the Interior for administration under the Taylor Grazing Act. Executive Order 12548 of February 14, 1986 indefinitely extended the PRIA grazing fee formula;
- The Oregon and California Railroad Grant Land Act of 1937, 43 U.S.C. 1181d; and
- Other public land orders, executive orders, or agreements that relate to the Secretary of the Interior's authority to administer livestock grazing on specified lands.

A Federal rulemaking to address the health, productivity, and sustainability of BLM-administered public rangelands established fundamentals of rangeland health and standards and guidelines for grazing administration (60 FR 9969 [Feb. 22, 1995], as amended at 71 FR 39508 [July 12, 2006]; codified in 43 CFR 4180). The four fundamentals of rangeland health identified in Federal regulation include: (1) properly functioning watersheds; (2) properly functioning ecological processes, including water, nutrient, and energy cycling; (3) achievement of state water quality standards; and (4) protection of habitat for Federal threatened and endangered species, Federal proposed or candidate threatened and endangered species, and other special status species (43 CFR 4180.1). The Wyoming Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management, developed by the BLM State Director, are consistent with these fundamentals and require the development of quantifiable resource objectives and specific management practices at the BLM field office level (BLM 1997b).

The Sublette County Comprehensive Plan discourages residential and recreational development on lands of high agricultural value and requires evaluation of any development that may adversely impact the amount and quality of grazing lands available to the agricultural community (Sublette County 2003).

The Sublette County Conservation District provides myriad services and programs to promote and support rangeland planning and health in Sublette County. The Sublette County Long Range Plan identifies the District's objectives to assist livestock producers with range improvements, to participate in development-related reclamation and mitigation, and promote the use of ESDs in developing vegetation objectives (Sublette County Conservation District 2013).

3.10.3 Livestock/Grazing Management

Livestock grazing occurs across the Project Area, which includes portions of nine grazing allotments—Alkali Draw, Blue Rim Desert, Blue Rim Individual, Boundary, Eighteen Mile, Figure Four, Reardon Canyon, Sand Draw, South Desert, and Sublette (Table 3-24 and Map 11).[27] All of the affected allotments extend beyond the Project Area boundary. Of these allotments, six are authorized for cattle, one is authorized for sheep, and two are authorized for sheep and cattle grazing. Collectively, the allotments support 64,065 permitted Animal Unit Months (AUMs),[28] 19,270 of which are currently suspended from use. Suspended AUMs on public lands are not authorized for use and may only be removed from suspension under the provisions of the grazing regulations at 43 CFR 4110.3-1(b). Approximately 16,499 AUMs of the total 64,065 AUMs supported by these nine grazing allotments are within the Project Area.

State lands in the Project Area support seven grazing leaseholds with a combined allocation of 1,449 AUMs. Because livestock management and AUM allocations on State leaseholds are often conducted in coordination with grazing permits on surrounding BLM-administered lands, grazing on State lands is assumed to be consistent with the description of BLM grazing allotment conditions and management throughout the remainder of this section.

There are no identified livestock driveways in the Project Area. The BLM has not identified any calving areas in or adjacent to the Project Area. There are identified lambing areas approximately one mile east of the Project Area (Map 11).

The approximately 9,000 head of cattle authorized to graze allotments within the Project Area (BLM 2015c) constitute roughly 13 percent of all cattle within Sublette County, as reported by the 2012 Agricultural Census (U.S. Department of Agriculture [USDA] 2014). Comparable data on sheep is withheld to avoid disclosing data for individual farms.

The BLM categorizes the level of management required to properly administer each grazing allotment from low to high as *custodial*, *maintain*, or *improve*. The required levels of management for allotments in the Project Area were designated in accordance with BLM Handbook 1740-1 (BLM 1987), which has subsequently been augmented with additional criteria from BLM Instruction Memorandum (IM) No. 2009-018 (BLM 2008c). Based on the original designation criteria, five of the nine allotments are designated as *maintain* allotments (BLM 2015c), with the remaining allotments designated as *improve* allotments.

Allotment Management Plans (AMPs) prescribe specific management objectives for the allotment, including grazing practices to be used, season of use, development and use of range improvements, salting practices, and management objectives such as vegetation condition goals or livestock performance targets. The BLM has developed AMPs for all but one of the allotments that intersect the Project Area (Reardon Canyon).

Cattle have shifted their traditional use patterns due to increased levels of human activity associated with oil and gas development in the region. Existing surface disturbance as a percentage of total allotment acreage is highest for the Sand Draw allotment, where surface disturbance is present on an estimated 7 percent (2,181 acres) of the allotment (see Section 4.10.1 – *Analysis Area, Methodology,*

[27] *The Blue Rim Individual Allotment was determined to have minimal (less than one acre) to no overlap with the Project Area, and was therefore excluded from the analysis.*

[28] *One AUM represents the amount of forage required to sustain either one cow, one cow with a calf of six months or younger, or five sheep for one month.*

and Analysis Assumptions) for methods used to estimate existing disturbance). The Sand Draw allotment was rested from livestock grazing between 2008 and 2012 due to conflicts with the intensive oil and gas development in the JIDPA, which overlaps a large portion of this allotment. Existing surface disturbance constitutes less than 2 percent of the land area of the eight remaining allotments that overlap the Project Area (Table 3-24).

The resultant effects on livestock grazing in the Project Area due to oil and gas development over the last two decades are likely to be similar in nature to the following effects described in the JIDPA EIS (BLM 2006a), but on a much smaller scale due to the lower density of proposed surface development in the Project Area:

- The quality of forage on successfully reclaimed well pads and ROWs, which is typically younger, more succulent, and more easily obtained than forage from surrounding areas, is attractive to livestock, wild horses, and antelope, provided that their access to the vegetation is not prevented by fencing around the well pad perimeter.
- New water sources are now available for livestock use that either supplement existing water sources or provide new water in previously dry areas.
- Livestock mortalities have occurred from drinking toxic fluids in drilling pits and from vehicular collisions along the upgraded roads; however, the installation of fencing around most livestock hazards has greatly reduced the risk of mortalities.
- Fencing has also shifted livestock use patterns and movements and increased the recovery of vegetation in some disturbed sites. However, shifting livestock use patterns and movements is generally viewed as an adverse impact to livestock grazing.
- Surface disturbances have increased the amount of fugitive dust and its accumulation on forage, decreasing forage quality and palatability.

Brief summaries of the nine grazing allotments within the Project Area are provided below. All information was obtained through the BLM Rangeland Administration System (RAS) (BLM 2015c) and geographic information systems (GIS) data obtained from the BLM PFO and RSFO (BLM 2015a), unless otherwise indicated.

Table 3-24. Livestock/Grazing Allotments within the Project Area

Allotment Name	BLM Field Office	Total Allotment Acreage	Federal Acres in Allotment	Existing Surface Disturbance in Allotment (acres)[2]	Total Permitted AUMs in Allotment	Average Acres per AUM	Allotment Acreage within Project Area[1]	Projected AUMs within Project Area	Livestock Type	Grazing Period	
										Begin	*End*
Alkali Draw	PFO	28,574[1]	27,128[1]	184	2,993	9.5	15,606	1,635	Cattle	05/01	10/31
Blue Rim Desert	PFO	41,274[1]	39,508[1]	217	5,432	7.6	18,401	2,422	Cattle	05/01	06/21
Boundary	RSFO	32,028	29,995	536	3,626	8.8	17,911	2,030	Cattle	05/01	01/31
									Sheep	05/01	01/31
Eighteen Mile	RSFO	245,658	228,840	4,237	22,430	11.0	1,162	106	Cattle	05/01	01/31
									Sheep	05/01	01/31
Figure Four	RSFO	117,693	114,425	2,416	11,108	10.6	4,178	395	Cattle	05/10	01/10
Reardon Canyon	PFO	23,930	21,650	144	2,114	11.3	325	29	Cattle	05/10	09/09
Sand Draw	PFO	31,967	30,047	2,181	4,465	7.2	10,752	1,507	Cattle	05/01	06/21
South Desert	PFO	34,564[1]	33,285[1]	500	4,741	6.2	33,561	4,603	Cattle	05/01	06/21
Sublette	RSFO	73,895	66,029	444	7,156	10.3	38,958	3,773	Cattle	05/01	01/31
									Sheep	05/01	01/31
Total[3]		**629,583**	**590,907**	**10,859**	**64,065**	**10.0[4]**	**140,852**	**16,499**	**N/A**	**N/A**	**N/A**

Source: Grazing allotment information was obtained through the BLM RAS (BLM 2015c), supplemented by GIS data provided by the PFO and RSFO (BLM 2013b).

[1]Represents a GIS-derived value.
[2]See Section 4.10.1 (*Analysis Area, Methodology, and Analysis Assumptions*) for methods used to estimate existing disturbance.
[3]Sum of column values may not equal column totals due to rounding and GIS clipping.
[4]Represents the weighted average acres per AUM for the nine allotments that overlap the Project Area (weighted by the total acreage of each allotment).

AUM Animal Unit Month
BLM Bureau of Land Management
GIS geographic information system
N/A Not Applicable
NPL Normally Pressured Lance
PFO Pinedale Field Office
RAS Rangeland Administration System
RSFO Rock Springs Field Office

Note: Grazing allotment acreages obtained from GIS data differ from acreages obtained through the BLM RAS. The BLM RAS values are assumed to be more accurate; however, GIS-derived values were used as necessary to obtain specific information for the Project Area.

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3.10.3.1 Alkali Draw Allotment

The season of use in this allotment is from May 1 until October 31. This allotment contains approximately 28,574 total acres and has two cattle grazing permits totaling 2,993 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 9.5 acres per AUM. About 55 percent (15,606 acres) of the allotment occurs within the Project Area. The allotment currently has 1,437 suspended AUMs (48 percent of total preference level) and is classified under the *maintain* category.

The most recent forage utilization records show that utilization was light (10 to 20 percent) in the southeastern portion of the allotment and moderate (30 to 50 percent) in the southwestern portion of the allotment. Utilization data has not been collected in the northern half of the allotment (Lopez 2013).

Trend data collected in 2004 characterized 47 percent of the plant composition by weight as Letterman's needlegrass (*Achnatherum lettermannii*) followed by rabbitbrush (*Chrysothamnus* spp.) at 17 percent composition by weight. Other plant species found were in quantities of less than 10 percent (Lopez 2013). Sublette County Conservation District is planning on conducting an ecological site inventory and the results will be reported to the BLM, when available.

3.10.3.2 Blue Rim Desert Allotment

The season of use in this allotment is from May 1 until June 21. This allotment contains approximately 41,274 total acres and has four cattle grazing permits totaling 5,432 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 7.6 acres per AUM. About 45 percent (18,401 acres) of the allotment occurs within the Project Area. The allotment currently has 2,599 suspended AUMs (48 percent of total preference level) and is classified under the *maintain* category.

The most recent data shows low to moderate utilization levels (0 to 37 percent) on five monitoring sites throughout the allotment (Feeman 2015).

Trend data collected in 2004 indicated that thickspike wheatgrass (*Elymus lanceolatus*) made up the largest percentage (36 percent) of plant composition by weight followed by Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*) (32 percent). This trend data was confirmed by use of the Daubenmire method for determining cover class (Lopez 2013). Sublette County Conservation District is planning on conducting an ecological site inventory and the results will be reported to the BLM, when available.

3.10.3.3 Boundary Allotment

The season of use in this allotment is from May 1 until January 31. This allotment contains approximately 32,028 total acres and has one cattle grazing permit and one sheep grazing permit totaling 3,626 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 8.8 acres per AUM. About 56 percent (17,911 acres) of the allotment occurs within the Project Area. The allotment currently has 630 suspended AUMs (17 percent of total preference level) and is classified under the *maintain* category.

The Boundary allotment is grazed in conjunction with the Poston Allotment (BLM 1981). General observations suggest that the northern portion of this allotment experiences light forage utilization (BLM 2006a). Sheep grazing is managed by a short-duration rotation grazing system requiring utilization of the plant species in the allotment to be less than 25 percent before seed ripe time for the entire allotment (BLM 1981). Cattle use is managed by a three-pasture deferred grazing system.

3.10.3.4 Eighteen Mile Allotment

The season of use in this allotment is from May 1 until January 31. This allotment contains approximately 245,658 total acres, and has one cattle grazing permit and six sheep grazing permits totaling 22,430 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 11.0 acres per AUM. Less than one percent (1,162 acres) of the allotment occurs within the Project Area. The allotment currently has 3,436 suspended AUMs (15 percent of total preference level) and is classified under the *improve* category as of the most recent allotment assessment (BLM 1999a). The rationale and status of this determination are described in greater detail in Section 3.10.5 (*Wyoming Standards for Healthy Rangelands*) below.

Livestock grazing on the Eighteen Mile allotment is managed as a two-pasture deferred rotation system (BLM 2003a). Use areas within each pasture are associated with water developments and rivers. Grazing management schemes for this allotment must consider the goals of the *Big Sandy Grazing Management Plan EA* (BLM 2003b), which promotes "the improved ecological function of the river corridor and improvement/sustainability of native vegetation communities."

3.10.3.5 Figure Four Allotment

The season of use in this allotment is from May 10 until January 10. This allotment contains approximately 117,693 total acres and has two cattle grazing permits totaling 11,108 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 10.6 acres per AUM. About four percent (4,178 acres) of the allotment occurs within the Project Area. The allotment currently has 4,464 suspended AUMs (40 percent of total preference level) and is classified under the *improve* category.

The Figure Four allotment is divided into two use areas; each use area is managed by a two-pasture deferred rotation grazing system (BLM 1980). The allotment experiences a short growing season of approximately 100 days due to a short warm season and persistent westerly winds.

3.10.3.6 Reardon Canyon Allotment

The season of use in this allotment is from May 10 until September 9. This allotment contains approximately 23,930 total acres and has two cattle grazing permits totaling 2,114 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 11.3 acres per AUM. About 1 percent (325 acres) of the allotment occurs within the Project Area. The allotment currently has 993 suspended AUMs (47 percent of total preference level) and is classified under the *improve* category.

The topography and lack of reliable water sources in this allotment have created areas of high utilization around water sources, while other areas remain unutilized. According to the most recent allotment utilization data, the highest levels of forage utilization have occurred along the western edge of the allotment, in the vicinity of Milleson Draw and Reardon Canyon (Lopez 2013).

In 1993, the Reardon Draw Project, a coordinated effort between the BLM, Natural Resources Conservation Service (NRCS), Sublette County Conservation District, the EPA, and permittees, was implemented to enhance livestock distribution through active herding and to reduce sediment runoff into the Green River. Active herding was used to push cattle into areas where the new gravity-fed pipeline watering system had been installed. Despite these efforts, monitoring sites established along the pipeline indicated little success in the five years following the project's implementation due to mechanical failures with the watering system and unsuccessful herding attempts (Lopez 2013).

3.10.3.7 Sand Draw Allotment

The season of use in this allotment extends from May 1 until June 21 and is important to the permittee for spring grazing. This allotment contains approximately 31,967 total acres and has one cattle grazing permit for 4,465 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 7.2 acres per AUM. About 34 percent (10,752 acres) of the allotment occurs within the Project Area. The allotment currently has 2,141 suspended AUMs (48 percent of total preference level) and is classified under the *maintain* category.

The permittee in this allotment turns out cattle on the northern end of the allotment during odd-numbered years and the southern end during even-numbered years. The cattle then drift to the opposite ends of the allotment. In 2004, the permittees of the Sand Draw Allotment entered into a joint cooperative rangeland monitoring program funded through the Secretary of the Interior's 4Cs initiative, and through an agreement between the BLM and the Public Lands Council (BLM 2006a; Lopez 2013). Under this program, the grazing permittees jointly monitor rangeland use and health, with BLM range specialists using scientifically approved rangeland monitoring methods, focusing primarily on annual forage utilization and the long-term trend of species composition (BLM 2006a).

Due to the heavy oil and gas activity and the conflicts that arose during the boom in the JIDPA, this allotment was rested for five years, from 2008 to 2012. Collection of forage utilization data in 2015 from the seven 4C's monitoring sites throughout the allotment indicates generally low utilization (0 to 18 percent) (Feeman 2015). In addition, an ecological site inventory is being conducted for this allotment by the Sublette County Conservation District and results will be reported to the BLM once available (Lopez 2013).

3.10.3.8 South Desert Allotment

The season of use in this allotment is from May 1 until June 21. This allotment contains approximately 34,564 total acres and has five cattle grazing permits for 4,741 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 7.3 acres per AUM. About 97 percent (33,561 acres) of the allotment occurs within the Project Area. The allotment currently has 2,486 suspended AUMs (52 percent of total preference level) and is classified under the *maintain* category.

Utilization data collected in 2015 from seven monitoring sites throughout the allotment indicate light forage utilization (0 to 29 percent) (Feeman 2015). Trend monitoring locations are scattered throughout the allotment and use different methods to assess trends. Trend data from 2005 identified 12 species, with thickspike wheatgrass and Indian ricegrass (*Achnatherum hymenoides*) as the two dominant plant species, at 81 percent and 8 percent of plant composition by weight, respectively. All other plant species were 3 percent or less in weighted composition (Lopez 2013). Sublette County Conservation District is planning on conducting an ecological site inventory and the results will be reported to the BLM, when available.

3.10.3.9 Sublette Allotment

The season of use in this allotment is from May 1 until January 31. This allotment contains approximately 73,895 total acres and has one cattle/sheep grazing permit and two sheep grazing permits for 7,156 permitted AUMs. The land area and permit relationship indicate an approximate stocking rate of 10.3 acres per AUM. About 53 percent (38,958 acres) of the allotment occurs within the Project Area. The allotment currently has 1,084 suspended AUMs (15 percent of total preference level) and is classified under the improve category.

Water control is the basis of grazing management for the Sublette allotment, which utilizes a deferred rotation management system. Both sheep and cattle are managed by herding and water control (BLM 1983).

3.10.4 Structural Range Improvements

There are approximately 82 existing structural range improvements on grazing allotments within the Project Area (BLM 2015a, BLM 2015b). These projects generally serve to improve the transport and storage of stock water, and include 20 water supply wells, 25 reservoirs, 12 water supply wells and reservoirs, 15 pits, 8 pipelines, and 2 raintraps, as summarized in Table 3-25 and depicted on Map 11.

Table 3-25. Structural Range Improvements within the Project Area

Grazing Allotment (Number of Range Improvement Projects)[1]/Project Name	Range Improvement Project Type
Alkali Draw (17)	
Alkali Bend Pit	Pit
Alkali Draw #3	Pit
Alkali Draw Pit #1	Pit
Alkali Draw Pit #2	Pit
Alkali Draw Pit #4	Pit
Alkali Ridge Res #3	Pit
Alkali Ridge Res One	Pit
Alkali Ridge Res Two	Pit
Alkali Spring	Water Supply Well
Buckhorn Well #4	Water Supply Well
Dirt Bike Pit	Pit
Luman Res #1	Reservoir
Reardon Breaks Res	Pit
Vital Reservoir	Reservoir
Wardell Wood Res #1	Reservoir
Wardell Wood Res #2	Reservoir
Wardell Wood Res #5	Reservoir
Blue Rim Desert (15)	
AE Schwabacher Res	Reservoir
Alkali Draw Pit #5	Pit
Burma Pipeline #2 Trough 1	Pipeline
Burma Pipeline #2 Trough 2	Pipeline
Burma Pipeline SE Trough 1	Pipeline
Burma Pipeline SE Trough 2	Pipeline
Burma Road Well	Water Supply Well
Burma Well #3	Water Supply Well
Burma West Well	Water Supply Well
Desert Well W Trough	Pipeline

Table 3-25. Structural Range Improvements within the Project Area

Grazing Allotment (Number of Range Improvement Projects)[1]/Project Name	Range Improvement Project Type
Granite Res	Reservoir
Granite Wash Res #1	Reservoir
Granite Wash Well	Water Supply Well
Luman Res #2	Reservoir
Wardell Reservoir	Reservoir
Boundary (11)	
Boundary Well	Water Supply Well and Reservoir
Erramouspe Reservoir	Reservoir
Erramouspe Well	Water Supply Well and Reservoir
Flowing Well Reservoir	Water Supply Well and Reservoir
GE Reservoir #19	Reservoir
GE Reservoir #20	Reservoir
GE Reservoir #21	Reservoir
GE Reservoir #23	Reservoir
Jonah Well #1	Water Supply Well
Unknown	Reservoir
Windmill Well	Water Supply Well and Reservoir
Sand Draw (11)	
Antelope Res #6	Reservoir
Burma Road Rain Trap	Raintrap
Clay Hill Pipeline W Trough 2	Pipeline
Desert Well	Water Supply Well
Granite Reservoir	Reservoir
Horse Trap Well	Water Supply Well
Sagebrush Res	Reservoir
Southeast Desert Pit #1	Pit
Wild Horse Trap Ret Dam	Pit
Yellow Point Pipeline S Trough 2	Pipeline
Yellow Point Ret Dam	Pit
South Desert (18)	
Alkali Fence Well	Water Supply Well
Antelope Pipeline[2]	Pipeline
Antelope Res #3	Reservoir
Antelope Res #4	Reservoir
Antelope Res #5	Reservoir
Antelope Res #7	Reservoir
Antelope Well[2]	Water Supply Well
Buckhorn Well #2	Water Supply Well

Table 3-25. Structural Range Improvements within the Project Area

Grazing Allotment (Number of Range Improvement Projects)[1]/Project Name	Range Improvement Project Type
CCC Road Well	Water Supply Well
Chapel Canyon Pit	Pit
Dry Lakes Rain Trap[2]	Raintrap
J. William Bloom Well[2]	Water Supply Well
Piney Cutoff Well Drill	Water Supply Well
South Desert Well	Water Supply Well
Sugar Loaf Well #1	Water Supply Well
Sugar Loaf Well #2[2]	Water Supply Well
Wardell Wood Res #6[2]	Reservoir
Wardell Wood Res #7[2]	Reservoir
Sublette (10)	
12 Mile Road Well	Water Supply Well and Reservoir
Arambel Flowing Well	Water Supply Well and Reservoir
Capped Well	Water Supply Well
Davis Luman Well	Water Supply Well and Reservoir
Ed Swanson Well	Water Supply Well and Reservoir
Holmes 5-1 Well and Pipeline	Water Supply Well
Sublette #4 Well	Water Supply Well and Reservoir
Sublette #5 Well	Water Supply Well and Reservoir
Sublette Reservoir 2	Water Supply Well and Reservoir
Tea Kettle Butte Well	Water Supply Well and Reservoir

Source: BLM 2015a; BLM 2015b.

[1]No range improvements exist on the portions of the Reardon Canyon, Figure Four, and Eighteen Mile grazing allotments located within the Project Area.
[2]Range improvement represented by multiple points on Map 11.

3.10.5 Wyoming Standards for Healthy Rangelands

The BLM periodically reviews grazing allotments or groups of allotments in a watershed based on an allotment categorization and prioritization process. Eight of the grazing allotments that overlap the Project Area have been evaluated for compliance with the Wyoming Standards for Healthy Rangelands. Based on the most recent assessments, which were completed between 1998 and 2003, six of these allotments are in attainment with the standards (Lopez 2012; Mastny 2012) (Table 3-26). Due to continuing adverse effects to riparian and wetland areas within the Alkali Draw allotment from mechanical alterations to Alkali Creek in the 1930s, this allotment failed to meet standard number two (condition of riparian and wetland vegetation) of the Wyoming Standards for Healthy Rangelands in 2003 (Lopez 2012).

The BLM determined that the Eighteen Mile grazing allotment also failed to meet standard number two of the Wyoming Standards and Guidelines for Livestock Grazing Management due to livestock grazing practices when it was assessed in 1999 (BLM 1999a). Another assessment has been initiated, but results were not available for incorporation in this document. Due to coordinated efforts from both BLM and permittees to improve conditions in this allotment in accordance with the *Big Sandy Grazing Management Plan EA*, the results of the 1999 assessment may not reflect current conditions.

Table 3-26. Grazing Allotments Management Status and Health within the Project Area

Allotment Name	Management Category[1]	AMP Implemented? (Year)[1]	Wyoming Standards for Healthy Rangelands Assessment Completed? (Year)[2]	Met Standards?[2]	Reason Standards Not Met (if applicable)[2]
Alkali Draw	Maintain	Y (1969)	Y (2003)	N	Riparian/Wetland-Mechanical alterations of Alkali Creek in the 1930s (not due to grazing)
Blue Rim Desert	Maintain	Y (1969)	Y (2001)	Y	N/A
Boundary	Maintain	Y (1981)	Y (2002)	Y	N/A
Eighteen Mile	Improve	Y (2003)	Y (1999)	N	Riparian/Wetland-Livestock Management[3]
Figure Four	Improve	Y (1980)	Y (2002)	Y	N/A
Reardon Canyon	Improve	N	N	Not Assessed	N/A
Sand Draw	Maintain	Y (1969)	Y (2001)	Y	N/A
South Desert	Maintain	Y (1969)	Y (2001)	Y	N/A
Sublette	Improve	Y (1983)	Y (2002)	Y	N/A

[1]Grazing allotment management categories and AMP status was obtained through the BLM RAS (BLM 2015c) and personal communication with the BLM (Mastny 2012).
[2]Rangeland health status information was obtained through communication with the BLM PFO and RSFO (Lopez 2012; Mastny 2012).
[3]The most recent assessment of the Eighteen Mile allotment was conducted in 1999, and thus may not reflect current conditions.

AMP Allotment Management Plan
N No
N/A Not Applicable
NPL Normally Pressured Lance
Y Yes

3.11 Noise

3.11.1 Overview

This section presents an evaluation of existing sound levels in the Project Area as measured at noise monitoring sites. Noise monitoring locations were identified based on the location of Sage-Grouse PHMA, which were identified as the primary sensitive noise receptor in the Project Area. The analysis area for noise includes the Project Area, the primary transportation corridors (U.S. Highway 191 and State Highway 351), and the primary NPL field access road (Luman Road). To adequately assess the noise-related impacts of the NPL Project, an ambient noise monitoring program was implemented to document baseline conditions and to allow comparison and analysis of project-related noise levels resulting from construction and operation of the NPL Project. The BLM used noise monitoring sites at six Greater Sage-Grouse (*Centrocercus urophasianus*) display sites (leks) within the Project Area to determine ambient or baseline noise levels to compare with project-related noise levels in order to comply with the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and Wyoming EO 2015-4.

The natural noise environment in the Project Area is primarily characterized by wind noise through the vegetation along with animal and insect noise. Anthropogenic noise sources in the Project Area include existing natural gas development activities, including well pad, road, and pipeline construction; flaring, drilling, and facility operations; vehicle traffic; and site reclamation.

3.11.2 Laws, Ordinances, Regulations, and Standards

3.11.2.1 Federal

The Federal Noise Control Act of 1972 (Public Law 92-574) established a requirement that all federal agencies administer their programs to promote an environment free of noise that would jeopardize public health or welfare. The EPA was given the responsibility for:

- Providing information to the public regarding identifiable effects of noise on public health and welfare.
- Publishing information on the levels of environmental noise that will protect the public health and welfare with an adequate margin of safety.
- Coordinating Federal research and activities related to noise control.
- Establishing Federal noise emission standards for selected products distributed in interstate commerce.

As part of its responsibility, the EPA published “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety” in 1974 (EPA 1974). This report identifies sound levels less than or equal to 55 Day-Night Levels (L_{dn}) as being requisite in residential areas (and other places in which quiet is a basis for use) to avoid annoyance and interference with outdoor activity (EPA 1974).

The FLPMA of 1976, as amended, identifies requirements for protecting public lands in Federal ownership. Title II of the FLPMA relates to noise and states that, in the development and revision of land use plans, the Secretary of the Interior shall provide for compliance with applicable pollution control laws, including state and Federal air, water, noise, or other pollution standards or implementation plans.

3.11.2.2 State

Wyoming E0 2015-4, as adopted by the BLM, specifies Wyoming’s statewide requirements for protecting Sage-Grouse in identified PHMA.[29] Attachment B of Wyoming EO 2015-4 specifies

[29] *The BLM and Jonah Energy would apply to the NPL Project resource protection measures, stipulations, and other guidance for development in sage-grouse habitat resulting from the BLM Sage-Grouse 9 Plan RMP Amendment (BLM 2015e) and other new/revised decisions and policy, as appropriate.*

stipulations for development in identified Sage-Grouse Core Habitat (i.e., PHMA). One of the general stipulations in Wyoming EO 2015-4 relates to noise and states:

> *New project noise levels, either individual or cumulative, should not exceed 10 decibels (as measured by L_{50}) above baseline noise at the perimeter of a lek from 6:00 p.m. to 8:00 a.m. during the breeding season (March 1–May 15).*

Several other general stipulations relate to minimum distances allowed between occupied Sage-Grouse leks and development activities.

3.11.2.3 Local

The Project Area is within Sublette County and local ordinances and regulations would be followed for applicable actions under local jurisdiction. Section 14 of the Sublette County Zoning and Development Regulations relates to noise and states:

> *No use shall be operated so that noise resulting from said use is perceptible beyond the boundaries of the property on which said use is located. Intermittent noise from vehicles, ranching and farming operations, chainsaws and similar equipment in private use, temporary construction operations, and uses in the C-1, CH-1, I-L, and I-H districts shall be exempt from this section.*

The exempt land uses are:

- **General Commercial (C-1)**: Provides areas for orderly and compact commercial development.
- **Highway Commercial (CH-1):** Provides areas for orderly and compact highway-related commercial development.
- **Light Industrial (I-L):** This district provides areas for safe, non-nuisance causing industrial uses.
- **Heavy Industrial (I-H):** This district provides areas for general industrial uses.

3.11.3 Noise Terminology and Concepts

3.11.3.1 Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. *Noise* is defined as loud, unexpected, or annoying sound.

In the science of *acoustics*, the fundamental model consists of a sound source, a receiver, and the propagation path between the two. The loudness of the source and obstructions or atmospheric factors affecting the propagation path to the receiver determine the sound level and characteristics of the sound perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

3.11.3.2 Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz (20 kHz).

3.11.3.3 Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. A logarithmic scale is commonly used to determine sound pressure level (SPL) in terms of decibels (dB). The dB is a unitless measure of sound on a logarithmic scale. Under the decibel scale, a doubling of sound energy corresponds to a three-dB increase. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB; rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level five dB louder than one source.

The decibel scale alone does not adequately characterize how noise is perceived. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. The “A-weighted” sound level (expressed in units of A-weighted decibels [dBA]) approximates the frequency response of the average healthy human ear when listening to most ordinary sounds. When people judge the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted levels of those sounds. Noise levels for environmental noise studies are typically reported in terms of dBA. Table 3-27 describes typical A-weighted noise levels for various noise sources.

Table 3-27. Typical Sound Levels Measured in the Environment and Industry

Example Noise Source or Noise Environment	A-weighted Sound Levels	Subjective Impression
Shotgun (at shooter’s ear) or on a carrier flight deck	140	Painfully loud
Civil defense siren (100 feet)	130	-
Jet takeoff (200 feet)	120	Threshold of pain
Loud rock music	110	-
Pile driver (50 feet)	100	Very loud
Ambulance siren (100 feet) or in a boiler room	90	-
Pneumatic drill (50 feet) or in a noisy restaurant	80	-
Busy traffic; hair dryer	70	Moderately loud
Normal conversation (5 feet) or in a data processing center	60	-
Light traffic (100 feet); rainfall or in a private business office	50	-
Bird calls (distant) or in an average living room or library	40	Quiet
Soft whisper (5 feet); rustling leaves or inside a quiet bedroom	30	-
In a recording studio	20	-
Normal breathing	10	Threshold of hearing

Source: Beranek 1988.

3.11.3.4 Noise Descriptors

Noise in the daily environment fluctuates over time. Various noise descriptors have been developed to describe time-varying noise levels. Following are noise descriptors commonly used in environmental noise analysis.

Equivalent Sound Level (L_{eq}). The average of sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level that in a stated period would contain the same acoustical energy as the time-varying sound that actually occurs during the same period.

Percentile sound levels (L_N). Since the noise levels in a community vary with time in a more or less random manner, the descriptors of these time varying noise levels may be defined in statistical terms. The statistical descriptors are referred to as the percentile sound levels, with L_N defined as the level exceeded N percent of the time. The descriptors often used are:

- L_1, Level of Highly Intrusive Sounds—The level exceeded 1 percent of the time, a measure of highly intrusive sounds.
- L_{10}, Level of Intrusive Sounds—The level exceeded 10 percent of the time, used to indicate the average level of the intrusive sounds.
- L_{50}, Median Level—The level exceeded 50 percent of the time, or the median level, a useful measure of the average noise conditions on a site.
- L_{90}, Background Level—The level exceeded 90 percent of the time. It provides a good indication of the steady background noise level on a site.

Maximum and Minimum Sound Levels (L_{max} and L_{min}). The maximum and minimum sound levels measured during a measurement period.

Day-Night Level (L_{dn}). The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

3.11.3.5 Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The nature of the source, including its height relative to the ground, atmospheric factors (e.g., wind direction), and shielding (e.g., by topographic features) all influence how sound decreases over distance. The manner in which noise reduces with distance depends on whether the source is localized (point) or multiple sources on a defined path (line). The sound level decreases at a rate of six dB for each doubling of distance from a point source. Noise from a line source propagates outward in a cylindrical pattern. Sound levels attenuate at a rate of three dB for each doubling of distance from a line source (e.g., a highway).

The propagation path of noise from a highway to a receiver is usually very close to the ground. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance.

Weather conditions, such as air pressure, humidity, and turbulence (wind), can all affect sound propagation. Receptors downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels.

A large object or barrier in the path between a noise source and a receiver can substantially decrease noise levels at the receiver. The amount of decrease depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills, dense woods) and human-made features (e.g., buildings, walls) can substantially reduce noise levels. A barrier that breaks the line of sight between a source and a receiver typically will result in at least five dB of noise reduction. Vegetation is rarely effective in reducing noise because it does not create a solid barrier.

3.11.3.6 Human Response to Changes in Noise Levels

As discussed above, doubling sound energy results in a three dB increase in SPL. However, given a sound-level change measured with precise instrumentation, the subjective human perception of a doubling of loudness usually will be different from what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern one-dB changes in sound levels when exposed to steady, single-frequency ("pure-tone") signals in the 1,000 Hz to 8,000 Hz range. In typical noisy environments, changes in noise of one to two dB generally are not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of three dB in typical noisy environments. Further, a five-dB increase is generally perceived as a distinctly noticeable increase, and a 10 dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a three-dB increase in sound generally would be perceived as barely detectable.

3.11.3.7 Sage-Grouse Response to Noise

The discussion above relates specifically to the frequency response of the human ear, and how humans perceive noise. The auditory system of the Sage-Grouse has a much different frequency response than the human ear. In general, optimal avian hearing is in a frequency range between 1 and 5 kHz (Dooling 2002).

Ambient sound plays a central role in Sage-Grouse breeding behavior. Male Sage-Grouse select leks that are highly visible and have good acoustic propagation characteristics (Dantzker et al. 1999; Braun et al. 2002), relatively free of tall vegetation or ground cover. The male mating display sequence consists of a cooing pattern with highly directional sound energy in the range of 300–600 Hz, followed by popping and whistling sounds in the range of 600–3200 Hz. The lower frequencies of the cooing and popping components of the male display propagate over fairly long distances (Dantzker et al. 1999). Sounds produced by a lekking male allow females to locate leks and select mating partners among displaying males (Blickley et al. 2012). It should also be noted that communication between females and broods may be as important as communication between lekking males and females. Most vocalizations between hens and chicks are much quieter than sounds produced by males on leks, and therefore much more prone to masking due to construction or operational noise (Patricelli et al. 2013).

A study conducted at the University of Wyoming in 2005 concluded that declines in numbers of male Sage-Grouse attending leks were greatest in areas downwind of drilling activities or within three kilometers (km) (two miles) of haul roads (Holloran 2005). The study indicated that increased noise intensity at lek sites was likely a contributing factor to decreases in lek attendance.

A multi-year study conducted on public lands in Fremont County, Wyoming, by the University of California-Davis focused on effects of noise on Sage-Grouse mating behavior and long-term lek attendance rates by isolating the effects of noise from other factors, such as visibility of gas developments and habitat fragmentation. Drilling noise and road noise was played on leks at 70 dBF sound pressure level (unweighted decibels). There is evidence that the effects of chronic, or continuous, noise may differ substantially from those of short-term noise and is another contributing factor in decreases in lek attendance. The study found that introduction of noise associated with oil and gas development resulted in an immediate and sustained decrease in lek attendance. The results of the study suggest that intermittent[30] noise sources such as the fluctuation of noise from heavy truck traffic on haul roads have a greater negative effect on lek attendance than continuous noise, such as emissions from drilling operations. The study indicated a decrease of 73 percent in peak male attendance due to road noise, while continuous noise resulted in a decrease of 29 percent (Blickley et al. 2012), suggesting that noise metrics that account for characteristics of intermittent noise (e.g., L_{max}) would be better predictors of the effects of introduced noise on Sage-Grouse lek attendance, compared to hourly average noise metrics.

There are 10 occupied Sage-Grouse leks located throughout the Project Area (Map 13). Noise guidelines in the BLM Sage-Grouse 9 Plan RMP Amendment (BLM 2015e) and Wyoming EO 2015-4 were issued in part to help reduce adverse impacts of noise on Sage-Grouse. The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and Wyoming EO 2015-4 limit noise generated by human development to 10 dBA above the existing baseline noise level at the perimeter of a Sage-Grouse lek. While the frequency range of the acoustic component of the male display falls within the dominant frequencies of the human ear, the dominant frequencies of the Sage-Grouse auditory system differ from the A-weighted scale, which is designed for humans. However, because dBA do conform with the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and Wyoming EO 2015-4, which relates to Sage-Grouse, as well as L_{dn} standards for residential areas, they are used in the NPL Project noise analysis in this EIS.

3.11.4 Existing Noise Sources in the Project Area

The Project Area consists of relatively flat, dry rangeland with sparse, low vegetation and few trees. The ground is dry in the warmer months and typically covered in snow during winter months. With the exception of Jonah Energy's workforce facility in the JIDPA, there are no developed areas for human habitation in or in the immediate vicinity of the Project Area. The nearest populated areas are several miles west of the NPL Project perimeter.

Existing natural gas development activities in the Project Area generate noise through well pad, road, and pipeline construction; flaring, drilling, and facility operations; vehicle traffic; and site reclamation. Additional sources of noise include wind through vegetation and wildlife-related vocalizations and activity.

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[30] *Intermittent traffic is defined as short periods of loud noise interspersed with longer periods of quiet (Blickley and Patricelli 2013).*

3.11.5 Ambient Noise Level

3.11.5.1 Methodology

The existing ambient noise environment was characterized by conducting an ambient noise monitoring study within the Project Area, focusing on Sage-Grouse leks the primary sensitive noise receptor in the Project Area. The purpose of the noise monitoring was to establish an understanding of existing ambient noise levels at the perimeter of Sage-Grouse leks in the Project Area and to inform the programmatic-level analysis in the NPL Project EIS.

At the present time, noise impact thresholds for Sage-Grouse are directed by Wyoming EO 2015-4 and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) which indicate that new project noise levels, either individual or cumulative, should not exceed 10 dBA (as measured by L_{50}) above baseline noise at the perimeter of a lek from 6:00 p.m. to 8:00 a.m. during the breeding season. The ambient noise levels monitored at Sage-Grouse leks in the Project Area and presented in this EIS are not intended to serve as the baseline for assessing noise increase thresholds for site-specific permitting and development. Prior to authorizing site-specific development, the BLM will consider the need for additional site-specific noise monitoring based on updated noise monitoring protocols and standards, current Sage-Grouse science and research, specific proposed development locations in relation to Sage-Grouse leks and other Sage-Grouse habitats, and other factors.

Ambient noise level monitor kits were installed at the perimeter of six Sage-Grouse leks in the Project Area (Map 13). Noise monitor sites were set up at perimeter locations around active Sage-Grouse leks such that they would cause minimal visual disturbance to birds visiting the lek (Table 3-28) (Map 13). Each kit consisted of a Larson-Davis Model 820 Type 1 sound level meter connected to a 1/2-inch random incidence microphone, which was installed on a tripod at a height of approximately eight feet above the ground. Noise monitors were set to collect noise level data continuously from April 17 to April 26, 2012.

Periods of high wind (i.e., approximately 4.6 meters per second or higher) were identified in the noise monitoring data based on wind speed data collected at Big Piney and Pinedale weather stations during the time of monitoring. Wind data was compiled from each weather station on an hourly basis and was correlated with hourly monitored noise data from each of the six monitoring locations collected during the NPL Project noise monitoring in 2012. To conform to ANSI standards, periods of high wind speed were excluded from the data set to avoid possible data contamination from wind-microphone interactions. During hours when wind speed exceeded 4.6 meters per second at either weather station, noise data records for those hours were excluded from the data set for each site. During the ten-day noise monitoring period, 126 hours of data fell between the hours of interest (6 p.m. to 8 a.m.), resulting in a total of 126 hourly records. Identifying hourly periods where wind exceeded 4.6 meters per second resulted in exclusion of 58 hourly records of monitoring data from data sets for each site, resulting in a total of 68 hourly records used in the assessment of average L_{50} values for each of the six monitoring sites. The hourly records excluded due to high wind fell primarily between the hours of 6:00 p.m. and 12:00 a.m.

Following the exclusion of periods of high wind, an average L_{50} value for the hours of 6:00 p.m. to 8:00 a.m. was calculated for each site (referred to as L_{50} average) and an overall average L_{50} value was calculated across all six monitoring sites using the same criteria.

Refer to Appendix G (*Noise Technical Report*) for additional information on methodology for the ambient noise monitoring for the NPL Project.

Table 3-28. Noise Monitoring Measurements in the NPL Project Area: Location and Timing

Monitor Site	Location Description	Sage-Grouse PHMA	Field Office	Monitoring Duration
M1	Jonah Gulch lek	Yes	Rock Springs	April 17 to April 26, 2012
M2	Canadian Flowing Well lek	Yes	Rock Springs	April 17 to April 26, 2012
M3	East Buckhorn Canyon lek	Yes	Rock Springs	April 18 to April 26, 2012
M4	Kemmer Marie lek	Yes	Rock Springs	April 17 to April 26, 2012
M5	Prairie Dog lek	No	Pinedale	April 18 to April 26, 2012
M6	West Buckhorn Draw lek	No	Pinedale	April 18 to April 26, 2012

Source: ICF 2012a.
PHMA Priority Habitat Management Area

3.11.5.2 Ambient Noise Measurement Results

At the time the noise monitors were retrieved from sites M1, M2, and M6, the microphone tripod at each of these locations was found to be in a horizontal position, with the microphone suspended in sagebrush about one foot above the ground. The cause of tripod tipping over is unknown, but none of these cases resulted in damage to the microphones or other equipment. Additionally, after an inspection of the data, no evidence of data corruption or instrument overload was found. There was no single data event or change in collected data that indicates notable difference in monitored sound levels from when the microphones were at 8 feet and when they fell to approximately 1 foot. This indicates that a microphone height of 1 foot versus a microphone height of 8 feet had no notable influence on the noise monitoring data collected.

Noise levels recorded at each monitoring station are presented in Table 3-29. Average hourly noise levels ranged from a low of 17.0 to a high of 43.1 dBA L_{50} across the six monitoring sites with an overall average hourly noise level of 23.5 dBA L_{50} (Table 3-29). Periods of high noise levels generally corresponded to morning or late afternoon times of increased vehicle traffic.

Table 3-29. Noise Monitoring Measurements in the Project Area (dBA)

Monitoring Site (Refer to Map 13)	Hourly Average Maximum Noise Level (dBA L_{eq}[h]); Time	Hourly Average Minimum Noise Level (dBA L_{eq}[h]); Time	Range of Hourly Average L_{50}, 6:00 pm to 8:00 am (dBA)	Average Hourly L_{50}, 6:00 pm to 8:00 am (dBA)
M1	51.8; 6 p.m. hour, 4/20/12	18.6; 11 p.m. hour, 4/17/12	18.6 to 26.7	22.6
M2	60.5; 6 p.m. hour, 4/21/12	19.8; 4 a.m. hour, 4/20/12	17.6 to 43.1	30.6
M3	56.9; 4 p.m. hour, 4/22/12	17.4; 4 a.m. hour, 4/25/12	17.5 to 38.9	22.1
M4	58.1; 5 p.m. hour, 4/23/12	19.8; 11 a.m. hour, 4/17/12	19.7 to 32.6	25.0
M5	50.8; 5 p.m. hour, 4/19/12	17.0; 4 a.m. hour, 4/19/12	17.0 to 30.6	19.7
M6	57.0; 4 p.m. hour, 4/22/12	17.6; 1 a.m. hour, 4/19/12	17.5 to 27.0	20.1
Average dBa L_{50} for all six monitoring sites			**23.5**	

Source: ICF 2012a.
dBA A-weighted decibel
L_{eq}(h) Average hourly equivalent sound level
L_{min} Minimum sound level
L_{max} Maximum sound level
Note: Refer to Appendix G (*Noise Technical Report*) for additional information on ambient noise measurements

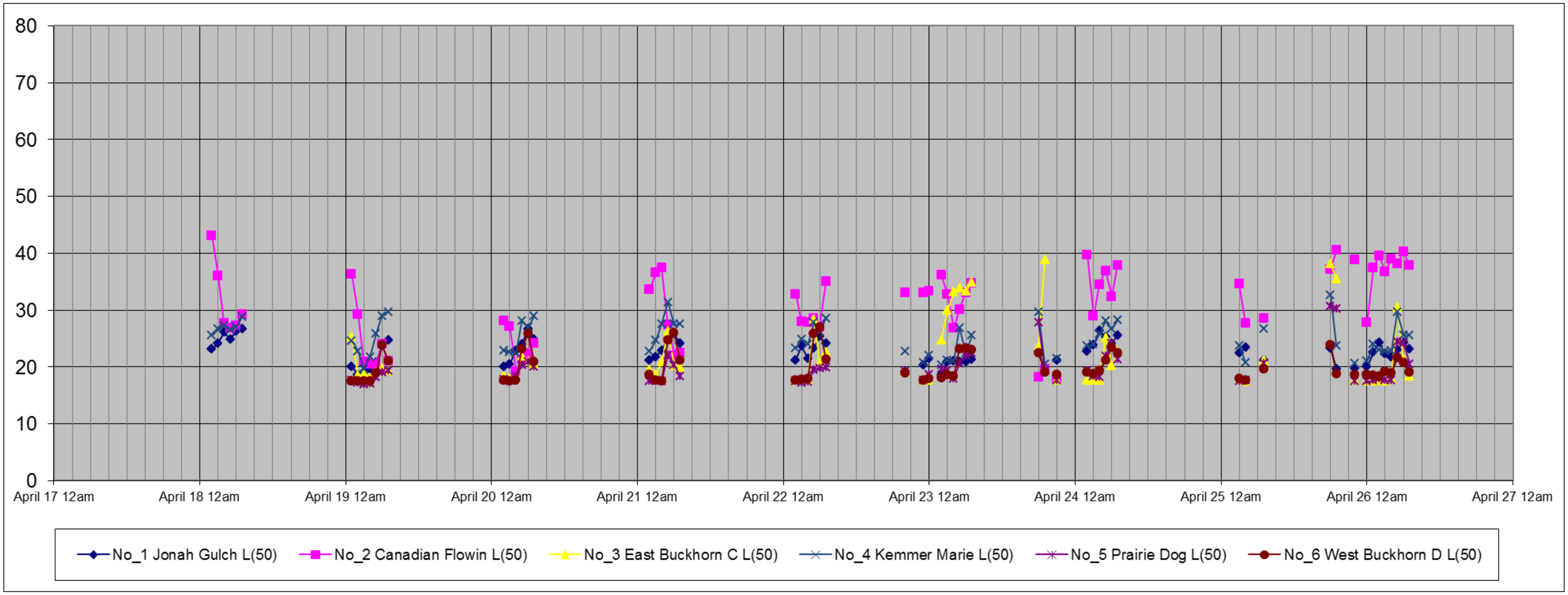
3.11.5.3 Ambient Noise Levels

The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and Wyoming EO 2015-4 indicate that "New project noise levels, either individual or cumulative, should not exceed 10 dBA (as measured by L_{50}) above baseline noise at the perimeter of the lek from 6:00 p.m. to 8:00 a.m. during the breeding season (March 1 – May 15)." As a result, ambient noise levels during this time period at the perimeter of lek monitoring locations were identified as the key time period to establish ambient noise levels.

The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and Wyoming EO 2015-4 indicate that the L_{50} noise metric is to be used to characterize the "ambient noise" level. The L_{50} noise metric represents the median sound level measured over each 1-hour measurement interval (i.e., half the time sound levels were higher than the L_{50} value and half the time sound levels were less than the L_{50} value). Continuous noise monitoring at sites M1 through M6 includes measured L_{50} values during the period of 6:00 p.m. to 8:00 a.m.

Monitored noise data in terms of L_{50} dBA noise levels between the hours of 6:00 p.m. and 8:00 a.m. are presented in Table 3-29 and depicted graphically Figure 3-18.

Figure 3-18. Hourly L50 Data at Lek Perimeter Locations in the NPL Project Area (Monitoring Sites M-1 through M-6), from the hours of 6:00 p.m. to 8:00 a.m., Excluding Hours where Wind Speed Exceeded 9 kt (10.4 mph, 4.6 m/s), April 17–April 26, 2012



Source: Refer to Appendix G (*Noise Technical Report*).

L_{50} median sound level

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Minimum L_{50} values for all monitoring sites (Map 13) between the hours of 6:00 p.m. and 8:00 a.m. were in the range of 17.0 to 19.7 dBA L_{50}, and maximum values were in the range of 26.7 to 43.1 dBA L_{50} (Table 3-29). Average L_{50} values for the six Sage-Grouse lek perimeter monitoring sites ranged from 19.7 to 30.6 dBA L_{50} (Table 3-29). The overall average L_{50} at the six lek perimeter monitoring locations between the hours of 6:00 p.m. and 8:00 a.m. was 23.5 dBA L_{50}. For the purposes of analysis, and consistent with the BLM Wyoming Sage-Grouse RMP Amendment (BLM 2015e) and Wyoming EO 2015-4, this EIS uses the average L_{50} values at each monitoring site and the overall average L_{50} for all six monitoring sites (23.5 dBa) to characterize the ambient noise level at the perimeter of lek locations in the NPL Project EIS.

Research conducted by Patricelli et al (2013) indicates that in Wyoming sagebrush habitat, ambient noise levels during nighttime and early morning hours under pre-development conditions are generally between 20 and 22 dBA. They also note that requiring an absolute value for maximum allowable ambient noise level, rather than an increase above ambient/baseline levels, may offer more protection to Sage-Grouse than either an unrealistic default value (e.g., the "Farm in Valley" definition by EPA of 39 dBA L_{50}) or limiting the increase in ambient values based on noise measurements at lek edge. The future use of an absolute value requirement may be informed by recent scientific work related to the acoustic environment of the sagebrush-steppe habitat, consistent with guidance in Wyoming EO 2015-4: *"Specific noise protocols for measurement and stipulations for implementation will be developed by additional research and as information emerges."*

At the present time, noise thresholds are directed by Wyoming EO 2015-4 and the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) which indicate that new project noise levels, either individual or cumulative, should not exceed 10 dBA (as measured by L_{50}) above baseline noise at the perimeter of a lek from 6:00 p.m. to 8:00 a.m. during the breeding season. The ambient noise levels monitored at Sage-Grouse leks in the Project Area and presented in this EIS are not intended to serve as the baseline for assessing noise increase thresholds for site-specific permitting and development. Prior to authorizing site-specific development, the BLM will consider the need for additional site-specific noise monitoring based on updated noise monitoring protocols and standards, current Sage-Grouse science and research, specific proposed development locations in relation to Sage-Grouse leks and other Sage-Grouse habitats, and other factors.

It is important to note the distinction between ambient noise levels measured in the Project Area and "baseline" noise levels. Baseline noise levels are representative of the natural environment with no anthropogenic sources present, such as vehicle activity and oil and gas development and operation. Ambient noise levels are representative of the existing sound environment including anthropogenic sources that may be present. It should be noted that ambient noise levels monitored in the Project Area include some level of human activity from oil and gas operations, as observed at sites M-1 and M-4. As a result, ambient levels at the monitored lek perimeter locations (Map 13) include natural sounds along with the influence of anthropogenic noise. Unless a long term monitoring program is continuously manned by observers to note noise sources of human origin, it is not possible to definitively confirm whether anthropogenic noise sources influence sound levels at the monitored lek perimeter locations. In the case of this monitoring study, oil and gas development was visible at distant locations from two sites (M-1 and M-4). The overall L_{50} average from these sites (22.6 dBA L_{50} and 25.0 dBA L_{50}, respectively) is in close agreement with the ambient noise background level suggested by Patricelli et al (20-22 dBA) and within the overall range of L_{50} levels measured (19.7 dBA L_{50} and 30.6 dBA L_{50}) across all six sites. This suggests an overall minor influence of ongoing activity during the measurements.

In the years following the noise monitoring conducted for the NPL Project in 2012, other noise monitoring studies have been conducted at Sage-Grouse leks in the Pinedale Anticline Project Area

(PAPA), the Jonah Infill Development Project Area (JIDPA), and other locations in the Upper Green River Basin. These various studies indicate a range of ambient noise levels in the region. These variations are likely based on different monitoring methods and equipment, location of monitoring sites, the level of ongoing development and associated noise proximate to the locations of monitoring, and other factors.

One study conducted in 2015 monitored sound levels during the month of April for three consecutive years at 19 Sage-Grouse leks in the PAPA. The median hourly L_{50} average across all three years was 26.0 dBA L_{50}, with a median annual variability of 3.9 dBA (Ambrose et al. 2015). The study noted that sound levels at leks varied according to proximity to well pads or other types of existing gas field activity. The median hourly ambient noise levels from the three-year PAPA study (26.0 dBA L_{50}) is relatively similar to the measured median hourly ambient noise levels for all sites monitored for the NPL Project noise study (23.5 dBA L_{50}), though slightly higher likely due to the generally higher level of existing development in the PAPA.

In December 2015, an ambient sound level survey was performed in the JIDPA at the perimeter of the Sound Draw Reservoir and South Rocks Sage-Grouse leks (Behrens and Associates 2016). The survey measured ambient sound at two locations on opposite sides of each lek for 7 days. The 7 day average dBA L_{50} for the Sand Draw Reservoir lek was 36.3 dBA and 30.0 dBA for the South Rocks lek. These monitored sound levels are generally higher than the ambient levels monitored in the Project Area, likely due to the higher level of ongoing development in the JIDPA, compared to the Project Area.

Other noise monitoring studies have indicated a lower ambient sound level in undeveloped rural Wyoming, including in the Upper Green River Basin. During April to May, 2014 ambient noise levels were monitored at four rural undeveloped sites in Wyoming including 524 hours in undeveloped sage-brush habitat in the Upper Green River Basin (Ambrose et al., 2014). The monitoring data indicated a median hourly L_{50} of 14.3 dBA between the hours of 8:00 p.m. and 6:00 a.m. at the Upper Green River Basin monitoring site and a median L_{50} for all hours at all sites of 15.4 dBA. Some of the data monitored was near the noise floors of the sound level meters used, indicating that actual sound levels may be even lower. This study measured sound levels in undeveloped sage-brush habitats common in rural Wyoming, not at a specific lek location or within the NPL Project Area. While these monitoring results were not specific to the perimeter of lek locations in the NPL Project Area, the methods and results should be considered when assessing ambient noise levels and potential noise impacts during site-specific permitting for the NPL Project.

Based on the application of the noise monitoring methods described in Appendix G (*Noise Technical Report*) and the collection of noise monitoring data specific to the Sage-Grouse lek perimeters in the NPL Project Area, the ambient noise levels measured for the NPL Project represent the best available existing information for characterizing the noise environment at Sage-Grouse leks in the Project Area and is appropriate for the programmatic-level analysis in the NPL Project EIS. Prior to authorizing site-specific development for the NPL Project, the BLM will consider the need for additional site-specific noise monitoring based on updated noise monitoring protocols and standards, current Sage-Grouse science and research, specific proposed development locations in relation to Sage-Grouse leks and other Sage-Grouse habitats, and other factors.

3.11.6 Ambient Noise Summary

The noise environment in the analysis area is primarily characterized by natural sounds, including wind noise through the vegetation as well as anthropogenic sounds associated with natural gas development, including compressor station activity and vehicle traffic. Minimum L_{50} values for all monitoring sites between the hours of 6:00 p.m. and 8:00 a.m. were in the range of 17.0 to 19.7 dBA L_{50}, and maximum values were in the range of 26.7 to 43.1 dBA L_{50} (Table 3-29). Average L_{50} values for the six monitoring sites ranged from 19.7 to 30.6 dBA L_{50} (Table 3-29). The overall average L_{50} at the six lek perimeter monitoring locations between the hours of 6:00 p.m. and 8:00 a.m. was 23.5 dBA L_{50}.

Research indicates that increased noise intensity at Sage-Grouse lek sites is a contributing factor to decreases in lek attendance (Blickley et al. 2012; Holloran 2005). The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and Wyoming EO 2015-4 were issued to help reduce adverse impacts of noise on Sage-Grouse PHMA, limiting noise generated by human development to 10 dBA above the ambient noise level at the perimeter of leks. Based on noise monitoring between the hours of 6:00 p.m. and 8:00 a.m., for the purposes of analysis, and consistent with the BLM Wyoming Sage-Grouse RMP Amendment (BLM 2015e) and Wyoming EO 2015-4, this EIS uses the average L_{50} values at each monitoring site (Table 3-29) and the overall average L_{50} for all six monitoring sites (23.5 dBa) to characterize the noise level at the perimeter of lek locations in the NPL Project Area.

3.12 Paleontology

3.12.1 Overview

Paleontological resources refer to fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth. The analysis area for paleontological resources is the Project Area.

3.12.2 Laws, Ordinances, Regulations, and Standards

Fossils on Federal lands are protected under provisions of NEPA; the FLPMA, as amended, 43 U.S.C. 1737(b); PL 26 94-579; PL 111-011; and the Omnibus Public Land Management Act of 2009, Subsection D, Section 6302. The BLM has adopted the Potential Fossil Yield Classification (PFYC) system as the standard for evaluating potential impacts to paleontological resources on public lands (BLM 2016b). The system uses an eight-part classification of geologic units with respect to their potential for the production of scientifically important fossils. The evaluation scale runs from 1 (very low probability) to 5 (very high probability), based upon the unit’s lithology, age, depositional setting, risk for adverse impacts, and history of producing fossils. Ice, Water, and Unknown have their own PFYC designations in addition to the PFYC 1 to 5 classes. Approval of surface-disturbing activities affecting geologic formations rated 4 or 5 is likely to require surveys by a qualified paleontologist prior to or during construction. The presence of alluvial and/or colluvial soils overlying sensitive formations may prevent the qualified paleontologist from determining whether or not fossil bearing materials are present during site-specific surveys. As a result, the BLM also may apply protective mitigations, and local field offices can make specific management decisions based on site-specific information. Refer to BLM IM 2016-124, *Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands* (BLM 2016b), for more information on the PFYC system.

3.12.3 Survey Methodology

Existing paleontological resources for the Project Area were assessed through a field survey and a review of existing geological and paleontological information from the Project Area vicinity, consisting of museum database searches for existing fossil localities within the Pinedale Anticline, Jonah I, and Jonah II project areas, which are considered broad enough to include the Project Area, and a 2007 survey

(Bilbey et al. 2007) of the JIDPA, which is adjacent to the Project Area (Winterfeld 2011). This assessment was used to determine the potential for paleontological resources in the Project Area and included: (1) identification of surficial and bedrock geological formations; (2) contacts between bedrock units; (3) fossil-rich areas; and (4) areas where adverse impacts to significant fossils could result from oil and gas-related development in the Project Area.

3.12.4 Paleontological Resource Potential

All three bedrock formations underlying the Project Area (Wasatch Formation, the Laney Member of the Green River Formation, and the Bridger Formation) have a PFYC of 5, which represents the highest potential for the presence of paleontological resources (Map 9). These formations would be ranked as 5 if exposures are present and if exposures are covered and shallow enough to be impacted by excavation (Winterfeld 2011). Fossil yield potential in the three identified formations within the Project Area is summarized in Table 3-30 and further described in the subsections below. Although most observations from fossil surveys in the Project Area are associated with bedrock exposures due to their accessibility, subsurface bedrock features are likely to exhibit similar fossil-bearing characteristics.

Table 3-30. Paleontological Potential by Geologic Unit in Project Area

Bedrock Formation/ Member	Acreage within Project Area	Fossils Types Known from Formation	Fossils Abundance from Field Surveys in Project Area	Potential Fossil Yield Classification
Wasatch Formation				
Alkali Creek Member (Twa)	31,916[1]	vertebrate (fish and mammals), invertebrate, and trace fossils	rich in fossil vertebrates	5
unnamed variegated member (Twu)	31,916[1]	vertebrate (jaws and teeth of mammals, post cranial bones of mammals and reptiles, and turtle shell fragments)	rich in fossil vertebrates	5
Green River Formation				
Laney Member (Tgl)	107,554	vertebrate (fish, amphibians, reptiles, birds, and mammals), invertebrate (insect, gastropod, bivalve, and ostracod), and plant	very few fossils of any kind identified (some fragmentary fish from thin shales)	5
Bridger Formation				
unidentified	1,276	vertebrates (fish, amphibians, reptiles, birds, and mammals) and invertebrates, with less abundant trace fossils and plant fossils (primarily silicified wood)	no fossils identified	5

Source: Winterfeld 2011; BLM 2012c.

[1]Total for Wasatch Formation in the Project Area.

3.12.4.1 Wasatch Formation

The Wasatch Formation contains two members, the Alkali Creek Member and an unnamed variegated member, within the Project Area. Paleontological findings in the Alkali Creek Member of the Wasatch Formation from previous surveys not limited to the Project Area include fossil vertebrates and trace fossils near Kemmerer, Wyoming (Roehler 1991 a-b); abundant invertebrates and fish, as well as some mammals, east of Kemmerer, Wyoming (Dames and Moore 1992a-b; Chinook 1993; Erathem-Vanir

1993); and 12 fossil vertebrate-bearing (including 33 mammalian taxa) localities in the New Fork Tongue, to the north and east of the Pinedale Anticline and JIDPA (West 1973). Within the Project Area, more than a dozen locations were identified that produced fossil vertebrate remains in the unnamed variegated member, including the jaws and teeth of mammals, the post-cranial bones of mammals and reptiles, and turtle shell fragments (Winterfeld 2011). The field survey identified several areas in the northwestern part of the Project Area that were particularly rich in bone fragments (Winterfeld 2011).

3.12.4.2 Green River Formation

The Laney Member of the Green River Formation contains fossils in four major layers that occur over wide parts of the GRB. It is unknown which, if any, of these layers are present in the Project Area (Winterfeld 2011). Paleontological findings in the Laney Member of the Green River Formation from previous surveys not limited to the Project Area include fish bones present in mass mortality accumulations of the *Astephus* and *Erismatopterus* fish species, as well as catfish (*Astephus*) and sucker (*Amyzon*) fossils (Winterfeld 2011); mammal, black chert, and mollusk fossils in the LaClede Bed (Roehler 1992 a-c); gastropod, bivalve, ostracod, fish, and turtle fossils in the Hartt Cabin Bed (Winterfeld 2011); and amphibian, reptile, bird, invertebrate, and plant fossils throughout the Greater GRB (West 1973; Grande 1984). With the exception of fossil wood and occasional fossil invertebrate shells, very few fossils were identified in the Laney Shale member within the Project Area (Winterfeld 2011). Most areas of the Laney member of the Green River Formation that occur within the Project Area are covered in vegetation or not well exposed (Winterfeld 2011). Previous field surveys and construction excavation adjacent to, but located outside of, the Project Area have produced very few fossils of any kind, with the exception of fragmentary fish from thin shales (Winterfeld 2011).

3.12.4.3 Bridger Formation

The field survey did not result in the identification of any fossils in the Bridger Formation that occurs within the Project Area; however, the Bridger Formation is generally fossil abundant, including many vertebrates and invertebrates with fewer plant and trace fossils. Paleontological findings in the Bridger Formation from previous surveys not limited to the Project Area include fragmentary fish fossils of *Lepisosteus* (garpike), *Amia* (bowfin), and catfish; amphibians, including salamanders and frogs; reptiles, including a variety of turtles, crocodilians, lizards, and snakes; mammalian fossils representing 67 genera; and, less commonly, birds, including primitive flamingos, owls, hawks, rails, thick-knees, and stone curlews (Murphey 2014).

3.13 Recreation

3.13.1 Overview

The analysis area for recreation is the Project Area. Recreational uses in and around the Project Area include hunting, wildlife viewing, fishing, camping, and motorized recreation (e.g., OHV use).

Population growth and recent population shifts to locations in the western United States, along with the diversity and availability of resources found on public lands, have produced an increasing demand for recreational uses on BLM-administered lands in Wyoming. Dean Runyan Associates (2014) estimates that total travel spending in southwestern Wyoming (Carbon, Lincoln, Sublette, and Sweetwater counties) was $465.6 million in 2013, with Sweetwater County having the most ($183.3 million) and Sublette County the least ($42.9 million). Travel spending has increased steadily between 2000 and

2013 at a rate of 4.7 percent (Sublette County) to 5.5 percent (Sweetwater County) in the four-county region (Dean Runyan Associates 2014). Expenditures by out-of-state visitors for goods and services such as fishing, hunting, backpacking, and winter sports are vital to local economies, with travel-generated state sales tax revenues of $5.2 million in Carbon County, $2.5 million in Lincoln County, $1 million in Sublette County, and $5.5 million in Sweetwater County (Dean Runyan Associates 2014).

Based on a statewide survey, the most popular recreational activities in Wyoming include driving for pleasure/sightseeing by auto (69.5 percent of respondents participate); viewing natural features such as scenery, flowers, etc., (67.8 percent); picnicking and family day gatherings (63.6 percent); viewing wildlife, birds, fish, etc., (62.7 percent); general/other, such as relaxing, escaping crowds and noise (62.7 percent); and hiking or walking (61.5 percent); (Wyoming Department of State Parks and Cultural Resources 2013).

3.13.2 Laws, Ordinances, Regulations, and Standards

In accordance with the FLPMA, the BLM manages public lands for multiple uses, including recreation. BLM recreation management classifies land as Extensive Recreation Management Areas (ERMAs) or Special Recreation Management Areas (SRMAs) (BLM Land Use Planning Handbook H-1601-1, Appendix C). BLM guidance in IM No. 2006-060 establishes the agency's commitment to incorporating the framework of benefits-based management into its recreation management program. Benefits-based management is a method of managing recreation that focuses on the beneficial outcomes from engaging in recreational activities, rather than only on the recreation activities themselves. This approach gives the BLM a framework within which to manage recreation on public lands to provide outcomes that benefit individuals, communities, economies, and the environment.

3.13.3 Recreation Use

There are no developed recreation sites within the Project Area; however, BLM-administered lands in the analysis area provide a variety of recreational opportunities experienced by public land users, including hunting, driving for pleasure, OHV use, wildlife viewing, antler collecting, and hiking. In recent years, commercial and private interest in activities associated with OHV sport riding and wildlife viewing of antelope, Sage-Grouse, and raptors in the PFO has increased. The BLM authorizes commercial Special Recreation Permits for big game hunting and fishing. A small amount of guided sport hunting activities are known to occur in the region. However, these activities have not been noted in the Project Area.

Table 3-31 presents data on hunting activity that indicate the level of hunting potentially occurring within the Project Area. Hunting data are available only as totals for the hunt areas delineated by the Wyoming Game and Fish Department (WGFD). Data in the table are the totals for the entire hunt areas that intersect the Project Area because information is not available for smaller areas within the hunt areas. The Project Area has several antelope, mule deer, and elk hunting areas, but these hunt areas are not particularly active in terms of the number of hunters in 2014, relative to other hunt areas in Wyoming (WGFD 2015a). The Project Area makes up a much smaller portion of the Sage-Grouse, upland birds, and small game management areas.

Table 3-31. Indicators of Hunting Activity by Species in the Wyoming Game and Fish Department Hunt Areas that Encompass the Project Area, 2014

Game Species	Hunt or Management Area	Total Active Hunters	Non-Resident Hunters	Hunter Success	Average Days per Hunter
Antelope	90 Yellow Point	506	111	102.6%	3.8
Mule Deer	138 Boulder	291	8	15.8%	4.8
Elk	98 Boulder	1,138	163	30.2%	7.8
Sage-Grouse	D	406	Not provided	Not provided	3.1
Upland Birds and Small Game	4	2,863	Not provided	Not provided	4.1

Sources: WGFD 2015a.

3.13.4 Recreation Management

The management goal for recreation resources under the revised BLM PFO Approved RMP and ROD is to "provide substantial personal, community, economic, and environmental benefits to local residents and visitors through recreational uses of the public lands." Management objectives include maintaining or enhancing the health and viability of recreation-dependent natural resources and settings within the planning area, promoting commercial competitive events and organized group activities where appropriate, and managing SRMAs to provide for current and future recreation opportunities (BLM 2008a). Under the BLM Green River Approved RMP and ROD, the objectives for recreation management in the BLM RSFO are to: (1) ensure the continued availability of outdoor recreational opportunities sought by the public while protecting other resources; (2) meet legal requirements for the health and safety of visitors; and (3) mitigate conflicts between recreation and other types of resource uses (BLM 1997a).

The Project Area is in the BLM PFO ERMA and BLM RSFO ERMA (Map 14). Management objectives for ERMAs include providing an array of resource-dependent dispersed recreation opportunities, such as hunting, fishing, motorized use, and open space. The BLM does not manage ERMAs to provide specific recreational activities and opportunities, but these areas generally provide dispersed recreation. There are two SRMAs within 10 miles of the Project Area (in the analysis area): the Green and New Fork Rivers SRMA in the BLM PFO and the Wind River Front SRMA in the BLM RSFO (Map 14).

The closest portion of the Green and New Fork Rivers SRMA is approximately 3.4 miles to the west of the Project Area. Activities in this SRMA include float and wade fishing, hunting, family and group camping, float camping, and wildlife viewing (BLM 2008b). The SRMA also has several developed recreation sites along the Green River. The management objective for this SRMA is to manage each zone to provide opportunities for the public to achieve targeted, high-quality recreation activities and experiences that produce significant benefits to the visiting public (BLM 2008a). The portion of the SRMA closest to the Project Area is accessed via U.S. Highway 189 (Map 14).

The Wind River Front SRMA is approximately 1.7 miles east of the Project Area on the east side of U.S. Highway 191 in the BLM RSFO (Map 14). The objectives for this SRMA are to: (1) provide protection and enhancement of the recreation opportunities, activities, and setting of the area; (2) maintain the high visual values of the area; (3) protect air quality in the adjacent Class I airshed; (4) maintain or enhance biological diversity; (5) prevent fragmentation of grasslands, shrublands, streams, wetlands, and forest habitats; and (6) maintain crucial big game habitats and migration routes so that WGFD population objectives can be met (BLM 1997a)

The designated Ross Butte Management Area (MA), which offers recreational opportunities for semiprimitive motorized activities, overlaps 444 BLM-administered acres of the western portion of the Project Area in the BLM PFO (Map 14) (BLM 2008b). Motorized vehicle use, except for over-the-snow equipment, is limited to designated roads and trails in the MA (BLM 2008a). Access to the Ross Butte MA is via State Highway 351 to the north of the Project Area, or via U.S. Highway 189 to the east of the Project Area.

The Wind River Front MA is 6.2 miles east of the Project Area boundary in the BLM PFO (Map 14). The Wind River Front MA supports semiprimitive motorized and nonmotorized recreation opportunities including hunting, rock climbing, wilderness access, sightseeing, antler hunting, hiking, mountain biking, and fishing (BLM 2008a). U.S. Highway 191 provides access to the MA.

3.13.4.1 Travel Management

See Section 3.17.2.1 (*Road Classification System*) for a description of existing travel routes in the Project Area. Travel management designations in the Project Area are limited to existing roads and trails, except for the portion of Ross Butte MA that overlaps the Project Area (444 acres), where travel is limited to designated roads and trails (BLM 2008a). Travel Management Plans for lands included in the Project Area have not been completed. When complete, all roads including the network of roads utilized for ongoing fluid mineral development will be designated as open for motorized travel, closed, or deemed a linear disturbance feature subject to removal when use is no longer necessary. Motorized vehicle use in the Project Area is generally limited to travel associated with ongoing oil and gas development, range management and livestock operations, and recreational (e.g., OHV) travel.

3.14 Socioeconomics

3.14.1 Overview

3.14.1.1 Study Area

The socioeconomic study area (SESA) includes Lincoln County, Sublette County, and Sweetwater County, which encompass the communities in southwest Wyoming most likely to experience socioeconomic effects resulting from the NPL Project (Map 15). Information on the State of Wyoming is also included, where available and pertinent. Efforts were made to include the population centers in these three counties that would likely be affected by the NPL Project, namely LaBarge and Kemmerer in Lincoln County; Big Piney, Marbleton, and Pinedale in Sublette County; and Green River, Rock Springs, Eden, and Farson in Sweetwater County. Like much of Wyoming, the SESA is predominantly rural. Although Wyoming is the tenth-largest state in terms of area, it is the least populous. All three counties have relatively low population densities, as summarized in Table 3-32. The average number of persons per square mile in 2015 ranged from 2.0 in Sublette County to 4.6 in Lincoln County. Population densities in all three counties were below the state average of 6.0.

Table 3-32. Geographic and Demographic Characteristics of the Socioeconomic Study Area in 2015

Geographic/Demographic Characteristic	Wyoming	Lincoln	Sublette	Sweetwater
Land area (square miles, 2010)[1]	97,093	4,076	4,887	10,427
Land area (millions of acres)	62.1	2.6	3.1	6.7
Population (2015)[2]	586,107	18,722	9,899	44,626
Population density per square mile (2015)	6.0	4.6	2.0	4.3

[1]U.S. Census Bureau 2010a
[2]U.S. Census Bureau 2016a

3.14.2 Laws, Ordinances, Regulations, and Standards

The general LORS included in Section 1.6 (*Regulatory Setting*) apply to public land uses that could affect social and economic conditions. LORS that provide guidance specific to social and economic resources include:

- **NEPA 42 U.S.C. 4321 et seq.:** Under NEPA, an EIS must discuss social and economic effects if they are related to the natural or physical effects and the definition of "effects" includes economic and social factors. Consequently, the EIS must include an analysis of the proposed project's economic, social, and demographic effects related to effects on the natural or physical environment in the affected area, but economic, social, and demographic effects may not be analyzed in isolation from the physical environment**.**
- **Executive Order 12898 (*Federal Register*, Vol. 59, No. 32, February 11, 1994):** EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs all federal agencies to focus attention on the human health and environmental conditions for low-income populations, minority populations, or Indian tribes. "Indian tribes" refers to any federally recognized Indian or Alaska Native tribes, bands, nations, pueblos, villages or communities that the Secretary of the Interior recognizes to be eligible for special programs and services provided by the United States to Indians because of their status as Indians (25 U.S.C. 479a). The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Indian tribes that may experience common conditions of environmental exposure or effect associated with a plan or project. EO 12898 also requires federal agencies to ensure opportunities for effective public participation by identified potentially affected low-income populations, minority populations, or Indian tribes that are considered environmental justice populations.

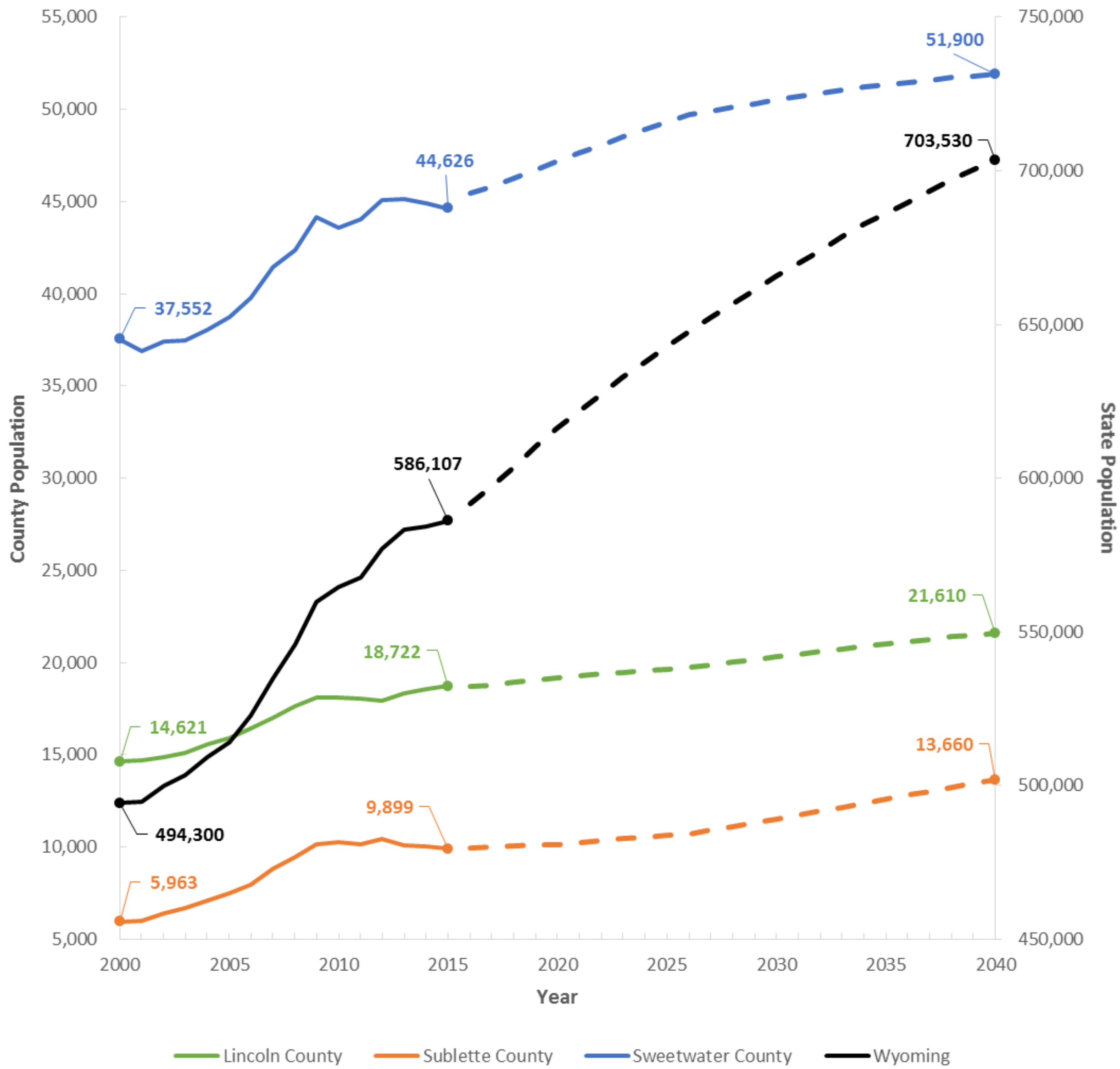
3.14.3 Social Conditions

3.14.3.1 Population

All three counties in the analysis area experienced net population growth from 2000 to 2015 (U.S. Census Bureau 2010b; U.S. Census Bureau 2016a), and continued population growth is projected through 2040 (Wyoming Department of Administration and Information 2015a) (Figure 3-19). Between

2000 and 2010, rapid growth occurred in Sublette County (71.8 percent population increase), while moderate growth occurred in Lincoln County (23.7 percent population increase) and Sweetwater County (16.1 percent population increase). In all three counties, population growth exceeded the statewide rate of 14.2 percent over the decade. Between 2015 and 2040, Sublette County's population is projected to grow by 38.0 percent, Sweetwater County's population is projected to grow by 16.3 percent, and Lincoln County's population is projected to grow by 15.4 percent. The statewide population is expected to increase by 20 percent during the same period.

Figure 3-19. Population Estimates and Projections, 2000-2040



Note: Resident population data for years 2000-2009 from U.S. Census Bureau Intercensal Estimates (U.S. Census Bureau 2010b). Resident population data for years 2010-2015 from U.S. Census Bureau Population Estimates Program (U.S. Census Bureau 2016a). Population projections for years 2016-2040 (indicated by dashed lines) from Wyoming Department of Administration and Information 2015a.

The presence of a relatively large transient gas-field worker population in Sublette County adds a confounding element to county population trends. Transient workers are typically counted by the U.S. Census as members of their community of permanent residence, rather than their temporary community. As a result, from 2000 to 2008, the total number of residents of Sublette County substantially exceeded the population reported by the Census. With the sharp decline in gas development in Sublette County in 2008/2009 (Headwaters Economics 2012) and subsequent oil and gas development in other regions, such as North Dakota's Bakken Formation, many transient workers have moved out of Sublette County. Meanwhile, other formerly transient workers have established permanent residency in Sublette County, causing the county's Census-reported population to show a continued increase.

3.14.3.2 Housing

Information on housing in Lincoln, Sublette, and Sweetwater counties from Census 2000 and 2010–2014 American Community Survey 5-year estimates is presented in Table 3-33. The number of authorized building permits issued between 2000 and 2014 are listed in Table 3-34. Rental rates and costs in the three counties compared to those for the state as a whole are presented Table 3-35. Housing data reported in Table 3-33 through Table 3-35 provide an overview by state and county and are not intended to reflect conditions in particular communities.

There were 6,934 vacant units available for housing in the SESA in 2010–2014, with Sublette County having the highest vacancy rate (39 percent) followed by Lincoln County (27 percent) and Sweetwater County (12 percent) (Table 3-33) (U.S. Census Bureau 2014a).

Housing units that are classified as vacant for seasonal, recreational, or occasional use are used or intended for use only in certain seasons or for weekends or other occasional use throughout the year (U.S. Census Bureau 2012). This category of housing units is commonly used to estimate the number of "vacation" homes in an area, but may also include temporary residences for workers. In 2010–2014, an estimated 17,496 housing units (7 percent) in Wyoming were vacant for seasonal, recreational, or occasional use. During the same period, vacant homes for seasonal, recreational, or occasional use accounted for 25 percent (1,449 units) of the total housing units in Sublette County, 13 percent (1,212 units) of the total housing units in Lincoln County, and 2 percent (309 units) of the total housing units in Sweetwater County (U.S. Census Bureau 2014a). The number of vacant homes for seasonal, recreational, or occasional use increased in all three counties from 2000 to 2010–2014 (Table 3-33).

Monthly rental rates for homes in the fourth quarter of 2014 ranged from $622 in Lincoln County-Kemmerer to $1,144 in Sublette County, while the statewide average was $1,050 (Table 3-35). Monthly apartment rental rates were lowest in Lincoln County-Afton ($518) and highest in Sublette County ($819) in the fourth quarter 2014 (Wyoming Department of Administration and Information 2014). Between 2000 and 2014, the number of new building permits decreased in Lincoln (-53 percent) and Sublette (-50 percent) counties, but increased by 454 percent in Sweetwater County (Wyoming Department of Administration and Information 2015b).

In 2014, the average sales price of homes statewide was $263,432, while in the SESA, average sales prices were $248,511 in Sweetwater County, $246,701 in Lincoln County, and $234,338 in Sublette County (Wyoming Community Development Authority 2016).

Table 3-33. Housing Availability in 2000 and 2014

	Wyoming		Lincoln County		Sublette County		Sweetwater County	
	2000[1]	*2010–2014 5-Year Estimates[2]*	*2000[1]*	*2010–2014 5-Year Estimates[2]*	*2000[1]*	*2010–2014 5-Year Estimates[2]*	*2000[1]*	*2010–2014 5-Year Estimates[2]*
Occupancy Status								
Owner-occupied	135,514	156,289	4,280	5,423	1,737	2,587	10,586	11,774
Renter-occupied	58,094	69,225	986	1,161	634	953	3,519	4,913
Total Vacant	30,246	39,681	1,565	2,408	1,181	2,275	1,816	2,251
Vacant (for rent)	6,214	5,921	275	233	51	272	681	499
Vacant (for sale)	2,977	2,601	122	251	42	131	282	160
Vacant (for seasonal, recreational, or occasional use)	12,389	17,496	912	1,212	930	1,449	243	309
Total housing units	223,854	265,195	6,831	8,992	3,552	5,815	15,921	18,938
Percent of Total Housing Units								
Owner-occupied	61	59	63	60	49	44	66	62
Renter-occupied	26	26	14	13	18	16	22	26
Vacant	14	15	23	27	33	39	11	12
Vacant (for rent)	3	2	4	3	1	5	4	3
Vacant (for sale)	1	1	2	3	1	2	2	1
Vacant (for seasonal, recreational, or occasional use)	6	7	13	13	26	25	2	2

[1]U.S. Census Bureau 2000
[2]U.S. Census Bureau 2014a

Table 3-34. Authorized Residential Building Permits for Wyoming and Counties in the Study Area from 2000 to 2014

Year	Wyoming			Lincoln			Sublette			Sweetwater		
	Total	Single Family	Multi-family	Total	Single Family	Multi-family	Total	Single Family	Multi-family	Total	Single Family	Multi-family
2000	1,582	1,429	153	145	145	0	54	54	0	41	36	5
2001	1,907	1,485	422	218	214	4	76	72	4	38	38	0
2002	2,045	1,822	223	204	192	12	88	74	14	48	48	0
2003	2,877	2,328	549	180	180	0	95	83	12	63	63	0
2004	3,318	2,815	503	212	206	6	93	77	16	216	216	0
2005	4,002	3,174	828	261	253	8	185	179	6	260	260	0
2006	3,846	3,349	497	243	232	11	197	177	20	269	237	32
2007	4,584	3,735	849	228	198	30	263	257	6	472	438	34
2008	2,669	2,178	491	100	94	6	114	100	14	245	144	101
2009	2,294	1,574	720	62	58	4	44	44	0	351	130	221
2010	2,298	1,546	752	49	49	0	42	40	2	147	100	47
2011	2,114	1,453	661	40	40	0	25	13	12	122	102	20
2012	2,110	1,661	449	28	28	0	26	26	0	132	116	16
2013	2,302	1,693	609	32	32	0	53	29	24	103	87	16
2014	1,937	1,650	287	68	68	0	27	27	0	227	108	119

Source: Wyoming Department of Administration and Information 2015b.

Note: Building permit data represent the number of single and multi-family units authorized by permit-issuing authorities in each county.

Table 3-35. Residential Rental Rates (2001 to 2014, in 2014 Dollars)

Apartment					
Location	*2001 Q4[1] ($)*	*2005 Q2[2] ($)*	*2010 Q4[3] ($)*	*2014 Q4[4] ($)*	*Change (%) 2001 Q4 or 2005 Q2 to 2014 Q4*
Wyoming average	576	575	710	730	27
Lincoln County[5]	391	NR	NR	NR	-
Lincoln County: northern portion	NR	565	703	523	-8
Lincoln County: southern portion	NR	432	723	518	20
Sublette County	591	797	990	819	39
Sweetwater County	523	584	753	684	31
House					
Location	*2001 Q4[1] ($)*	*2005 Q2[2] ($)*	*2010 Q4[3] ($)*	*2014 Q4[4] ($)*	*Change (%) 2001 Q4 or 2005 Q2 to 2014 Q4*
Wyoming average	803	790	1,013	1,050	31
Lincoln County[5]	536	NR	NR	NR	-
Lincoln County: northern portion	NR	829	870	775	-6
Lincoln County: southern portion	NR	464	739	622	34
Sublette County	821	1,005	1,441	1,144	39
Sweetwater County	714	767	1,018	1,055	48
Mobile Home					
	2001 Q4[1] ($)	*2005 Q2[2] ($)*	*2010 Q4[3] ($)*	*2014 Q4[4] ($)*	*Change (%) 2001 Q4 or 2005 Q2 to 2014 Q4*
Wyoming average	584	576	676	700	20
Lincoln County[5]	422	NR	NR	NR	-
Lincoln County: northern portion	NR	543	457	NR	-
Lincoln County: southern portion	NR	426	NR	716	68
Sublette County	469	673	634	NR	-
Sweetwater County	565	677	872	800	41

Table 3-35. Residential Rental Rates (2001 to 2014, in 2014 Dollars)

Mobile Home Lot					
	2001 Q4[1] ($)	*2005 Q2[2] ($)*	*2010 Q4[3] ($)*	*2014 Q4[4] ($)*	*Change (%) 2001 or 2005 Q2 to 2014 Q4*
Wyoming average	239	231	306	315	32
Lincoln County[5]	212	NR	NR	NR	-
Lincoln County: northern portion	NR	237	348	NR	-
Lincoln County: southern portion	NR	203	412	404	99
Sublette County	235	274	NR	NR	-
Sweetwater County	269	244	348	370	37

[1]Wyoming Department of Administration and Information 2003
[2]Wyoming Department of Administration and Information 2005
[3]Wyoming Department of Administration and Information 2012a
[4]Wyoming Department of Administration and Information 2014
[5]Starting in 2003, the Wyoming Cost of Living report no longer reported residential rental rates for Lincoln County as a whole, but divided the county into a northern portion (Lincoln-Afton) and southern portion (Lincoln-Kemmerer) (Wyoming Department of Administration and Information 2005).

Definitions:
Apartment: Two-bedroom, unfurnished, excluding gas and electric.
House: Two- or three-bedroom, single family, excluding gas and electric.
Mobile Home: This price reflects total monthly rental expense, including lot rent.
Mobile Home Lot: Single-wide, including water.

- not calculated due to lack of information
NR not reported (too few observations)
Q fiscal year quarter

3.14.3.2.1 Lincoln County

During 2010–2014, Lincoln County had 8,992 housing units with, of which 60 percent were owner-occupied, 13 percent were renter-occupied, and 27 percent were vacant. Of the 2,408 vacant units, 233 were for rent, 251 were for sale, and 1,212 were for seasonal, recreational, or occasional use. The number of vacant housing units increased from 2000 to 2010–2014 by 843 units (from 23 percent to 27 percent of housing units in Lincoln County). The number of vacant units for seasonal, recreational, or occasional use increased from 2000 to 2010–2014 by 300 units, but remained relatively constant as a proportion of total housing units (U.S. Census Bureau 2000; U.S. Census Bureau 2014a).

In 2014, apartment and house rental rates were the least expensive in the SESA in Lincoln County-Kemmerer ($518) and Lincoln County- Afton ($523), respectively (Table 3-35). Between the second quarter of 2005 and fourth quarter 2014, inflation-adjusted apartment rental rates decreased by 8 percent in Lincoln County-Afton and increased by 20 percent in Lincoln County-Kemmerer. During that same period, inflation-adjusted house rental rates decreased by 6 percent (Lincoln County-Afton) and increased by 34 percent (Lincoln County-Kemmerer). Only 68 residential building permits were issued in Lincoln County in 2014 (Table 3-34), a decrease of 77 permits since 2000 (Wyoming Department of Administration and Information 2015b).

3.14.3.2.2 Sublette County

Among the counties in the SESA during 2010–2014, Sublette County had the fewest housing units (5,815), of which 44 percent were owner-occupied, 16 percent were renter-occupied, and 39 percent were vacant (Table 3-33). The number of vacant units increased from 2000 to 2010–2014 by 519 units (56 percent). Sublette County had the highest vacancy rate among counties in the SESA for both 2000 and 2010–2014; however, during 2010–2014, only 18 percent of the vacant units (403 units) were for sale or rent, while 64 percent were for seasonal, recreational, or occasional use (U.S. Census Bureau 2000; U.S. Census Bureau 2014a).

Rental rates in 2014 were $819 for an apartment and $1,144 for a house. Inflation-adjusted rental rates increased in this county from 2001 to 2014, up 39 percent for apartments and houses, but declined between 2010 and 2014. Sublette County rental rates were the most expensive in the SESA in 2014. Inflation-adjusted apartment rental rates also showed the greatest increase among counties in the SESA from 2001 to 2014 (Table 3-35) (Wyoming Department of Administration and Information 2003; Wyoming Department of Administration and Information 2014).

New building permits also decreased in this county, from 54 in 2000 to only 27 in 2014 (Wyoming Department of Administration and Information 2015b).

Demand for housing in Sublette County increased rapidly during the gas boom of 2000 to 2007, with associated increases in home prices and rents. Many motels and recreational vehicle parks were largely used for transient worker housing. One response to increased housing demand was creation of approximately 500 residential lots in 2007, only a small share of which have since been built on (Leniger 2013; Thomas 2013). With the abrupt cessation of gas development in 2007/2008 and subsequent exodus of gas-field workers, housing demand has declined, although home prices and rents have generally not declined as noticeably. Many formerly transient workers have become first-time home buyers, thus maintaining pressure on the market for affordable housing (Thomas 2013). Many of the lots created in 2007 either remain available for home construction or have been removed from the market (Thomas 2013). The Sublette County housing market has moderated considerably since the boom years. Home seekers are generally able to select from multiple available properties, although available housing affordable to lower-income households remains relatively scarce (Jacquet 2013).

3.14.3.2.3 Sweetwater County

During 2010–2014, Sweetwater County had the highest number of housing units among counties in the SESA (18,938), of which 62 percent were owner-occupied, 26 percent were renter-occupied, and 12 percent were vacant(Table 3-33). Sweetwater County had the highest proportion of renter-occupied housing units in both 2000 and 2010–2014. The number of vacant units increased 24 percent (435 units) between 2000 and 2010–2014. During 2010–2014, 29 percent of the vacant units (659 units) in Sweetwater County were for rent or sale. The proportion of homes for seasonal, recreational, or occasional use (2 percent) was lowest among the counties in the SESA in both 2000 and 2010–2014 (U.S. Census Bureau 2000; U.S. Census Bureau 2014a).

Rental rates in 2014 were $684 for an apartment and $1,055 for a house. Inflation-adjusted rental rates increased in this county from 2001 to 2014, up 31 percent for apartments and 48 percent for houses (Table 3-35) (Wyoming Department of Administration and Information 2003; Wyoming Department of Administration and Information 2014).

Sweetwater County was the only county in the SESA where new building permits increased between 2000 and 2014, from 41 in 2000 to 227 in 2014 (Table 3-34) (Wyoming Department of Administration and Information 2015b). The Sweetwater County Comprehensive Plan (Sweetwater County 2002) discourages the establishment of workforce facilities (man-camps) and encourages workers to live in established communities where public facilities and services are readily available. However, workforce facilities may be established through the Sweetwater County Conditional Use Permit Process.

All development in Sweetwater County requires coordination and potential permitting with the following Sweetwater County Departments: Road and Bridge, Public Works, Health, Weed and Pest, Emergency Management, Fire, and Planning and Zoning.

3.14.3.3 Quality of Life

3.14.3.3.1 Social Development and Culture

Understanding the social development, culture, and history of an area provides valuable insight into how events or changes to the area may affect the livelihood and quality of life of the residents. Historically, communities in the SESA were developed with sparse populations, rural characteristics, and natural resource-based economies. Many of the communities within the area share similar historical paths (BLM 2008a). Public lands in the SESA provide a natural resource base for economic activities and abundant scenic beauty, wildlife habitat, and recreational opportunities. Because public lands comprise the majority of lands within the SESA, management decisions on public lands can affect lifestyles of residents as well as the economic base of communities in the SESA. The information below provides a general overview of social development and culture for the SESA. Refer to the BLM PFO Approved RMP and ROD for additional information on social development, culture, and history of specific communities in the SESA (BLM 2008a).

Social and economic development in the SESA has been based on a variety of activities including ranching, mineral extraction, tourism, and recreation (BLM 2008a). The SESA remains one of the least populated and most undeveloped areas in the contiguous United States, with a population density ranging from 2.1 people per square mile in Sublette County to 4.4 people per square mile in Lincoln County in 2010. Land ownership is largely public (80 percent of Sublette County, 79 percent of Lincoln County, and 72 percent of Sweetwater County). Oil and gas and other mineral development have played a significant role in the regional economy since the 1920s. Historically, most of the oil and gas activity in the SESA was limited to the LaBarge area in Lincoln County and southwestern Sublette County, but now extends over much of the southern portion of Sublette County.

The social characteristics throughout the SESA are similar to those in other rural western communities and are strongly tied to traditional natural resource-based industries, such as agriculture and extractive industries. Agriculture and ranching provided the basis for community development during much of the twentieth century, and ranching and grazing continue to be an important part of communities in the SESA. Although agricultural activities have declined in economic importance relative to mineral extraction in recent years, agriculture is important for its historic and cultural influence, in addition to its ongoing economic contributions.

3.14.3.3.2 Crime

The Wyoming Attorney General, Division of Criminal Investigation (DCI) produces annual reports on crime statistics for the State of Wyoming. Crime data are compiled from the Uniform Crime Reporting (UCR) records submitted to the DCI by law enforcement agencies across the state. In 2014, 60 individual law enforcement agencies, whose jurisdiction encompasses 97.3 percent of the state’s population, contributed UCR data. The intent of the UCR program is to gather relevant standardized data at the city, county, and state levels for use in compiling and analyzing national crime statistics (Wyoming Attorney General 2014).

The UCR program defines crime rates in terms of numbers of crimes reported in relation to the population of a given jurisdiction. The UCR program calculated the 2014 Wyoming population using U.S. Census Bureau data. Serious offenses reported in UCR data are categorized as violent crimes (murder, forcible rape, robbery, and aggravated assault) or as property crimes (burglary, larceny-theft, and motor vehicle theft). Crime rates are calculated by dividing the number of offenses by the population and multiplying the result by 10,000. In 2014, the State Attorney General reported there were 1,018 violent offenses and 11,044 property crimes in Wyoming, a crime rate of 206.5 per 10,000 inhabitants (20.7 per 1,000 inhabitants) (Wyoming Attorney General 2014). Crime rates discussed below are expressed in crimes per 1,000 inhabitants in 2014.

In 2014, Lincoln County had a crime rate of 10 (per 1,000 inhabitants), which is lower than the state crime rate and the second-lowest in the SESA after Sublette County. There were 13 violent crimes, 161 property crimes, and 174 total index offense arrests in Lincoln County in 2014. Crimes associated with the greatest number of arrests were larceny-theft (128), burglary (26), aggravated assault (9), motor vehicle theft (7), forcible rape (3), and murder/non-negligent manslaughter (1).

In 2014, Sublette County had a crime rate of 8.7, also lower than the state crime rate and the lowest in the SESA. There were 10 violent crimes, 76 property crimes, and 86 total index offense arrests. Crimes associated with the greatest number of arrests were larceny-theft (68), aggravated assault (8), burglary (5), motor vehicle theft (3), forcible rape (1), and murder/non-negligent manslaughter (1) (Wyoming Attorney General 2014). Table 3-36 provides detailed information on the incidence of index crimes, which include violent and relatively serious nonviolent crimes, in Sublette County from 2002 to 2014.

Table 3-36. Index Crime Incidence in Sublette County, 2002–2014

Year	Murder and Non-negligent Manslaughter	Forcible Rape	Robbery	Aggravated Assault	Burglary	Larceny-theft	Motor Vehicle Theft	Total
2002	0	0	0	16	17	150	2	185
2003	0	1	0	28	14	159	12	214
2004	0	2	0	25	18	203	14	262
2005	0	-1	0	39	20	265	17	340
2006	1	2	1	27	27	196	10	264
2007	1	3	0	33	48	184	12	281
2008	0	3	2	17	48	156	17	243
2009	0	4	1	22	32	125	10	194
2010	0	0	0	8	22	120	7	157
2011	0	1	0	9	29	116	6	161
2012	0	1	0	11	22	57	4	95
2013	0	0	0	5	3	4	0	12
2014	1	1	0	8	5	68	3	86

Source: Wyoming Division of Criminal Investigation 2015.

Note: Includes adult and juvenile crimes.

As shown in Table 3-36, index crime incidence generally increased during the previous gas boom between 2003 and 2008, while the county's permanent population roughly doubled and its transient worker population became a substantial share of the total population. Following the boom, index crime incidence subsided, while many transient workers either moved away or established permanent residence. Index crime rate expressed per 10,000 inhabitants (i.e., permanent residents counted by the Census) was relatively stable during the boom, and declined thereafter.

The crime rate for Sweetwater County was 20.7, the highest in the SESA and the same as the state crime rate. In Sweetwater County, there were 134 violent crimes, and 820 property crimes. The greatest number of arrests from index crimes in 2014 were associated with all larceny-theft (624), burglary (124), aggravated assault (92), motor vehicle theft (72), forcible rape (36), robbery (5), and murder/non-negligent manslaughter (1) (Wyoming Attorney General 2014).

3.14.3.3.3 Infrastructure

Lincoln County

Lincoln County is west of Sublette and Sweetwater counties, along Wyoming's border with Idaho and Utah, and encompasses approximately 4,076 square miles (Lincoln County 2012). The largest communities in the county are Kemmerer and Afton (Wyoming Department of Administration and Information 2015c).

LaBarge

Located on U.S. Highway 189 approximately 75 miles north of Green River and 21 miles south of Big Piney, LaBarge was initially settled in the mid-1800s and became incorporated in 1973. Emergency services include one full-time and one part-time police officer, emergency telephone service, and a 15-member volunteer fire department. Health care is provided by a weekly clinic and an ambulance service. Communication services include a weekly newspaper, cable TV, and post office. Recreation facilities include one ice-skating rink, two baseball fields, bike paths, and two parks. In addition, LaBarge has a small airport.

Sublette County

Sublette County encompasses approximately 4,887 square miles in west-central Wyoming. Its largest communities are Pinedale, Big Piney, Marbleton, and Boulder.

Pinedale

Located approximately 100 miles northwest of Rock Springs on U.S. Highway 191, Pinedale is the Sublette County seat. The town has 911 emergency service and a volunteer fire department. Police protection for the town is provided through contract with the Sublette County Sheriff's Office. Medical services include a clinic, two dental offices, ambulance service, and a nursing home with 107 rooms. Recreation facilities include a golf course, ice-skating rink, bike paths, two parks, and a recreation center.

Big Piney

Big Piney is located on U.S. Highway 189, about 95 miles north of Green River and 35 miles southwest of Pinedale. The town has 911 emergency service and a voluntary fire department. Police protection is provided by the Sublette County Sheriff's Office. There is a 40,000-volume library, one day care center, six churches, and three motels. Medical services include two doctor offices, one dentist office, and an ambulance service. There is one ice-skating rink, one bike path, three parks, three baseball fields, one swimming pool, and a small airport.

Marbleton

Marbleton is located on U.S. Highway 189, one mile north of Big Piney. It has an RV Park and picnic grounds.

Boulder

Boulder is an unincorporated community on U.S. Highway 191, 12 miles south of Pinedale, and features an RV park with nine spaces.

Sweetwater County

Consisting of approximately 10,427 square miles, Sweetwater County is in the southwestern part of Wyoming, with 60 miles of its border touching the states of Utah and Colorado. The two largest cities in the county are Rock Springs and Green River (the county seat).

Rock Springs

Established in 1888 as a mining town, Rock Springs is located along Interstate 80 in west-central Sweetwater County and serves as the economic hub of southwest Wyoming. Law enforcement and fire protection services are available, along with 911 emergency service. Public education is provided by 10 elementary schools, two junior high schools, two high schools, and Western Wyoming Community College (two-year junior college).

Recreation resources include 17 baseball fields, 24 tennis courts, six swimming pools, eight soccer fields, two golf courses, one ice-skating rink, two recreation centers, and 22 parks. Outdoor recreation sites available within 30 miles of the city include Flaming Gorge National Recreation Area and BLM-administered lands, including Boar’s Tusk, sand dunes, petroglyphs, and the Oregon/California Trails.

Eden/Farson

Eden and Farson are unincorporated communities located on U.S. Highway 191, about 40 miles northwest of Rock Springs. Government services are provided by Sweetwater County. Emergency services include a resident sheriff’s officer and highway patrolman, a 26-member volunteer fire department, ambulance service, and 911 emergency phone service. Recreational facilities include a youth center, two county parks, and a new community center.

Local medical resources include a tele-healthcare system with links to regional health care providers, a weekly onsite walk-in clinic, and chiropractic services. There is one elementary and one secondary school. Sweetwater School District #1 is replacing the existing schools and constructing a new primary and secondary school (K through 12th grades).

3.14.3.3.4 Cost of Living

A common quality-of-life concern in communities experiencing rapid industrial development is that relatively high wages paid in the rapidly growing industries—and these industries’ high demands for goods and services—induce inflation, which reduces the discretionary spending capacity of individuals and households not employed by, or benefiting directly from, the growth industries. By increasing living costs for the entire population, the higher wages in, and increased demands by, the growth industries can reduce the real (i.e., adjusted for inflation) incomes of households living on fixed or nearly fixed incomes, despite the increase in overall regional income levels resulting from industrial development.

In the fourth quarter of 2014, the cost of living index in Sweetwater County was equal to the statewide index, while Sublette County's index was 107 percent of the statewide index, and the index in Lincoln County was 92% of the statewide index (Wyoming Department of Administration and Information 2014). Counties in the State's Southwestern region collectively experienced deflation (-0.9%) in 2014 (Wyoming Department of Administration and Information 2014; Ecosystem Research Group 2009). From 2008 to 2014, the average annual rate of inflation in southwestern Wyoming (which includes the three-county SESA plus Uinta County) was 1.8 percent, which was below the statewide inflation rate of 2.5 percent, but exceeded the national average rate of 1.6 percent over the same period (Department of Administration and Information 2014).

3.14.3.3.5 Education

Each county in the SESA has two public school districts. Total enrollment in these districts from 2005 to 2014 is shown in Table 3-37.

Table 3-37. Enrollment in SESA Public School Districts (2005–2014)

Year	Lincoln County		Sublette County		Sweetwater County	
	District #1	*District #2*	*District #1*	*District #9*	*District #1*	*District #2*
2005	629	2,542	767	617	4,240	2,582
2006	627	2,533	841	646	4,413	2,552
2007	656	2,579	940	680	4,742	2,599
2008	629	2,650	989	691	4,957	2,671
2009	602	2,640	780	675	5,033	2,601
2010	583	2,609	1,020	672	5,159	2,635
2011	612	2,601	1,043	649	5,296	2,641
2012	603	2,559	1,018	627	5,514	2,653
2013	624	2,627	1,034	650	5,607	2,729
2014	634	2,681	1,035	627	5,719	2,726

Source: Wyoming Department of Education 2015.

The most notable trend among SESA school districts has been the enrollment increase in Sublette County District #1, which includes Pinedale. This trend persisted through 2011 despite the decline in gas field development since 2008, as many formerly transient workers, along with their families, have established permanent residence in Sublette County. District #1 enrollments have declined since 2011 (McAdams 2013). Senior high school capacity is currently most constrained in District #1, while middle school capacity is most constrained in District #9. However, both districts currently have capacity to accommodate additional students in all grades (McAdams 2013; Anschutz 2013).

Statewide, 92.3 percent of persons 25 years or older were high school graduates and 25.1 percent had obtained a bachelor's or higher degree for the 2010–2014 5-year estimate (Table 3-38). Study-area counties had similar rates of educational attainment, with Sublette County having the highest (94.7 percent) and Sweetwater County the lowest (90.5 percent) rates of high school completion. Bachelor's degree attainment rates for SESA counties were slightly lower than the statewide rate, with Sublette having the highest percent (23.6) and Sweetwater the lowest (18.1 percent) (U.S. Census Bureau 2015a).

Table 3-38. Educational Attainment (2010–2014)

Location	High School Graduates (%)	Bachelor's Degree or Higher (%)
	2010–2014 5-year estimate[1]	*2010–2014 5–year estimate*[1]
Wyoming	92.3	25.1
Lincoln County	93.4	20.1
Sublette County	94.7	23.6
Sweetwater County	90.5	18.1

Source: U.S. Census Bureau 2015a.

[1]Percent of persons 25 years old and older.

3.14.4 Economic Conditions

3.14.4.1 Income and Poverty

Income and poverty data are presented in Table 3-39. The real (i.e., adjusted for inflation) median household income for Wyoming increased by 9 percent between 2000 and 2014. Between 2000 and 2014, real median household income in Lincoln County increased by 7 percent. During that same period, real median household income in Sublette and Sweetwater counties increased by 33 and 5 percent, respectively (U.S. Census Bureau 2015b).

Wyoming estimates for real personal per capita income increased 12 percent across the state between 2000 and 2014 (U.S. Census Bureau 2015a). Personal per capita income in 2014 in Wyoming was $29,381, while personal per capita income in the SESA grew at higher rates than the state, ranging from 14 percent in Sweetwater County, to 15 percent and to 23 percent in Sublette and Lincoln counties, respectively (Table 3-39).

The poverty rate in Wyoming was similar in 2000 (10.4 percent) to 2013 (10.9 percent). Fluctuations in intervening years mirrored the recession and recovery periods for the US at large. Poverty rates in the SESA in 2013 ranged from a low of 6.3 percent in Sublette County to a high of 8.9 percent in Lincoln County (Table 3-39). In the SESA, only Sweetwater County saw an increase in the poverty rate (13 percent) between 2000 and 2013 (U.S. Census Bureau 2015b).

Table 3-39. Income and Poverty

Location	Median Household Income (2014 Dollars)		Personal Per Capita Income (2014 Dollars)		Poverty Rate (percent)	
	2000[1]	*2014[1]*	*2000[2]*	*2010–2014 5-year estimate[3]*	*2000[1]*	*2014[1]*
Wyoming	53,340	58,291	26,214	29,381	10.4	11.2
Lincoln County	59,533	63,575	24,020	28,077	9.0	9.0
Sublette County	58,174	77,222	27,477	33,532	8.7	6.8
Sweetwater County	68,821	72,604	26,818	30,500	7.7	9.8

Sources:
[1]U.S. Census Bureau 2015b.
[2]U.S. Census Bureau 2003.
[3]U.S. Census Bureau 2015a.

Note: Median household income is for all geographic units; personal per capita is for towns and cities. Poverty rate is the percent of people in poverty.

3.14.4.2 Labor Force and Employment

In August 2015, the civilian labor force in the SESA included a total of 36,699 persons in Lincoln County, Sublette County, and Sweetwater County, approximately 1,424 of whom were unemployed (Table 3-40). The preliminary, not seasonally adjusted unemployment rate in Lincoln County was the same as the statewide average (3.5 percent); unemployment rates in Sublette and Sweetwater County, both 4.0 percent, were higher than the statewide average. There was no statistically significant change in total nonfarm employment in Wyoming (measured by place of work) from August 2014 to August 2015 (Wyoming Department of Workforce Services 2015). The sections that follow discuss changes in employment by industry from 2001 to 2014.

Table 3-40. Labor Force, Employed, and Unemployed (August 2015)

Location	Labor Force[1]	Employed[2]	Unemployed[3]	Unemployment Rate[4]
	August 2015	*August 2015*	*August 2015*	*August 2015*
Wyoming	311,127	300,123	11,004	3.5
Lincoln County	8,653	8,351	302	3.5
Sublette County	5,015	4,816	199	4.0
Sweetwater County	23,031	22,108	923	4.0

Source: Wyoming Department of Workforce Services 2015.

[1]Labor Force: All persons who meet the criteria given below as either employed or unemployed.
[2]Employed: All persons who, during the reference week, did any work at all as paid employees, worked in their own business, profession, or on their own farm, or worked 15 hours or more as unpaid workers in a family business.
[3]Unemployed: All persons who had no employment during the reference week, were available for work, and had made specific efforts to find employment sometime during the four-week period ending with the reference week.
[4]Unemployment Rate: The number of unemployed as a percent of the labor force.

Note: Preliminary data are not seasonally adjusted.

3.14.4.2.1 Wyoming

Employment grew statewide by 22 percent (72,609 jobs) from 2001 to 2014 (Table 3-41). Mining, quarrying, and oil and gas extraction experienced the largest net increase (14,438 jobs), and the largest relative increase (70 percent) in jobs over this period. Retail trade and federal, military were the only industries that had declining employment (BEA 2015a).

3.14.4.2.2 Lincoln County

From 2001 to 2014, 1,573 jobs (19 percent increase) were added in Lincoln County (Table 3-41). Mining, quarrying, and oil and gas extraction experienced the largest net increase in employment during this period (349 jobs), as well as the largest relative increase in jobs (81 percent). Industries experiencing declining employment included forestry, fishing, and related services; construction, manufacturing, retail trade, accommodation and food services, federal, and civilian (BEA 2015a).

3.14.4.2.3 Sublette County

From 2001 to 2014, 3,256 new jobs (77 percent increase) were added in Sublette County (Table 3-41). Mining, quarrying, and oil and gas extraction experienced the largest net increase in employment during this period (1,120 jobs), while the transportation and warehousing industry had the largest relative increase in jobs (660 percent). The information industry, which lost 13 jobs, was the only industry experiencing declining employment (BEA 2015a).

3.14.4.2.4 Sweetwater County

From 2001 to 2014, 5,911 new jobs (24 percent increase) were added in Sweetwater County (Table 3-41). State and local government experienced the largest net increase in employment during this period (1,569 jobs), while the largest relative increase in jobs occurred in the real estate and rental and leasing industry (88 percent). Industries with declining employment included information; retail trade; administration and support and waste management and remediation; arts, entertainment, and recreation; and federal, civilian (BEA 2015a).

Table 3-41. Employment by Industry, 2001 and 2014

Industry	Wyoming		Lincoln County		Sublette County		Sweetwater County	
	2001	*2014*	*2001*	*2014*	*2001*	*2014*	*2001*	*2014*
Farm Employment	12,447	13,928	593	667	409	461	201	274
Forestry, Fishing and Related Activities	2,608	2,980	102	100	80	127	NR	NR
Mining, Quarrying, and Oil and Gas Extraction	20,719	35,157	430	779	434	1,554	NR	6,165
Utilities	NR	2,590	NR	245	NR	27	NR	NR
Construction	27,179	31,853	1,223	1,117	472	944	1,806	2,123
Manufacturing	11,419	12,008	402	227	NR	56	1,426	1,497
Transportation and Warehousing	NR	15,727	220	278	83	548	1,115	1,742[3]
Wholesale Trade	7,718	10,518	NR	103	NR	23	NR	NR
Information	NR	4,721	124	126	50	37	254	208
Retail Trade	38,859	38,526	988	970	433	521	2,866	2,842
Finance and Insurance	10,395	16,174	223	293	81	172	542	793
Real Estate and Rental and Leasing	11,940	17,836	297	499	162	431	641	1,203
Professional, Scientific, and Technical Services	13,776	17,342	224	406	231	293	592	851
Management of Companies and Enterprises	923	1,383	NR	NR	NR	NR	91	135
Administrative and Support and Waste Management and Remediation Services	11,479	12,971	NR	NR	NR	NR	805	721
Educational Services	2,378	3,734	21	59	NR	NR	91	135
Health Care and Social Assistance	22,871	29,363	NR	520	NR	NR	1,117	1,479
Arts, Entertainment, and Recreation	6,325	6,856	112	155	85	NR	258	216
Accommodation and Food Services	23,452	34,745	580	532	383	426	2,093	2,420
Other Services	NR	18,468	370	527	205	285	1,045	1,158

Table 3-41. Employment by Industry, 2001 and 2014

Industry	Wyoming		Lincoln County		Sublette County		Sweetwater County	
	2001	*2014*	*2001*	*2014*	*2001*	*2014*	*2001*	*2014*
Federal, Civilian	7,186	7,363	114	111	105	124	258	217
Federal, Military	6,122	6,072	85	100	40	51	212	240
State and Local Government	51,962	62,052	1,358	1,663	557	947	2,743	4,312
Total Full Time and Part Time Employment	**330,154**	**402,763**	**8,250**	**9,823**	**4,219**	**7,475**	**24,216**	**30,127**

Source: BEA 2015a.

NR Not reported for this sector to avoid disclosure of confidential information. Estimates for these sectors are included in total.

Note: Industry classifications are based on the North American Industry Classification System.

3.14.4.3 Compensation and Personal Income

Average employee compensation (i.e., wages, salaries, and supplements to wages and salaries) for Wyoming and the SESA counties in 2001 and 2014 is summarized in Table 3-42. As shown in Table 3-42, the real (i.e., adjusted for inflation) average compensation per employee increased by 28 percent statewide from 2001 to 2014, with Sublette County's average compensation increasing substantially faster (75 percent). Average compensation in Lincoln and Sweetwater counties increased slightly less than the state average, by 27 and 23 percent, respectively (BEA 2015b).

Personal income is the income received by, or on behalf of, all persons from all sources. Personal income for Wyoming and the SESA counties in 2001 and 2014 is summarized in Table 3-42. As shown in Table 3-42, the real per capita personal income increased by 33 percent statewide from 2001 to 2014. Sweetwater County's per capita personal income increased by 38 percent during the same period, while real per capital personal income in Lincoln and Sweetwater counties increased by 19 and 27 percent, respectively (BEA 2015c). Because personal income is a more inclusive measure of income than compensation, it is discussed throughout the remainder of this section.

Table 3-42. Compensation and Personal Income (2001 and 2014, in 2014 Dollars)

Location	Average Compensation per Job[1, 2]		Per Capita Personal Income[3]	
	2001	***2014***	***2001***	***2014***
Wyoming	46,907	59,878	41,186	54,584
Lincoln County	44,682	56,930	33,776	40,217
Sublette County	42,951	75,124	40,610	51,579
Sweetwater County	59,204	73,007	40,476	55,855

[1]The employment estimates used to compute the average compensation are a job, not person, count. People holding more than one job are counted in the employment estimates for each job they hold.
[2]Source: BEA 2015b
[3]Source: BEA 2015c

Personal income (Table 3-43) is discussed below by industry for Wyoming and the three counties in the SESA. All personal income data is from the Bureau of Economic Analysis (BEA 2015c), unless otherwise stated.

Table 3-43. Personal Income by Industry, 2001 and 2014 (in Thousands of 2014 Dollars)

Industry	Wyoming		Lincoln County		Sublette County		Sweetwater County	
	2001	2014	2001	2014	2001	2014	2001	2014
Farm Earnings	257,119	343,939	9,941	8,295	5,264	12,179	1,587	3,798
Forestry, Fishing, and Related Activities	63,1173	59,402	2,080	1,266	1,244	2,053	NR	NR
Mining, Quarrying, and Oil and Gas Extraction	1,830,849	3,780,997	38,222	75,181	27,400	175,965	NR	1,126,766
Utilities	NR	302,207	NR	NR	NR	3,344	NR	NR
Construction	1,373,753	1,951,340	59,349	46,920	20,621	65,847	104,340	145,725
Manufacturing	671,241	840,222	NR	7,277	NR	2,060	152,180	162,632
Wholesale Trade	489,120	805,160	NR	3,918	NR	786	NR	NR
Retail Trade	1,054,853	1,180,160	10,881	25,677	18,174	10,881	76,444	90,929
Transportation and Warehousing	NR	1,185,676	12,458	14,483	5,172	25,690	78,848	133,188
Information	NR	246,641	4,777	8,311	1,581	1,829	8,900	8,012
Finance and Insurance	459,503	551,995	10,677	8,101	6,017	4,451	24,594	23,619
Real Estate and Rental and Leasing	324,941	532,225	5,345	8,553	26,578	11,908	33,990	57,339
Professional, Scientific, and Technical Services	633,769	926,743	6,456	13,675	11,101	14,855	31,046	50,187
Management of Companies and Enterprises	58,565	926,743	NR	NR	NR	NR	6,774	13,813
Administrative and Support and Waste Management and Remediation Services	302,019	369,728	NR	NR	NR	NR	22,127	21,260
Educational Services	48,956	87,412	NR	324	NR	NR	1,136	2,166
Health Care and Social Assistance Services	942,807	1,449,351	NR	13,421	NR	NR	41,248	62,082
Arts, Entertainment, and Recreation	101,252	104,501	738	1,733	1,256	1,277	2,695	1,695
Accommodation and Food Services	554,271	870,152	7,843	8,888	7,355	12,644	40,417	53,069
Other Services	NR	647,593	8,981	13,463	6,486	11,367	33,571	43,600

Table 3-43. Personal Income by Industry, 2001 and 2014 (in Thousands of 2014 Dollars)

Industry	Wyoming		Lincoln County		Sublette County		Sweetwater County	
	2001	2014	2001	2014	2001	2014	2001	2014
Federal, Civilian	554,893	636,280	7,714	8,486	7,860	10,231	20,006	19,215
Federal, Military	265,923	352,247	1,482	2,986	1,053	1,534	3,704	7,148
State and Local Government	2,482,831	4,081,296	60,226	106,614	24,491	67,159	181,921	286,933
Total Personal Income	**13,394,704**	**21,415,149**	**311,731**	**413,520**	**149,036**	**460,811**	**1,343,599**	**2,431,602**

Source: BEA 2015c.

NR Not reported for this sector to avoid disclosure of confidential information. Estimates for these sectors are included in total.

Note: All state and local area dollar estimates are in current dollars (not adjusted for inflation). Industry classifications are based on the North American Industry Classification System.

3.14.4.3.1 Wyoming

Wyoming experienced a gain in overall total gross real personal income of 60 percent from 2001 to 2014 (Table 3-43). During this 13-year period, real personal income fell 6 percent in forestry, fishing, and related activities, but increased for all other industries. Industries with fast-growing real earnings included management of companies and enterprises (482 percent); mining, quarrying, and oil and gas extraction (106 percent); educational services (78 percent); wholesale trade (65 percent); state and local government (64 percent); real estate and rental and leasing (64 percent); accommodation and food services (57 percent); and health care and social assistance services (54 percent). Mining, quarrying, and oil and gas extraction added $1.95 billion to Wyoming's real personal income, while state and local government added $1.60 billion.

3.14.4.3.2 Lincoln County

Lincoln County experienced a gain in total real personal income of 33 percent from 2001 to 2014 (Table 3-43). Declining real personal income over this 13-year period occurred in farming (17 percent); forestry, fisheries, and related activities (39 percent)); construction (21 percent); and finance and insurance (24 percent). The fastest personal income growth occurred in retail trade (136 percent); arts, entertainment, and recreation (135 percent); professional, scientific, and technical services (112 percent); federal, military (101 percent); mining, quarrying, and oil and gas extraction (97 percent); state and local government (77 percent); information (74 percent); and real estate and rental and leasing (60 percent). The largest increases in county real personal income occurred in state and local government ($46.4 million) and mining, quarrying, and oil and gas extraction ($36.9 million).

3.14.4.3.3 Sublette County

Total real personal income in Sublette County grew by 209 percent from 2001 to 2014 (Table 3-43). During this 13-year period, real industry personal income declined in real estate, rental and leasing (55 percent); retail trade (40 percent); and finance and insurance (26 percent). Industries with fast-growing real personal income included mining, quarrying, and oil and gas extraction (542 percent); transportation and warehousing (397 percent); construction (219 percent); state and local government (174 percent); farming (131 percent); other services (75 percent); accommodation and food services (72 percent); and forestry, fishing, and related activities (65 percent). The largest increases in real personal income occurred in mining, quarrying, and oil and gas extraction ($148.5 million), followed by construction ($45.2 million) and state and local government ($42.7 million).

3.14.4.3.4 Sweetwater County

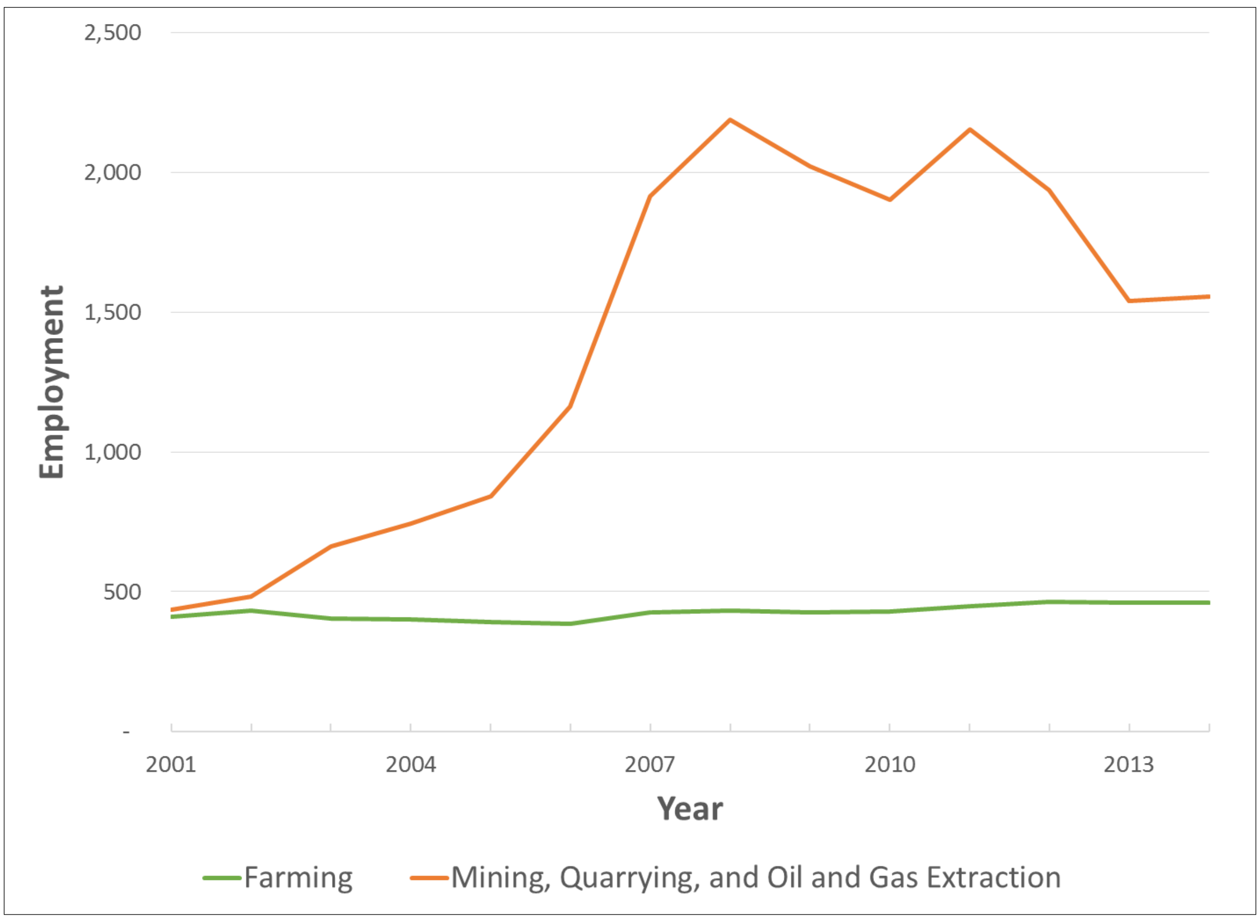
Sweetwater County experienced a gain in total real personal income of 81 percent from 2001 to 2014 (Table 3-43). Real personal income declined in arts, entertainment, and recreation (37 percent); information (10 percent); finance and insurance (4 percent); administration and support and waste management and remediation services (4 percent); and federal, civilian (4 percent). Industries with fast-growing real personal income included farming (193 percent); management of companies and enterprises (104 percent); federal, military (93 percent); transportation and warehousing (69 percent); real estate and insurance (69 percent); and professional, scientific, technical services (62 percent; and state and local government (56 percent). The largest contributions to increases in real personal income occurred in state and local government ($105.0 million); transportation and warehousing ($54.3

million); and construction ($41.4 million). Although mining, quarrying, and oil and gas extraction accounted for more of the county's personal income than any other industry in 2014 (46 percent, nondisclosure of its 2001 personal income makes its increase in personal income inestimable for the 2001-2014 period.

3.14.4.4 Livestock Grazing

Prior to the recent rapid expansion of the oil and gas industry in Sublette County, livestock production was the county's economic mainstay (Blevins et al. 2004). Although extractive resources have been increasingly relied upon as a source of employment and tax revenue for Wyoming counties, livestock production remains an important industry because it provides economic stability for local communities. Figure 3-20 compares farm employment to employment in resource extraction industries in Sublette County from 2001 to 2014. Employment in agriculture remained relatively stable during this period compared to the more volatile level of employment in resource extraction industries (BEA 2015a). Farm employment in Lincoln and Sweetwater counties displayed a slowing increasing trend from 2001 to 2014 (BEA 2015a).

Figure 3-20. Employment in Farm and Resource Extraction Industries in Sublette County, Wyoming, 2001–2014



Source: BEA 2015a.

In 2012, the SESA's total agricultural production was valued at $119.6 million (in 2014 dollars), 65 percent of which was accounted for by cattle production (USDA 2014). Total agricultural production value in the SESA increased by 30 percent between 2007 and 2014, as measured in constant dollars. The SESA's rangelands supported 128,746 cattle and calves in 2012, a 22-percent increase over 2007 (USDA 2014).

In 2012, Sublette County had a total of 398 farms, of which 162 were classified as beef cattle ranches (USDA 2014). Sublette County cattle ranching and farming employed a total of 75 workers in Sublette County in 2015; cattle ranch employment data for Lincoln and Sweetwater Counties for 2015 were not disclosed (U.S. Bureau of Labor Statistics 2016). As reported above in Section 3.10.3 (*Livestock/Grazing Management*), the Project Area has an estimated 16,499 AUMs. In 2015 the BLM charged permittees $1.69 per AUM (BLM 2015g). Although this amount is a measure of livestock forage value, it is a small fraction of the per-AUM value of livestock raised on BLM-administered ranges. Based on cattle prices for 2002-2011, this value was estimated at $55.44 for Wyoming's Basin and Range Region and at $52.69 for Wyoming's Northern Great Plains Region (in 2014 dollars), for an average per-AUM value in Wyoming of $54.06 (BLM 2015g). At this rate, the Project Area supports an estimated annual livestock production value of $703,699.

3.14.4.5 Recreation and Tourism

This section provides an overview of economic conditions related to recreation and tourism in the Project Area, based in part on the recreation conditions described in Section 3.13 (*Recreation*).

3.14.4.5.1 Value of Recreational Use

Recreation and associated travel and tourism spending can provide important value both in terms of public enjoyment and regional economic activity, including jobs, income, and sales tax revenues. Table 3-44 shows the estimated dollars spent by visitors in Wyoming and the SESA counties. Travel spending includes spending related to business visits as well as tourism and recreational visits. In 2013, Sweetwater County had the largest amount ($183.3 million) from travel spending in the SESA, and Sublette County had the least ($42.9 million). Travel spending has increased steadily, ranging from 4.7 percent in Sublette County to 5.5 percent in Sublette County (Dean Runyan Associates 2014).

Table 3-44. Estimated Travel Spending in the Analysis Area (2000,2010, and 2013)

Location	Travel Spending ($Millions)			
	2000	***2010***	***2013***	***Average Annual Change (percent)[1]***
Wyoming	1,721	2,661	3,209	4.9
Lincoln County	36.4	242.9	67.9	4.9
Sublette County	23.7	42.8	42.9	4.7
Sweetwater County	97.4	146.0	183.3	5.0

Source: Dean Runyan Associates 2014.

[1]Annual change is the average annual percentage change.

In 2013, travel spending generated state sales tax revenues of $2.5 million in Lincoln County, $1 million in Sublette County, and $5.5 million in Sweetwater County (Dean Runyan Associates 2014).

Existing oil and gas development has likely reduced non-consumptive recreation opportunities in the SESA, with the exception of camping associated with hunting, which is discussed below. No additional recreational monetary value has been identified that is directly attributable to the Project Area, and additional analysis was not conducted for these activities.

Recreation Expenditures

The primary recreation activities occurring in the Project Area are associated with hunting for pronghorn, mule deer, elk, Sage-Grouse, and other upland birds. Table 3-45 describes hunting and hunting-related expenditures for hunt areas that include the Project Area, along with the pro-rated share of hunt-area spending attributable to the Project Area. The greatest expenditures are associated with hunting small game and other upland birds. Additional spending occurs in association with other dispersed recreation uses including hunting, driving for pleasure, OHV use, wildlife viewing, antler collecting, and hiking.

Table 3-45. Total 2014 Hunting Days, Average 2010 Daily Trip-related Hunting Expenditures, and Total Trip-related Hunting Expenditures for the Hunt Areas That Include the Project Area, by Species

Species[1]	Hunt Area	Hunting Days[2]	Percent of Hunt Area in Project Area[3]	Estimated Hunting Days in Project Area	Average Total Expenditure per Recreation Day[4]	Total Project Area-related Expenditures
Pronghorn	90 (Yellow Point)	1,902	13.5	257	$126.10	$32,379
Mule deer	138 (Boulder)	1,406	13.5	190	$109.91	$20,862
Elk	98 (Boulder)	8,895	11.4	1,014	$100.33	$101,737
Sage-Grouse	D	1,266	5.4	68	$280.46	$19,071
Small game and other upland birds	4	11,789	1.05	124	$280.46	$34,777
Total	-	**13,469**	-	**1,461**	**$179.45**	**$208,826**

[1]Waterfowl are not included in this table because their distribution is localized around water features and therefore waterfowl hunter days are less reasonably assumed to be proportionally distributed across management areas.
[2]WGFD 2015a; WGFD 2015b
[3]WGFD 2005; WGFD 2010d; WGFD 2013a
[4]WGFD 2011a

NA Not Available

3.14.5 Fiscal Conditions

3.14.5.1 Taxes and Tax Revenues

3.14.5.1.1 Severance Tax

Wyoming imposes a 6 percent tax on the taxable value of mineral production, including natural gas, at the point of valuation, which is defined as the point where production has occurred, but prior to processing or transportation of minerals. The taxable value of Wyoming natural gas production has fluctuated substantially in recent years, declining by more than 50 percent from 2008 ($12.0 billion) to 2012 ($4.5 billion) (Wyoming Department of Revenue 2009, 2013). The taxable value of Wyoming natural gas production in 2014 was $5.8 billion (Wyoming Department of Revenue 2015a). In recent years, Sublette County has been Wyoming's largest gas-producing county, accounting for 53 percent of statewide production in 2015 (WOGCC 2016). Sweetwater and Lincoln counties are also major gas-producing counties (Wyoming Department of Revenue 2009, 2010, 2011, 2012, 2013, 2014, 2015a). Severance tax collections from Wyoming and the counties in the SESA from 2008 to 2014 are shown in Table 3-46.

Table 3-46. Natural Gas Severance Tax Collections 2008–2014, in Millions of 2014 Dollars

Year	Wyoming	Lincoln	Sublette	Sweetwater
2008	$792	$39	$356	$82
2009	$387	$17	$184	$38
2010	$497	$21	$235	$52
2011	$453	NA[1]	NA[1]	NA[1]
2012	$276	NA[1]	NA[1]	NA[1]
2013	$311	$11	$15	$45
2014	$348	$12	$17	$53

Source: Wyoming Department of Revenue 2009, 2010, 2011; 2012; 2013; 2014; 2015a.

[1]Exact values are not available in 2011 and 2012 Wyoming Department of Revenue Annual Reports.

NA Not Available

Wyoming's severance tax revenues are distributed primarily to statewide accounts such as the Permanent Wyoming Mineral Trust Fund, budget reserve account, and general fund. In 2014, 2.1 percent of severance tax collections were distributed to local governments (Wyoming Department of Revenue 2015a).

3.14.5.1.2 Gross Products Tax

Counties and special districts in Wyoming impose an *ad valorem* tax called the gross products tax on the taxable value of mineral production, as reported to the state for severance tax purposes. Gross products tax assessments account for most property tax assessments in the SESA. For example, in 2015, mineral and industry assessments accounted for 96 percent of all Sublette County property tax assessments, while residential, commercial, agricultural, and utility assessments collectively accounted for the remaining 4 percent. The county's top ten individual property tax payers were all mineral-affiliated companies, which collectively accounted for 83 percent of the county's total assessed value (Sublette Board of County Commissioners 2016).

Gross products tax collections are retained by the local jurisdictions. The taxable value of natural gas is its full market value. The gross products tax rate is determined by the mill levies applied by each county and its authorized special districts. For example, Sublette County imposes a mill levy of 12 (i.e., $1.20 per $1,000 of assessed value), but including the levies imposed by special districts, the countywide average mill levy was 58.9 in 2015 (Sublette Board of County Commissioners 2016; Wyoming Department of Revenue 2015a). Average mill levies for Sweetwater and Lincoln counties in 2015 were

66.5 and 63.2, respectively. Dividing the average mill levy by 10 gives the average gross products percentage tax rate, which ranged from 5.89 percent in Sublette County to 6.65 percent in Sweetwater County in 2015. Therefore, gross products tax collections in these counties were similar in magnitude to the 6 percent severance tax collections reported in Table 3-46.

3.14.5.1.3 Sales, Use, and Lodging Taxes

Wyoming charges a sales tax of 4 percent on most non-food and non-medical retail purchases, and also on certain services rendered at oil and gas well sites. Of this 4 percent of taxable sales, 69 percent accrues to the state general fund and 31 percent is disbursed to counties and municipalities (Wyoming Department of Administration and Information 2015d). Counties and municipalities may impose, by popular election, up to an additional 2 percent sales tax to support local government. For example, Sweetwater and Lincoln counties have optional sales tax rates of 2 percent and 1 percent, respectively, while Sublette County imposes no optional sales tax (Wyoming Department of Revenue 2015b). In 2015, Wyoming sales tax collections totaled $978 million, a 6.4 percent increase from the previous year (Wyoming Department of Administration and Information 2015d). Annual sales tax collections have increased steadily since 2010, but monthly revenues decreased considerably in the last three months of 2015. The main cause of the decline in sales tax collections was the halt in mineral exploration that resulted from the dramatic decline of oil and natural gas prices. Except for retail trade, mining is the largest source of sales tax revenues in Wyoming. Because of their dependence on mineral extraction, Sublette, Sweetwater, and Lincoln counties' sales tax collections are often reflective of activity in the oil and gas sector.

A use tax is imposed at the same rate as the sales tax on taxable purchases made outside of Wyoming that are brought into the state for use there. In addition, local governments in Wyoming may adopt a lodging tax of up to 4 percent on sales of lodging accommodations. Sublette County imposes a 3 percent lodging tax in Pinedale; Sweetwater County imposes a 2 percent lodging tax; and the Lincoln County municipalities of Afton, Cokeville, and Diamondville each impose a 2 percent lodging tax, while Kemmerer imposes a 4 percent lodging tax (Wyoming Department of Administration and Information 2015d).

Sales, use, and lodging tax revenues returned to counties in the SESA in 2015 are shown in Table 3-47. In comparison to the previous year, sales tax revenues increased for all three counties in the SESA, use tax revenues declined in all but Sublette County, and lodging tax revenues declined in all but Sweetwater County (Wyoming Department of Administration and Information 2015d).

Table 3-47. Sales, Use, and Lodging Tax Revenues Received by County (2015)

Revenues	Lincoln	Sublette	Sweetwater
Sales Tax	$12,482,189	$40,323,476	$54,768,168
Use Tax	$2,667,262	$4,999,437	$16,707,118
Lodging Tax	$98,989	$168,867	$701,393
Total	$15,248,440	$45,491,780	$72,176,679

Source: Wyoming Department of Administration and Information 2015d.

3.14.5.2 Federal Mineral Royalties

The Federal government generally imposes a royalty of 12.5 percent on the cash value of minerals extracted from Federal lands, such as BLM-administered lands, although royalty rates may vary depending on the terms of individual mineral leases. In fiscal 2015, Federal leases in Wyoming accounted for $1.8 billion in total (i.e., including all minerals) Federal royalty payments, approximately 50 percent of which ($0.9 billion) was returned to Wyoming, and subsequently disbursed to municipalities (U.S. Office of Natural Resource Revenue 2016). Among the communities in the SESA receiving Federal mineral royalties in 2015 were Afton, Alpine, Big Piney, Cokeville, Diamondville, Granger, Green River, Kemmerer, LaBarge, Marbleton, Opal, Pinedale, Rock Springs, and Thane. The amounts received by these communities ranged from $18,351 for Opal (population 96) to $988,267 for Rock Springs (population 23,036) (Wyoming Association of Municipalities 2015).

3.14.5.3 Federal Payments in Lieu of Taxes

The Federal government makes payments to counties to compensate for Federal lands in those jurisdictions not subject to local property taxes. The formula used to compute payments in lieu of taxes is based on county population, receipt sharing payments generated by the county, and the amount of Federal land in the county. In 2015, Wyoming received a total of $27.2 million in payments in lieu of taxes. Of this total, Lincoln County received $1.2 million, Sweetwater County received $3.3 million, and Sublette County received $0.9 million (DOI 2015a).

3.14.6 Nonmarket Values

Nonmarket environmental values (or simply “nonmarket values”) reflect the benefits individuals attribute to experiences of the environment, uses of natural resources, or the existence of particular ecological conditions that do not involve market transactions, and therefore lack prices. Nonmarket values generally result from three types of uses and benefits of the environment, including:

- Direct use of the environment through recreation, education, or other activities on the landscape that provide nonmarket values. These uses can also result in market values if there are market transactions;
- Indirect use of the environment, such as the protection of watersheds to preserve surface water quality for downstream communities or protecting scenic landscapes along historic trails to preserve cultural and historic settings; and
- Passive use (sometimes call non-use) benefits, which can stem from a desire to preserve a resource as a social or public good (existence value), for future use or for enjoyment by future generations. These passive use benefits often reflect nonmarket values.

Primary direct use nonmarket values in the SESA are associated with the general rural characteristics of the region (i.e., low traffic, low population density, appreciation of environmental and natural conditions, available recreation opportunities). Though industrial development has been increasing in the region due to past and ongoing oil and gas development, residents still enjoy and favor the generally rural characteristics of the region. As indicated in Section 3.14.4.5.1 (*Value of Recreational Use*) recreation can provide important direct use nonmarket value both in terms of public enjoyment (nonmarket values) and regional economic activity (market values), including jobs, income, and sales tax revenues. Primary recreation-related direct use values in the SESA includes hunting, OHV use, hiking, driving for pleasure, wildlife viewing, and camping. However, due to a lack of developed recreation sites and SRMAs in the Project Area recreational opportunities are likely less available than other areas in the SESA.

Indirect use of the environment, such as protection of air quality, and associated nonmarket values are closely related to management goals and objectives for physical resources (e.g., air, water) identified in the BLM Pinedale Approved RMP and ROD (BLM 2008a) and the BLM Green River Approved RMP and ROD (BLM 1997a). Due to the relatively low level of existing development in the Project Area, nonmarket values associated with indirect use of the environment are not likely being affected in any noticeable manner.

The relatively low level of development in the Project Area, compared to surrounding oil and gas fields, represents a passive use nonmarket benefit.

3.14.7 Environmental Justice

EO 12898, 59 Federal Register 7629, *Federal Action to Address Environmental Justice (EJ) in Minority Populations and Low Income Populations*, signed in 1994, directs all federal agencies to focus attention on the human health and environmental conditions for low-income populations, minority populations, or Indian tribes. “Indian tribes” refers to any federally recognized Indian or Alaska Native tribes, bands, nations, pueblos, villages or communities that the Secretary of the Interior recognizes to be eligible for special programs and services provided by the United States to Indians because of their status as Indians (25 U.S.C. 479a). The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Indian tribes that may experience common conditions of environmental exposure or effect associated with a plan or project. EO 12898 also requires federal agencies to ensure opportunities for effective public participation by identified potentially affected low-income populations, minority populations, or Indian tribes that are considered environmental justice populations.

Therefore, based on CEQ guidance under NEPA (CEQ 1997) and BLM environmental justice principles outlined in BLM H-1601-1, Land Use Planning Handbook, the environmental justice considerations for this action include the following:

- Identification of low-income populations, minority populations, or Indian tribes that meet the criteria to be considered an environmental justice population;
- Determination of disproportionately high and adverse human health effects on low-income populations, minority populations, or Indian tribes;
- Determination of disproportionately high and adverse environmental effects on low-income populations, minority populations, or Indian tribes;
- Identification and implication of differential patterns of consumption of natural resources by low-income populations, minority populations, or Indian tribes; and,
- Provision of opportunities for meaningful involvement of low-income populations, minority populations, or Indian tribes in BLM decision making processes.

Minority populations, as defined by CEQ guidance under the National Environmental Policy Act (CEQ 1997), include individuals in the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. A minority population is identified where “(a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the general population or other appropriate unit of geographic analysis." (CEQ 1997). Additionally, "[a] minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds" (CEQ 1997). CEQ guidance does not provide a specific threshold for determining when an area's minority population is "meaningfully greater". This analysis considers minority population percentages that are "meaningfully greater" as at least one percent of the area's total population and at least 20 percent higher than the next largest geographic reference area. Counties were used as the reference area to compare minority or low-income populations of census block groups or towns; the State of Wyoming was used as the reference area to compare minority or low-income populations of counties. Minority population percentages at least 20 percent higher than the next largest geographic reference area, but less than one percent of the total population, were not identified as environmental justice communities because percentage differences are exaggerated with small sample sizes.

Low-income populations are determined by the U.S. Census Bureau based upon poverty thresholds developed every year. The U.S. Census Bureau threshold for poverty in 2014 was $12,316 for an individual under the age of 65, $11,354 for an individual over the age of 65, and $24,230 for a family of four (U.S. Census Bureau 2014b). Because CEQ guidance does not provide specific criteria for determining low-income populations as it does for minority populations, this analysis applies the same criteria for identifying low-income populations as for identifying minority populations that may be considered environmental justice populations. Therefore, low-income populations or minority populations residing in the SESA constitute an "environmental justice population" through meeting either of the following criteria:

- At least one-half of the population is of minority or low-income status; or
- The percentage of population that is of minority or low-income status is at least one percent of the area's total population and represents at least a 20 percent higher than the next largest geographic reference area.

EO 12898 also applies to Tribes that are present or exercise treaty rights in the area. As described in Section 3.4 (*Cultural Resources*), the federally recognized Tribes that are recorded to have used the Project Area include the Eastern Shoshone Tribe of the Wind River Reservation, the Northern Arapaho Tribe of the Wind River Reservation, the Ute Tribe of the Uintah and Ouray Reservation, and the Shoshone Bannock Tribe. Historic and current land use by these Native American groups is visible through the presence of culturally sensitive sites. Within the Project Area, four sites have been previously identified as culturally sensitive by the Eastern Shoshone Tribe or the Ute Tribe of the Uintah and Ouray Reservation (Molenaar and Pulsipher 2011).

EJ impacts tend to be geographically highly localized and typically occur close to project activities. Examples of localized EJ impacts include noise or visual impacts associated with project construction in or adjacent to residential neighborhoods with disproportionately large low-income or minority populations. However, in some cases, EJ impacts are relatively dispersed environmental impacts, such as air pollution affecting an entire air basin, where the entire air basin has a disproportionately large low-income or minority population. To ensure that both localized and dispersed impacts on EJ populations would be considered, the low-income and minority components of various types of geographic areas were considered in this analysis. Specifically, the EJ analysis considered each of the three counties within the SESA (Lincoln, Sublette, and Sweetwater counties), the three communities within 20 miles of the Project Area for which 2010-2014 American Community Survey 5-year estimates were available (Mableton, Big Piney, and LaBarge), and the Sublette County census tract block group containing the project area. Because EJ impacts could be dispersed geographically, such impacts could occur more than 20 miles from the project area. If so, however, such impacts would almost certainly affect a large area (e.g., an air basin), as opposed to being localized in an individual community. For this reason the SESA counties were analyzed as potential EJ communities. The Census Bureau divides Sublette County into two census tracts, with tract 1.01 located west of U.S. Highway 191 and tract 1.02 east of Highway 191. Census tract 1.01 contains two block groups, with block group 1 located north of State Highways 350 and 351, and block group 2, which includes the project area, south of Highways 350 and 351 (Map 15). Proportions of the population that are minority or low-income in each of these areas and in the reference area (Wyoming) are shown in Table 3-48.

By applying the analysis criteria described above to 2010-2014 American Community Survey 5-year estimates, the following were identified as potential EJ populations (Table 3-48):

- Sweetwater County – Hispanic or Latino minority population, total minority population
- LaBarge – American Indian or Alaskan Native minority population, total minority population
- Marbleton – Hispanic or Latino minority population

No localities analyzed have larger disadvantaged populations than either Wyoming or the local county.

Refer to Chapter 5 (*Consultation and Coordination*) for additional information on tribal consultation associated with the NPL Project EIS.

Table 3-48. Percentages of Statewide and Local Populations that Were Minority or Low-Income, 2010-2014 5-Year Estimates

Locality	Total Population	American Indian or Alaskan Native alone	Asian or Pacific Islander alone[1]	Black or African American alone, not Hispanic or Latino	Hispanic or Latino[2]	Total Minority Population[3]	Income Below Poverty Level[4]
Wyoming	575,251	13,144 (2%)	5,709 (1%)	5,770 (1%)	54,181 (9%)	87,333 (15%)	12%
Lincoln County	18,180	59 (<1%)	98 (1%)	22 (<1%)	783 (4%)	1,270 (7%)	8%
LaBarge	581	**48 (8%)**	2 (<1%)	0 (<1%)	0 (<1%)	**80 (14%)**	8%
Sublette County	10,183	22 (<1%)	109 (1%)	0 (<1%)	788 (8%)	1,170 (11%)	8%
Big Piney	529	0 (<1%)	0 (<1%)	0 (<1%)	6 (1%)	14 (3%)	1%
Marbleton	1,188	0 (<1%)	0 (<1%)	0 (<1%)	**115 (10%)**	149 (13%)	2%
Block group 2 of census tract 1.01	1,788	0 (<1%)	3 (<1%)	0 (<1%)	106 (6%)	143 (8%)	1%
Sweetwater County	44,595	226 (1%)	481 (1%)	402 (1%)	**6,990 (16%)**	**8,886 (20%)**	12%

Source: U.S. Census Bureau 2015c.

[1]In accordance with the minority population groups identified in CEQ guidance (CEQ 1997), this column represents the sum of the 'Asian alone' and 'Native Hawaiian and Other Pacific Islander alone' populations. These groups were also analyzed independently, but did not meet the analysis criteria for identification as environmental justice communities because the minority population percentage was less than one percent of the area's total population or was not less than 20 percent higher than the next largest geographic reference area.
[2]People who identify as Hispanic or Latino may be of any race.
[3]Minority population = total population – White alone, not Hispanic or Latino population.
[4] The U.S. Census Bureau threshold for poverty in 2014 was $12,316 for an individual under the age of 65, $11,354 for an individual over the age of 65, and $24,230 for a family of four (U.S. Census Bureau 2014b).

Note: Populations with **bold** text meet the following analysis criteria for environmental justice populations:
- At least one-half of the population is of minority or low-income status; or
- The percentage of population that is of minority or low-income status is at least one percent of the area's total population and represents at least a 20 percent higher than the next largest geographic reference area.

3.15 Soil Resources

3.15.1 Overview

The analysis area for soils is the Project Area, which includes portions of 15 Hydrologic Unit Code (HUC)-12-digit watersheds that intersect the Project Area. Soils within the Project Area are predominantly loamy and generally have the characteristics of poor, shallow development, and in most cases, highly erodible, especially where steep slopes exist (NRCS 2012). Most of the soils in the Project Area have developed from residuum (direct weathering) of the underlying formation sediments (BLM 2008a). Generally, soils in the Project Area basins are formed in shales producing clayey textures, poor infiltration, high runoff, and high potential for slumping (BLM 2008a). A combination of factors including low precipitation, excessive drainage, and wind erosion pose potential limitations on reclamation and mitigation.

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service's (NRCS) Soil Survey Geographic (SSURGO) data (NRCS 2012) were used to determine soil mapping units, soil series, and soil characteristics for the Project Area. SSURGO is the most detailed level of soil mapping done by the NRCS. NRCS uses field mapping methods applying national standards to construct the soil maps in the SSURGO database. Soil surveys for Sublette County have been ongoing since 2004. The majority of soils in the Project Area have been surveyed and inventoried except for a few locations.

3.15.2 Laws, Ordinances, Regulations, and Standards

The USDA NRCS is the primary authority for the conservation, protection, and enhancement of soil resources. The Sublette County, Sweetwater County, and Lincoln County conservation districts assist with soils management at a local level. The following guidance applies to soil management and reclamation.

- The BLM Surface Operating Standards for Oil and Gas Exploration and Development (Gold Book) (BLM 2007a)
- Wyoming Bureau of Land Management Reclamation Policy (IM WY-2012-032)
- Wyoming Pollution Discharge Elimination System permitting requirements for construction stormwater
- Best management practices and guidelines in the BLM Green River Approved RMP and ROD (BLM 1997a) and the BLM PFO Approved RMP and ROD (BLM 2008a).

3.15.3 Existing Soil Conditions in the Project Area

The Project Area is in a high elevation, intermontane desert basin with physiography primarily comprised of scarp slopes, alluvial fan deposits, pediment surfaces, sandy/pebble/gravel/cobble streamways, escarpments, structural benches, and areas of barren, rocky landscape.

Soils in the Project Area were formed from various parent materials ranging from *in situ* geologic residuum, wind-transported materials (eolian deposits), water (alluvium), gravity (colluvium), glacial outwash, and glacial till. Variable climate and temperatures, site topography, vegetation communities, and natural resource management in the Project Area affect these parent materials to produce soils with diverse characteristics (NRCS 2012).

Soils in the Project Area generally range from shallow to moderately deep, and are moderately well-drained to well-drained, depending on specific locations. Soils that occur in floodplains are generally poorly drained to somewhat poorly drained. Predominant soils in the Project Area include fine-loamy, loamy-skeletal, sandy, bouldery, and gravelly to extremely gravelly soils. Slopes in the Project Area range from low slope angles (0 to 12 percent) to very steep, high gradient slopes (15 to 90 percent). Steep slopes are primarily located in the northwestern portion of the Project Area, with relatively flatter slopes located in the central and southeastern areas (Map 16). The BLM Approved PFO RMP and ROD (BLM 2008a) requires that surface disturbing activities avoid slopes greater than 10 percent with south-facing aspects and sensitive or highly erosive soils.

Approximately 39 soil map units occur within the Project Area (Map 16). Table 3-49 identifies the soil map units, general description, acreages, and percentages in the Project Area.

Table 3-49. Soil Types and Descriptions for the Project Area

Soil Map Unit	Soil Map Unit Name	Soil Map Unit Description	Acres in Project Area	Percent of Project Area[1]
2202	Sandbranch-Obadia-Forelle complex, 0 to 4 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	4,288	3.04
2203	Diamondville-Cushool-Edlin complex, 0 to 4 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	940	0.67
2205	Maysprings-Ryark-Comer complex, 0 to 4 percent slopes	Fine, smectitic, frigid Ustic Paleargids	394	0.28
2215	Debone-Sandbranch complex, 1 to 6 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Natrargids	1,956	1.39
2216	Sandbranch-Scooby complex, 1 to 8 percent slopes	Fine, smectitic, frigid Ustic Natrargids	8,167	5.8
2221	Sandbranch sandy loam, 1 to 4 percent slopes	Coarse-loamy, mixed, superactive, frigid Ustic Natrargids	265	0.19
2304	McFadden-Pahlow-Anchutz complex, 1 to 8 percent slopes	Anchutz Fine-loamy, mixed, superactive, frigid Ustic Calciargids McFadden Coarse-loamy, mixed, superactive, frigid Ustic Haplocalcids Pahlow Sandy-skeletal, mixed, frigid Ustic Haplocalcids	1,131	0.8
2308	Forelle-Bluerim-Cotha complex, 1 to 6 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	2,305	1.64
2309	Maysprings-Rawlins complex, 4 to 8 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	282	0.2
4201	Grubrob-Bruja complex, 2 to 6 percent slopes	Bruja Loamy-skeletal, mixed, superactive, frigid Ustic Haplocalcids Grubrob Fine-loamy, mixed, superactive, frigid Ustic Calciargids	2,078	1.47

Table 3-49. Soil Types and Descriptions for the Project Area

Soil Map Unit	Soil Map Unit Name	Soil Map Unit Description	Acres in Project Area	Percent of Project Area[1]
5203	Jonah-Luhon-Burmaloaf complex, 1 to 6 percent slopes	Loamy, mixed, superactive, frigid Lithic Ustic Haplargids	12,952	9.19
5204	Jonah, noncalcareous surface-Burmaloaf complex, 1 to 4 percent slopes	Burmaloaf Loamy-skeletal, mixed, superactive, frigid Ustic Calciargids Jonah Fine-loamy, mixed, superactive, frigid Ustic Calciargids	14,116	10.02
5303	Diamondville-Fluetsch complex, 1 to 6 percent slopes	Loamy, mixed, superactive, frigid, shallow Ustic Haplargids	321	0.23
5313	Abston-Diamondville-Forelle complex, 2 to 8 percent slopes	Loamy, mixed, superactive, frigid, shallow Ustic Haplargids	64	0.05
5321	Boettcher-Sandbranch-Cushool complex, 1 to 6 percent slopes	Fine, smectitic, frigid Ustic Haplargids	2,219	1.58
5325	Bodorumpe-Figuore complex, 1 to 10 percent slopes	Bodorumpe Mixed, frigid Ustic Torripsamments Figuore Coarse-loamy, mixed, superactive, frigid Ustic Haplocalcids	2,775	1.97
5331	Zagpeed-Sweetlette complex, 1 to 6 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	7,484	5.31
5332	Juel-Teakettle-Figuore complex, 1 to 8 percent slopes	Teakettle & Juel Fine-loamy, mixed, superactive, frigid Ustic Haplargids Figuore Coarse-loamy, mixed, superactive, frigid Ustic Haplocambids	10,530	7.48
5333	Figuore-Jonah-Burmaloaf complex, 1 to 6 percent slopes	Burmaloaf Loamy-skeletal, mixed, superactive, frigid Ustic Calciargids Jonah Fine-loamy, mixed, superactive, frigid Ustic Calciargids Figuore Coarse-loamy, mixed, superactive, frigid Ustic Haplocalcids	14,606	10.36
5334	Sweetlette sandy loam, 1 to 6 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	1,470	1.04
5402	Bluerim-Zagpeed-Tigon complex, 1 to 10 percent slopes	Coarse-loamy, mixed, superactive, frigid Ustic Haplargids	1,901	1.35
5405	Bluerim-Figuore-Forelle complex, 1 to 8 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Calciargids	2,809	1.99

Table 3-49. Soil Types and Descriptions for the Project Area

Soil Map Unit	Soil Map Unit Name	Soil Map Unit Description	Acres in Project Area	Percent of Project Area[1]
5409	Yoda-Forelle-Tigon complex, 1 to 10 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	3,787	2.69
5417	Badland-Diamondville complex, 2 to 20 percent slopes	Loamy-skeletal, mixed, superactive, frigid, shallow Ustic Haplocalcids	2,967	2.11
5419	Fonce-Taffom-Twocabin complex, 2 to 15 percent slopes	Coarse-loamy, mixed, superactive, frigid Ustic Calciargids	357	0.25
5422	Figuore-Bodorumpe complex, 4 to 20 percent slopes	Sandy, mixed, frigid, shallow Ustic Haplocalcids	23	0.02
5426	Langspring-Rosseau complex, 2 to 15 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Calciargids	1,689	1.2
5430	Diamondville-Oasiswell-Forelle complex, 1 to 10 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	11,172	7.93
5504	Forelle-Bluerim-Blackhall complex, 2 to 35 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargid	5,645	4.0
5507	Diamondville-Cotha complex, 1 to 10 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Haplargids	2,115	1.5
5516	Pilotpeak-Boettcher-Squaretop complex, 4 to 30 percent slopes	Boettcher Fine, smectitic, frigid Ustic Calciargids Pilotpeak Loamy-skeletal, carbonatic, frigid Lithic Ustic Haplocalcids Squaretop Fine, smectitic, frigid Ustertic Natrargids	12,524	8.89
5604	Forelle-Blazon, extremely stony-Delphill complex, 4 to 35 percent slopes	Fine-loamy, mixed, superactive, calcareous, frigid Ustic Torriorthents	825	0.59
5610	Rosseau-Kappes complex, 15 to 45 percent slopes	Kappes Coarse-loamy, mixed, superactive, frigid Ustic Haplocalcids Rosseau Loamy-skeletal, mixed, superactive, frigid Ustic Haplocalcids	129	0.09
5620	Bruja-Zagpeed complex, 4 to 30 percent slopes	Loamy-skeletal, mixed, superactive, frigid Ustic Haplocalcids	1,182	0.84
5702	Badland-Rock outcrop complex	Loamy-skeletal, mixed, superactive, frigid, shallow Ustic Haplocalcis	2,204	1.56
5704	Cragosen-Rock outcrop complex, 15 to 60 percent slopes	Loamy-skeletal, mixed, superactive, calcareous, frigid, shallow Ustic Torriorthents	259	0.18
5705	Spool-Rock outcrop complex, 8 to 40 percent slopes	Sandy, mixed, frigid, shallow Ustic Torriorthents	50	0.04

Table 3-49. Soil Types and Descriptions for the Project Area

Soil Map Unit	Soil Map Unit Name	Soil Map Unit Description	Acres in Project Area	Percent of Project Area[1]
8302	Subwater-Jonsouth complex, 1 to 6 percent slopes	Fine-loamy, mixed, superactive, frigid Ustic Natrargids	2,106	1.49
8401	Sandbranch-Kandaly complex, 1 to 10 percent slopes	Mixed, frigid Ustic Torripsamments	773	0.55

Source: NRCS 2012.

[1]Total may not equal 100 due to number rounding.

Note: Soil Survey Inventories for Sublette County are currently incomplete; therefore, specific details for some soils are not available.

3.15.4 Soil Characteristics of Greatest Management Concern

Several soils in the Project Area have certain characteristics that reduce their suitability for construction activities and limit the potential for successful reclamation. The presence of soils with characteristics that pose limitations does not necessarily mean they are unavailable for a particular use or cannot be reclaimed. However, characteristics that pose limitations may inhibit certain types of development and increase the overall difficulty in achieving successful reclamation.

Areas posing the most extreme reclamation challenges are identified by the BLM as having Limited Reclamation Potential (LRP). Areas identified as having LRP may require site-specific reclamation measures not specifically addressed in BLM IM WY-2012-032, *Wyoming Reclamation Policy*. As part of subsequent NEPA analysis during APD processing, the BLM would further analyze potential LRP areas on a site-specific basis.

The BLM identified a variety of soil characteristics in the Project Area that may limit development and successful reclamation, including salinity, sodicity, alkalinity, rooting depth (depth-to-bedrock), droughtiness, water erosion potential, and wind erosion potential. The BLM identified a range of parameters to categorize and map soils as exhibiting high risk, moderate risk, and low risk potential for each of these soil characteristics. Table 3-50 summarizes the soil characteristics that could pose limitations to development and reclamation, parameters used to define the limiting characteristics, and the range of parameters for high risk, moderate risk, and low risk for each limiting characteristic. High risk, moderate risk, and low risk parameters for each of the soil characteristics is based on SSURGO soils mapping and tabular data (NRCS 2012), established research, and BLM staff understanding of soil characteristics in the Project Area.

Table 3-50. Soil Characteristics and Limitation Parameters

<table>
<tr><th>Soil Characteristics That Pose Limitations</th><th>Parameter</th><th colspan="3">High Risk Range</th><th colspan="3">Moderate Risk Range</th><th colspan="3">Low Risk Range</th></tr>
<tr><td>Salinity[1]</td><td>Salinity (MMHOS/CM) of surface layer</td><td colspan="3">≥16</td><td colspan="3">8–16</td><td colspan="3"><8</td></tr>
<tr><td>Sodicity[2]</td><td>Sodium absorption ratio of surface layer</td><td colspan="3">>13</td><td colspan="3">4–13</td><td colspan="3"><4</td></tr>
<tr><td rowspan="3">Saline-sodic[3]</td><td>Salinity</td><td colspan="3">≥16</td><td colspan="3">8–16</td><td colspan="3"><8</td></tr>
<tr><td>and</td><td colspan="3">and</td><td colspan="3">and</td><td colspan="3">and</td></tr>
<tr><td>Sodicity of surface layer</td><td colspan="3">>13</td><td colspan="3">4–13</td><td colspan="3"><4</td></tr>
<tr><td>Alkalinity</td><td>pH</td><td colspan="3">>9.0</td><td colspan="3">7.9–9.0</td><td colspan="3"><7.9</td></tr>
<tr><td>Rooting depth</td><td>Minimum depth-to-bedrock or hardpan (inches)</td><td colspan="3"><10</td><td colspan="3">10–20</td><td colspan="3">>20</td></tr>
<tr><td>Droughtiness[4]</td><td>Available water supply (average to 100 cm) cm/cm</td><td colspan="3"><5</td><td colspan="3">5–10</td><td colspan="3">>10</td></tr>
<tr><td rowspan="3">Water Erosion Potential[5]</td><td>Kw Factor of surface layer</td><td>≥0.37</td><td rowspan="3">or</td><td>0.20-0.36</td><td>0.20-0.36</td><td rowspan="3">or</td><td><0.20</td><td>-[6]</td><td rowspan="3"></td><td>-</td></tr>
<tr><td>and</td><td>and</td><td>and</td><td>and</td><td>and</td><td>-</td><td>-</td></tr>
<tr><td>Slope</td><td>≥10%</td><td>>30%</td><td>10%-30%</td><td>>30%</td><td>-</td><td>-</td></tr>
<tr><td>Wind Erosion Potential</td><td>Wind erodibility index (tons/acre/year of soil loss due to wind erosion)</td><td colspan="3">101–250</td><td colspan="3">31–100</td><td colspan="3">0–30</td></tr>
</table>

[1]Maximum value for the range in soil salinity.
[2]Maximum value for the range in sodium adsorption ratio.
[3]Maximum value for the range in soil salinity and sodium absorption ratio.
[4]Maximum value for the range of available water capacity for the soil layer; inches of water per inches of soil.
[5]Kw Factor (erodibility) of surface layer adjusted for the effect of rock fragments. Slope is the maximum value for the range of slope of a soil component within a map unit.
[6]If soils do not meet High Risk or Moderate Risk Range, they were classified in the Low Risk Range.

cm centimeter
mmhos/cm millimhos per centimeter

Note: Parameters developed based on SSURGO soils mapping and tabular data (NRCS 2012).

Table 3-51 identifies the acreages of high, moderate, and low risk potential for the identified limiting characteristics that may affect development and reclamation. In general, soils that fall within the high risk category as identified in Table 3-51 and on Maps 17 through 24 represent those soils that may have limited reclamation potential. Appendix I (*Soil Resources Supporting Tables*) identifies the risk categories for each limiting characteristic assigned to each soil map unit in the Project Area. Maps 17 through 24 depict the risk potential associated with limiting soil characteristics across the Project Area.

Table 3-51. Acreages of Soils with Limiting Characteristics

Soil Characteristics That Pose Limitations	High Risk	Moderate/ High Risk	Moderate Risk	Moderate/ Low Risk	Low/ High Risk	Low Risk	No Applicable Data[1]	Total[2]
Salinity	0	0	1,956	0	0	136,697	2,204	140,859
Sodicity	0	0	39,181	8,144	0	91,328	2,204	140,859
Saline-sodic	0	0	1,956	45,369	0	91,328	2,204	140,859
Alkalinity	0	0	78,662	13,220	0	46,770	2,204	140,859
Rooting depth	2,994	0	12,763	20,667	2,931	96,577	4,925[3]	140,859
Droughtiness	138,653	0	0	0	0	0	2,204	140,859
Water erosion potential	259	0	1,027	0	0	137,367	2,204	140,859
Wind erosion potential	5,585	6,351	124,451	2,266	0	0	2,204	140,859

Source: NRCS 2012.

[1]2,204 acres from the Badland-Rock Outcrops Soil Map Unit (Soil Map Unit 5702) do not have applicable soil characteristics.
[2]Small differences in totals are due to rounding.
[3]Several Soil Map Units do not have available data for rooting depth.

3.15.4.1 Salinity

Soil salinity is measured by soil electrical conductivity of the soil. Saline soils have an electrical conductivity of eight millimhos per centimeter (mmhos/cm) or greater. Saline soils have calcium, magnesium, or other nonsodium salts dominating their ionic composition, although they might also contain some sodium salts. In general, saline soils contain increased concentrations of soluble salts, which interfere with plant establishment, growth, and development. Additionally, these soils typically have less plant-available water, which, when combined with the increased salt content, can reduce reclamation potential. Saline soils are generally managed to minimize impacts and to promote the revegetation of previously disturbed areas to the greatest extent possible due to erosion significantly affecting downstream water quality (BLM 2008a).

Soil salinity levels are generally low in the Project Area (Table 3-51), though there are moderate levels of salinity in approximately 1,956 acres of soils (1.4 percent of the Project Area) mostly located in areas along the Alkali Creek channel, with a small area near the central portion of the Project Area (Map 17).

3.15.4.2 Sodicity

Soils with high sodium levels (sodium absorption ratios of 13 or greater) are considered to have high risk potential for sodicity (BLM 2008b). The ionic composition of sodic soils is dominated by sodium salts. Infiltration of precipitation into these soils is reduced by the dispersion of soil particles caused by the higher levels of sodium. Reduced infiltration rates result in greater surface runoff rates and increased soil erosion and sediment yields. Many of these soils have a thin layer of less sodic soil above the sodic horizon; therefore, when this layer is disturbed or removed, reclamation can be irreversible (BLM 2008b).

Approximately 39,181 acres of soils (27.8 percent of the Project Area) have moderate risk potential for sodicity and 8,144 acres (5.8 percent of the Project Area) have moderate/low risk potential for sodicity (Table 3-51). Areas of moderate risk potential for sodicity are distributed throughout the Project Area

(Map 18). Low to moderate risk potential for sodicity indicates that storm water could run off rather than infiltrate soils, resulting in increased erosion during storm events.

3.15.4.3 Saline-Sodic

Saline-sodic soils exhibit characteristics and limitations of both saline and sodic soils as described in the sections above. Approximately 1,956 acres of soils (1.4 percent of the Project Area) have moderate risk potential for saline-sodic characteristics and 45,369 acres (32.2 percent of the Project Area) of soils have moderate/low risk potential for saline-sodic characteristics (Table 3-51). Areas of moderate risk potential for saline-sodic soils are distributed throughout the Project Area (Map 19).

3.15.4.4 Alkalinity

Alkaline soils are soils (mostly clay soils) with a high pH value (greater than 9), a poor soil structure, and a low water infiltration capacity. Alkaline soils are not necessarily saline. Alkaline soils can limit reclamation and vegetation potential due to reduced nutrient and micronutrient availability.

Approximately 78,662 acres (55.8 percent of the Project Area) of soils have moderate risk potential for alkalinity and 13,220 acres (9.4 percent of the Project Area) have moderate/low risk potential (Table 3-51). Areas of moderate risk potential for alkalinity are distributed throughout the Project Area (Map 20).

3.15.4.5 Rooting Depth

Rooting depth, or depth-to-bedrock, represents the depth of soils to fixed rock that is available for rooting of vegetation. Shallow soils with minimal rooting depth are often not conducive to vegetation establishment, are prone to soil erosion, and limit reclamation potential.

The majority of the Project Area has low to moderate risk potential for rooting depth (Table 3-51). However, approximately 2,994 acres of soils (2.1 percent of the Project Area) have high risk potential for rooting depth (i.e., shallow soils), mostly along Alkali Creek and at Teakettle Butte (Map 21).

3.15.4.6 Droughtiness

Droughty soils are defined by the water supply available to plants. Droughty soils typically have a coarse texture, low water-holding capacity, and a minimal amount of soil organic matter. High salinity levels can also be a contributing factor of droughtiness. Droughty soils can be prone to soil erosion and have limited reclamation potential.

As indicated in Table 3-51, all mapped soils in the Project Area (138,653 acres) have high risk potential for droughtiness (Map 22).

3.15.4.7 Water and Wind Erosion Potential

Wind and water erosion results in the loss of valuable topsoil, which can limit reclamation success.

Soils with high wind and water erosion potential can also contribute to sediment and salt loading into watersheds following natural and man-made surface disturbance. Additionally, soils with high wind and water erosion potential have a low reclamation potential due to lack of soil stability. Erosion generally increases when the vegetation community is disturbed by improper grazing, fire, road construction, or any other use that reduces the amount of vegetative cover.

The potential for water erosion of surface soils was evaluated based on the erodibility of the surface soil (Kw Factor) and the slope of the land surface. The majority of soils in the Project Area have low risk potential for water erosion, though 259 acres (0.18 percent of the Project Area) have high risk potential and 1,027 acres (0.73 percent of the Project Area) have moderate risk potential (Table 3-51). High and moderate risk potential for water erosion are likely associated with short, steep-sloped terrain within the larger, fairly flat topography of the Project Area (Map 23). Soils on slopes greater than 30 percent occur on approximately 129 acres (0.09 percent) of the Project Area (Map 23).

The potential for wind erosion was evaluated based on the wind erodibility index, which indicates the susceptibility of a soil to wind erosion, or tons of soil per acre per year that can be expected to be lost to wind erosion. As indicated in Table 3-51, the majority of mapped soils in the Project Area have moderate to high risk potential for wind erosion, with 5,585 acres (4.0 percent of the Project Area) having high risk potential (Map 24). Soils containing a high percentage of fine sands, such as those found in the Teakettle Dune Field, typically have moderate to high potential for wind erosion, with erosion potential increasing around blowouts, de-vegetated surfaces, and eroding dune margins.

3.16 Special Designations

3.16.1 Overview

Special designations managed by the BLM include components of the National Landscape Conservation System (NLCS) designated by presidential or congressional action, including National Monuments, National Conservation Areas, Wilderness Areas, Wilderness Study Areas, Wild and Scenic Rivers, and National Scenic and Historic Trails. Special designations also include areas designated by the BLM, usually to protect their resource values, such as Areas of Critical Environmental Concern and special Management Areas (MAs). MAs are administratively designated to protect particular resource values or to establish specific management objectives that may require restrictions on resource uses or other activities.

The analysis area for special designations includes the Project Area and surrounding special designations and MAs that may be affected by the NPL Project. The special designations and MAs within 15 miles of the Project Area are the Lander Cutoff of the Oregon and California NHTs, the Sublette Cutoff of the California NHT, and North Sublette Meadow Spring Variant of the Sublette Cutoff, the Ross Butte MA (32,418 BLM-administered acres), which overlaps 444 BLM-administered acres in the western portion of the Project Area; and the Wind River Front MA (98,661 BLM-administered acres), which is approximately 6.2 miles to the east of the Project Area (Map 14).

3.16.2 Laws, Ordinances, Regulations, and Standards

A presidential proclamation or act of Congress that designates an area within the National Landscape Conservation System (NLCS) supersedes conflicting direction by the FLPMA. These designations include, but are not limited to, National Monuments, National Conservation Areas, Wilderness Areas, National Scenic or Historic Trails, Wild and Scenic Rivers, Cooperative Management and Protection Areas, Outstanding Natural Areas, National Recreation Areas, Forest Reserves, or any other lands described in Public Law 111-11 Sec. 2002(b). Specifically, the land use plan and management direction for such a designation must comply with the purposes and objectives of the proclamation or act of Congress regardless of any conflicts with the FLPMA's multiple-use mandate. For more information on special designations and their management on BLM-administered land, refer to the BLM Land Use Planning

Handbook (H-1610-1), Appendix C (BLM 2005). For more information on NLCS lands and applicable LORS, refer to BLM Manual 6100 and the BLM's NLCS informational website (BLM 2012f).

3.16.3 Sublette Cutoff of the California National Historic Trail

The Sublette Cutoff, a branch of the California NHT, travels in an approximate east-west direction immediately south of the southern boundary of the Project Area, just below the Sublette/Sweetwater county line (Map 14). The Sublette Cutoff was one of the earliest shortcuts for the California Trail and provided an east-west connection between South Pass and Bear River, avoiding the southern loop of the Trails to Fort Bridger and saving approximately 70 miles or about three days travel time (BLM 2012b). Based on current understanding, a minor variant (the North Sublette Meadow Spring Variant) of the Sublette Cutoff runs east-west through the southern portion of the Project Area en route to or from North Sublette Meadow Spring (Juel Spring), which is immediately adjacent to the southeastern boundary of the Project Area (Map 14). The NPS is conducting a feasibility study to determine if the Sublette Cutoff should also be designated as a segment of the Oregon NHT (NPS 2016).

The North Sublette Meadow Spring Variant of the Sublette Cutoff served mainly as a detour to and from the main route of the Sublette Cutoff, and less frequently as a shortcut accessed from points northeast along the Big Sandy River. In both cases, the emigrants' purpose in using this route was to find grass in proximity to the spring where they could feed and rest their stock, and perhaps water them from the spring, before setting out on a rather arduous crossing of the Little Colorado Desert. Though the Sublette Cutoff was a popular and well-used route between 1849 and 1859, most emigrants did not deviate from the main route, and the North Sublette Meadow Spring Variant does not appear to have been heavily trafficked. After the abandonment of the Sublette Cutoff as an emigrant route, parts of both the main road and the North Sublette Meadow Spring Variant were adapted by herders and later homesteaders as a sheep camp road or ranch road (Fryman 2011).

Current aerial imagery of both the Sublette Cutoff and the variant suggests that the North Sublette Meadow Spring Variant solely resembles a post-emigrant period ranch road (or a modern OHV road), and has few physical characteristics typically evident in aerial views of heavily trafficked emigrant road trace. Such characteristics (e.g., deep or wide swales, multiple parallel tracks, widely spaced earthen berms) are, on the other hand, easily visible in aerial views of the main Sublette Cutoff south of the Project Area. However, aerial views of the portion of the North Sublette Meadow Springs Variant in the Project Area (the western branch) indicate multiple segments of older roads paralleling and threaded with the route of the modern two-track; some of these do exhibit the characteristic signature of historic wagon roads.

BLM Manual 6280 (*Management Of National Scenic And Historic Trails And Trails Under Study Or Recommended As Suitable For Congressional Designation*) requires a viewshed analysis and a trail inventory to be conducted as part of the EIS process if a trail management corridor has not been established in the BLM RMP. In accordance with the 6280 manual, the BLM conducted a viewshed analysis that is depicted on Map 28 and is used in the impacts analysis in Chapter 4 (*Environmental Consequences*). The BLM also conducted a Class III Cultural Resource inventory and assessment for the northeast to southwest running portion of the North Sublette Meadow Spring Variant (Bartlett 2012) to its junction with the Sublette Cutoff. The inventory identified and recorded remnants for the trail, described the existing environment associated with the trail, described historic and current uses and the historic and cultural setting of the trail, and provided management recommendations. Per the notification requirements in Section 5.C in the BLM Manual 6280 Manual, the BLM notified appropriate parties and invited parties to participate in the Programmatic Agreement Process. Other segments of the Sublette Cutoff and North Sublette Meadow Spring Variant outside of the Project Area have not been surveyed to identify (if possible) the precise location(s) of the variant route or presence/absence of historic wagon trail trace, emigrant period artifacts or features, or trail-associated sites along the trails (Fryman 2011).

Additional information on the Sublette Cutoff and the North Sublette Meadow Spring Variant can be found in the Emigrant Trail Study prepared for the NPL Project (Fryman 2011) as part of the Class I Cultural Resources Report (McKetta et al. 2011), and the North Sublette Meadow Spring Trail Extension Class III Cultural Resource Inventory (Bartlett 2012).

3.16.4 Lander Cutoff of the Oregon and California National Historic Trails

The Lander Cutoff, a branch of the Oregon and California NHTs, stretches from South Pass, Wyoming to Fort Hall, Idaho, travelling in an east-west direction approximately six miles north of the Project Area at its closest point, just north of Highway 351 (Map 14). The Lander Cutoff was the first government-built wagon road in the West and was used by wagon trains as a cutoff from the Oregon Trail to the California gold fields (BLM 2008a). After 1860, emigrant traffic on the Sublette Cutoff shifted to the Lander Cutoff, which featured plentiful water and grass, more timber and fuel, and river crossings that did not require ferries (McKetta et al. 2011). The Lander Cutoff is used by recreationists and other visitors that are interested in touring historic features (BLM 2008a) and participating in backcountry recreational opportunities. Along the Lander Cutoff, recreational and interpretive sites inform visitors about the fur trapping era and western explorers and area settlement (BLM 2008a).

3.16.5 Ross Butte Management Area

The Ross Butte MA overlaps 444 BLM-administered acres in the western portion of the Project Area in the BLM PFO (Map 14). The Ross Butte MA encompasses habitat for several endemic plant species, including Big Piney milkvetch (*Astragalus drabelliformis*), Beaver Rim phlox (*Phlox pungens*), large-fruited bladderpod (*Lesquerella macrocarpa*), and desert glandular phacelia (*Phacelia glandulosa* var. *deserta*) (Fertig 1998). *The Plant Species of Special Concern of the Ross Butte Ecosystem* report notes that the Ross Butte ecosystem is "unusually rich in both common and uncommon plant species" and that it has been identified as a priority natural area for the conservation of locally endemic plant species (Fertig 1998). The area also contains abundant archaeological materials and unique sites considered important and sensitive to Native Americans (BLM 2008a). The area offers recreational opportunities for semiprimitive motorized activities; motorized vehicle use, except for over-the-snow equipment, is limited to designated roads and trails in the Ross Butte MA (BLM 2008a). Access to the Ross Butte MA is via State Highway 351 to the north of the Project Area or via U.S. Highway 189 to the west of the Project Area.

The management goal for the Ross Butte MA is to protect fragile soils and watersheds, sensitive plant species and communities, paleontological and archaeological sites, unique geology, and visual values. The MA is unavailable for new oil and gas leasing, and the BLM PFO Approved RMP and ROD (BLM 2008a) specifies that Conditions of Approval will be applied on existing oil and gas lease activities to mitigate impacts on erosive soils and sensitive plant species habitat.

3.16.6 Wind River Front Management Area

The Wind River Front MA is approximately 6.2 miles from the Project Area boundary, on the east side of U.S. Highway 191 in the BLM PFO (Map 14). The MA supports semiprimitive motorized and nonmotorized recreation opportunities including hunting, rock climbing, wilderness access, sightseeing, antler hunting, hiking, mountain biking, and fishing. The Wind River Front MA also encompasses migration routes for big game and crucial winter ranges for moose, elk, and mule deer and supplies wintering and breeding habitats for Sage-Grouse (BLM 2008a). U.S. Highway 191 provides access to the MA from the west.

The management goals for the Wind River Front MA are to maintain the visual, recreation, and air quality resources in the MA, enhance wildlife habitat, and protect the integrity of the U.S. Air Force Detachment 489 Seismic Monitoring Station (BLM 2008b).

3.17 Transportation and Access

3.17.1 Overview

The analysis area for transportation and access includes the state highway network, primary access routes, and smaller collector roads and routes that would be used as the primary routes for access to and within the Project Area (Map 25). This section summarizes the transportation network, access to the Project Area, existing daily traffic along major highways, and secondary and local/collector roads near the Project Area. Refer to Appendix E (*Transportation Plan*) for additional information.

3.17.2 Laws, Ordinances, Regulations, and Standards

3.17.2.1 Road Classification System

The BLM classifies its roads according to the system described below, which is derived from the BLM Manual Section 9113 (BLM 2015h; BLM 1991).

- Collector Roads: These roads normally provide primary access to large blocks of land, and connect with or are extensions of a public road system. Collector roads accommodate mixed traffic and serve many uses. They generally receive the highest volume of traffic of all the roads in the Bureau system. User cost, safety, comfort, and travel time are primary road management considerations. Collector roads usually require application of the highest standards used by the Bureau. As a result, they have the potential for creating substantial environmental impacts and often require complex mitigation procedures.
- Local Roads: These roads normally serve a smaller area than collectors, and connect to collectors or public road systems. Local roads receive lower volumes, carry fewer traffic types, and generally serve fewer uses. User cost, comfort, and travel time are secondary to construction and maintenance cost considerations. Low volume local roads in mountainous terrain, where operating speed is reduced by effect of terrain, may be single lane roads with turnouts. Environmental impacts are reduced as steeper grades, sharper curves, and lower design speeds than would be permissible on collector roads are allowable.
- Resource Roads: These roads normally are spur roads that provide point access and connect to local or collector roads. They carry very low volume and accommodate only one or two types of use. Use restrictions are applied to prevent conflicts between users needing the road and users attracted to the road. The location and design of these roads are governed by environmental compatibility and minimizing Bureau costs, with minimal consideration for user cost, comfort, or travel time.

The collector and local roads in the Project Area include Luman Road, North Route, Southeast Route, South Route, Northwest Route, and West Route (includes the CCC Road cutoff) (Map 25).

Numerous undesignated resource roads currently provide access to existing well sites, including the Sol and Corona wells in the north-central Project Area; Holmes, Crimson, Yellowpoint, and Sugarload wells in the southern Project Area; Hacienda wells in the southeast Project Area; and the Tot, Ferry Island Unit area, and Cutlass Unit wells in the southwest Project Area. Additional resource roads would be constructed as needed to extend access to new well sites and facilities in the Project Area.

A variety of undesignated resource routes (unimproved/two-track roads) also provide access to water wells, grazing allotments, and recreational sites within the Project Area (Map 25). These are not used for heavy industrial traffic and have been used occasionally for wildlife inventories, archaeology studies, and various types of geodetic and seismic surveys. Some of the existing resource routes may be upgraded and used as local roads for natural gas development activities. Future resource roads (i.e., low traffic-volume roads) are not specifically identified in this document due to the lack of site-specific details for the NPL Project. Resource roads and future local roads would be identified during localized area transportation planning and would be specified in annual operational updates.

3.17.3 Access to the Project Area

Primary access to the Project Area would be from three paved all-weather main roads: U.S. Highway 189, west of the Project Area; State Highway 351, north of the Project Area; and U.S. Highway 191, east of the Project Area. Access from these main routes into the Project Area would be from several routes, with the existing unpaved Luman Road (BLM Road 5409) providing the primary field access route from U.S. Highway 191 into the Project Area. Additional methods of access into the Project Area from main roads include the North Route via Burma Road within the JIDPA, the South Route via Crimson and 18 Mile Road to the southern Project Area boundary, the eastern portion of the Northwest Route via Alkali Draw up to the turnoff to the Corona wells in Section 9, and the Southeast Route via Burma Road up to the Hacienda 12-21 well pad (Map 25).

3.17.4 Road Network and Uses

The main roads (U.S. Highway 189, U.S. Highway 191, State Highway 351) are all paved, all-weather roads; the remaining routes are unpaved. The portions of the routes currently used to access existing locations in the Project Area have been surfaced (e.g., gravel, aggregate) to be passable when wet and during the winter. Improvements and maintenance, including snow removal, are regularly performed on these segments. Historic use of the roads has been limited primarily to livestock operators and recreationists (e.g., hunters, off-road vehicle users). The primary current use of these and other roads in the area is for oil and gas-related traffic, particularly traffic associated with the JIDPA and existing Project Area wells. The existing transportation system is generally suitable for all current users.

Luman Road is used by all user groups, receives more use by large vehicles than any other road in the area, and is the most heavily used road in the area (BLM 2006a). Most use of Luman Road occurs in the JIDPA and eastward to U.S. Highway 191; however, access via the Southwest Route and West Route (via the CCC cutoff) is suited for traffic during drier weather. Most of the heavy vehicle traffic associated with the JIDPA travels Luman Road to U.S. Highway 191. Establishment of the Jonah Energy Work Force Facility has greatly reduced travel along Luman Road to U.S. Highway 191. This camp houses workers associated with drilling and completion phases, all of whom are currently working on drilling and completion activities associated with the JIDPA.

North Burma Road is traveled by all users, but is currently not well suited for all-weather travel or large vehicles. The road receives less traffic use than Luman Road; however, there is a moderate amount of heavy truck use during dry weather. Recent oil and gas development activities associated with the JIDPA have increased the level of vehicular activity along this road.

The South Route would provide primary access to existing wells in the south-central portion of the Project Area. Pumper truck and liquids hauler traffic occurs regularly on this road. The South Route ties into Sublette and Lincoln Counties via the following roads: U. S. Highways 189 and 191, Wyoming State Highways 372, 316, and 28 and Sweetwater County Roads 49 and 52.

Portions of the West, Southwest, and Southeast Routes, as well as North Burma Road, could be used to access well sites over the course of development for the NPL Project. Undesignated two-track roads, several of which are currently associated with existing access roads, could themselves be converted to access roads. During development, new roads would need to be constructed to extend the road network from the nearest access to proposed well sites. Some of the existing routes are used primarily by grazing permittees and recreationists, and may be prohibited for use by operators except in emergencies. Grazing permittees primarily use the two-track roads to access stock watering facilities.

Refer to Appendix E (*Transportation Plan*) for additional information on existing condition, uses, improvements, and other characteristics of the road network.

3.17.4.1 Travel Management

Motorized vehicle use in the Project Area is limited to existing roads and trails, except for the portion of Ross Butte MA that overlaps the Project Area (444 BLM-administered acres), where travel is limited to designated roads and trails.

3.17.5 Existing Traffic for the Road Network

Existing vehicular traffic along secondary and local/collector roads includes energy exploration and development activities, residential and business travel, livestock operations, and recreational activities. Table 3-52 provides the Average Daily Traffic (ADT) recorded along highways and secondary and local/collector roads associated with the NPL Project. As indicated in Table 3-52, vehicle trips on the primary main routes have increased substantially from 2000 to 2010, then decreased from 2010 to 2014. These changes in traffic volume are most likely attributable to oil and gas development in the region.

Table 3-52. Average Daily Traffic Along Major Highways, and Secondary and Local/Collector Roads near the Project Area

Transportation Route	Daily Vehicle Trips (2000)	Daily Vehicle Trips (2010)	Daily Vehicle Trips (2014)
U.S. Highway 191 (Junction Route 1801)	1,300 (160)[1]	2,229 (219)[1]	1,949 (187) [1]
U.S. Highway 191 (Junction Speedway Road)	1,500 (240)[1]	2,603 (497)[1]	2,268 (402) [1]
U.S. Highway 189 (Big Piney North Corporate Limits)	4,200 (280)[1]	4,748 (680)[1]	3,701 (461) [1]
State Highway 351 (Junction Route 11)	640 (110)[1]	1,341 (673)[1]	947 (205) [1]
Luman Road	No data available Heavy industry traffic (JIDPA only)	503 (161)[2]	–[5]
Southwest Road to LaBarge	No data available Very light commuter, grazing, and recreational traffic	20 (0)[3]	–[5]
North Route via Burma Road	No data available Minimal industry traffic	2 (0)[3] (outside JIDPA only)	–[5]
Southeast Route via South Burma Road	No data available Grazing, recreational only	1 (1)[4] (to Hacienda 12-21 well pad only)	–[5]
South Route via Crimson Road	No data available Crimson Road did not exist at this time. All traffic was for grazing, recreational uses only via 18 Mile Road	2 (2)[4]	–[5]
Northwest Route via Alkali Draw Road	No data available Grazing, recreational only	1 (1)[4] (to Corona 2-9,6-9 turnoff only)	–[5]
West Route via Reardon Road	No data available Grazing, recreational only	3 (0)[3]	–[5]

[1]Source: WYDOT 2014
[2]Source: JIO 2010
[3]Source: Estimates from Jonah Energy based on field observations
[4]Source: Jonah Energy-estimated pumper traffic only
[5]Daily vehicle trip data has not been collected for this route since 2010

JIDPA Jonah Infill Development Project Area

Note: Numbers in parentheses correspond to the total number of truck trips.

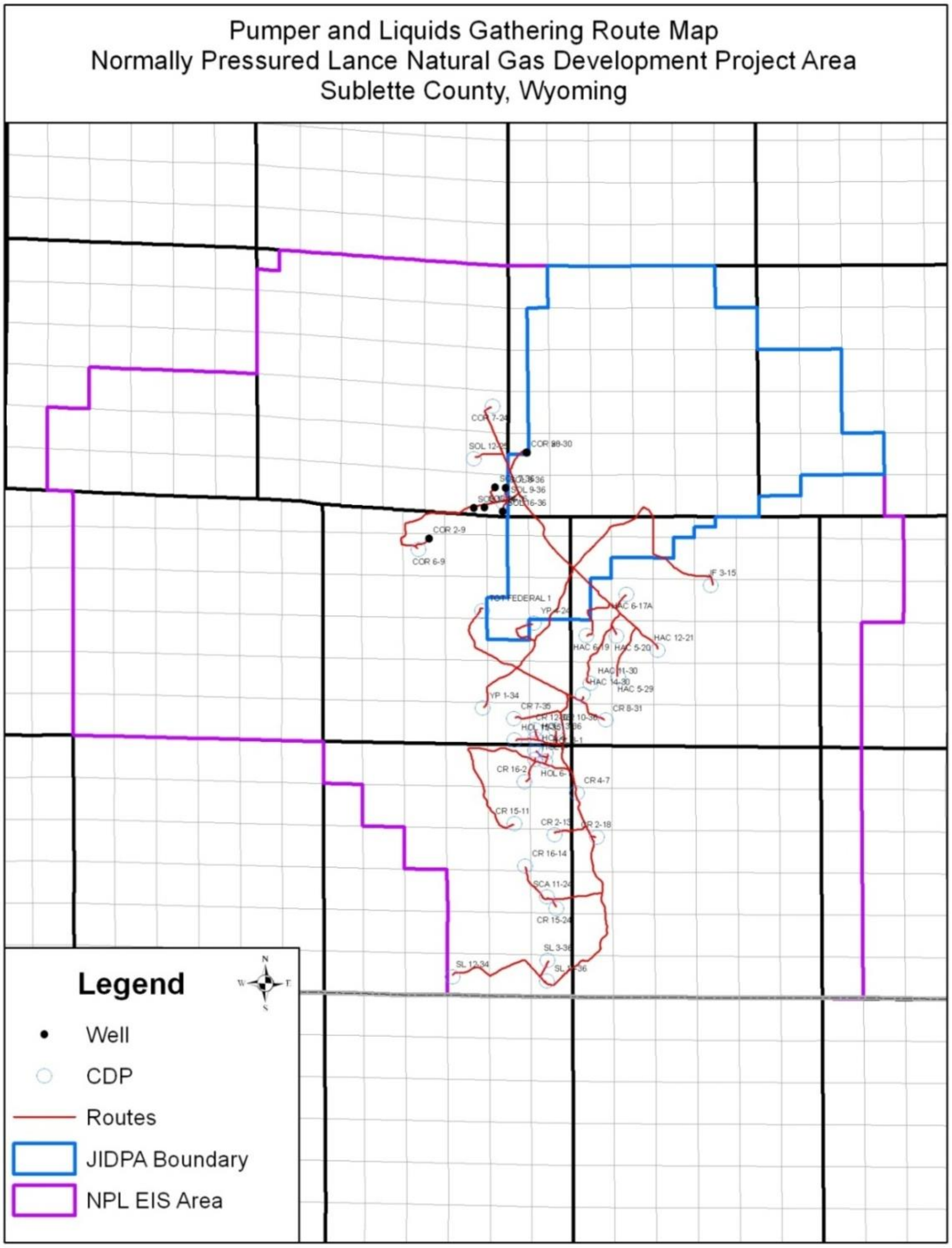
Existing vehicular traffic in the Project Area is related to 45 locations including 36 Central Delivery Points (CDPs) and nine satellite wells. These locations are serviced by pumper trucks (pickups) and liquids haulers (semi tankers) at various intervals (Figure 3-21). The pumper trucks and liquids haulers operate seven days a week. Approximately 48 miles of road provides access to these locations.

Pumper trucks travel to the CDPs and satellite wells in the Project Area at the intervals listed below:

- 23 CDPs on a daily basis;
- eight CDPs every two days;

- two CDPs every three days;
- three CDPs every two weeks; and
- nine satellite wells once per month.

Figure 3-21. Pumper and Liquids Gathering Routes



Source: Appendix E (*Transportation Plan*).

CDPs	Central Delivery Points
JIDPA	Jonah Infill Development Project Area

The liquids haulers only travel to the CDPs, not the satellite wells. Approximately 15 liquid loads (water or condensate) are hauled from the Project Area each week (an average of 2.14 loads each day). These loads may or may not be full loads, and one or more CDPs may be visited on each trip depending on many factors. The 36 CDPs receive essentially all of the pumper truck and liquids hauler traffic. The CDPs are evenly distributed over the entire area (i.e., they are not clustered) so that all road segments are used to access the CDPs.

3.18 Vegetation

The analysis area for vegetation is the Project Area. This section provides a description of the existing vegetation in the Project Area including general vegetation communities, riparian and wetland communities, invasive species and noxious weeds, and special status species plants. Unless otherwise noted, vegetation community cover and data information come from the U.S. Geological Survey (USGS), Northwest Gap Analysis Program (GAP), Version 2, for the State of Wyoming (USGS 2011). GAP Version 2 data provide a hierarchy of vegetation classification that conforms to the National Vegetation Classification System (NVCS). GAP vegetation data are reported at a more generalized Subclass level, which reflects global macroclimatic factors driven primarily by latitude and continental position, or reflect overriding substrate or aquatic conditions (USGS 2011). Vegetation data are also reported at a more refined Macrogroup level, taking into account sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (USGS 2011). GAP vegetation community descriptions are supplemented by the Ecoregions of Wyoming (Chapman et al. 2004).

General limitations of the GAP data should be recognized. GAP data are derived from remote sensing and modeling to make general assessments for conservation planning at a regional scale. All decisions based on the data must be supported by verification and more detailed analyses, such as during site-specific Project planning. GAP analysis provides a quick assessment of the distribution of vegetation and associated species and provides focus and direction for local, regional, and national efforts to maintain biodiversity. GAP data products and assessments also present a snapshot in time generally representing the date of the satellite imagery.

3.18.1 General Vegetation

3.18.1.1 Overview

The Project Area is within a high-elevation, semi-arid, cold desert ecosystem over variable terrain within the Wyoming Basin Ecoregion (Chapman et al. 2004). This area has a dry, arid climate, and contains expanses of barren land/rock outcrops, deep canyons, periods of high winds, large draws, and various soil types, including saline (increased salt content) soils. Vegetation type, composition, distribution, and density change over time and are a function of climate, aspect, elevation, soils, and disturbance variations (BLM 2008b).

3.18.1.2 Laws, Ordinances, Regulations, and Standards

In accordance with the FLPMA and BLM Integrated Vegetation Handbook H-1740-2, the BLM monitors vegetation disturbance levels within its respective field office management areas. Management actions include planning for natural vegetation community conservation and preservation, restoration activities, and reclamation actions as needed following surface disturbances. The BLM uses a Plant Conservation Program in association with integrated vegetation management that incorporates native plant materials into restoration/reclamation plans to achieve healthy functioning native plant communities on BLM-administered lands (BLM 2012g).

The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and State of Wyoming EOs establish requirements to avoid or minimize disturbance in sagebrush communities and identify areas for habitat restoration in order to alleviate factors contributing to the decline of Greater Sage-Grouse populations. Section 3.22.6 (*Special Status Wildlife Species*) describes laws, policies, and regulations that apply to Greater Sage-Grouse and associated sagebrush communities in greater detail.

3.18.1.3 Existing Conditions

The Project Area contains a diverse mix of vegetation communities across varied terrain and soil types. Sagebrush shrubland and steppe comprise the majority of the Project Area, followed by saltbush scrub. Table 3-53 identifies vegetation communities and coverage in the Project Area, and Map 26 depicts the vegetation communities.

Table 3-53. Vegetation Coverage in the Project Area

Generalized Land Cover Type (Subclass)	Specific Land Cover Type (Macrogroup)	Acres in Project Area	Percent of Project Area[1]
Human-Dominated Land Covers			
Developed & Urban	Developed & Urban	42	<1%
Herbaceous Agricultural Vegetation	Herbaceous Agricultural Vegetation	8	<1%
Native Land Covers			
Cool Semi-Desert Scrub & Grassland	Great Basin & Intermountain Dwarf Sage Shrubland & Steppe	1,378	1%
	Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe	91,423	65%
	Great Basin Saltbrush Scrub	37,864	27%
Open Water	Open Water	1	<1%
Semi-Desert Nonvascular & Sparse Vascular Vegetation	Intermountain Basin Cliff, Scree & Rock Vegetation	5,178	4%
Temperate & Boreal Shrubland & Grassland	Cool Semi-Desert Alkali-Saline Wetland	322	<1%
	Great Plains Brackish Marsh & Saline Wet Meadow	863	1%
	Great Plains Wet Meadow, Wet Prairie & Marsh	2	<1%
Temperate Forest	Great Plains Floodplain Forest[2]	3,778	3%

Source: GAP Version 2 Land Cover Data (USGS 2011).

[1]Total may not equal 100 percent due to rounding.
[2]Riparian habitat in the Project Area has not been field-verified and may be substantially less than reported here.

Note: GAP data presented in this table is intended only for purposes of analysis and should not be used as the basis for reclamation standards or requirements, which require site-specific vegetation assessments to establish actual vegetation types and conditions.

3.18.1.3.1 Description of Vegetation Communities

Developed & Urban

Human development in the Project Area is primarily associated with oil and gas development and facilities (e.g., wells, roads) and livestock grazing (e.g., range improvements). GAP land cover data estimates that human development comprises 42 acres (less than 1 percent) of the Project Area. Based on the estimate of existing surface disturbance in Section 2.3.1, the GAP data likely underestimates the amount of human development present by approximately 1,500 acres.

Agriculture

Agricultural coverage in the Project Area comprises eight acres (less than 1 percent) of the Project Area and is primarily herbaceous in nature. Agricultural areas can provide foraging habitat for raptor species.

Cool Semi-Desert Scrub & Grassland

Within the Cool Semi-Desert Scrub & Grassland Subclass, three shrub-dominated communities are mapped within the Project Area (see Table 3-53). The Great Basin & Intermountain Dwarf Sage Shrubland & Steppe and the Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe are collectively referred to as the *sagebrush-steppe* vegetation communities for the remainder of this document. They correspond to the Rolling Sagebrush Steppe Ecoregion identified by Chapman et al. (2004).

Great basin and intermountain tall sagebrush shrubland and steppe (sagebrush-steppe) is the primary vegetation type throughout the Project Area, comprising 91,423 acres (65 percent) of the Project Area and primarily occurring on hilly rolling plains, mesas, plateaus, valley bottoms, and benches (Chapman et al. 2004). The sagebrush-steppe communities are dominated by a mix of Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), rabbitbrush (*Chrysothamnus* spp.), winterfat (*Krascheninnikovia lanata*), greasewood (*Sarcobatus vermiculatus*), snowberry (*Symphoricarpos occidentalis*), and antelope bitterbrush (*Purshia tridentata*) (Chapman et al. 2004). In general, the sagebrush-steppe vegetation community is characterized by a mosaic distribution of sagebrush stands ranging from moderate to high density. The sagebrush-steppe community provides shade, food, cover, and habitat opportunities for various species of wildlife throughout the Project Area.

Some areas within sagebrush-steppe intergrade with grass-dominated communities. In these areas, vegetation is a mix of sagebrush species (*Artemisia* spp.) and perennial grasses, including Indian ricegrass (*Achnatherum hymenoides*), needle and thread (*Hesperostipa comata*), Sandberg bluegrass (*Poa secunda*), and thickspike wheatgrass (*Elymus lanceolatus*) (Fertig 1993). Additionally, common forbs in this community include Hood's phlox (*Phlox hoodii*), buckwheat (*Eriogonum* spp.), scarlet globemallow (*Sphaeralcea coccinea*), stemless goldenweed (*Stenotus acaulis*), and pepperweed (*Lepidium* spp.) (Fertig 1993).

The Great Basin Saltbrush Scrub vegetation community is the second most abundant community in the Project Area, comprising 37,864 acres (27 percent). This vegetation community is found within lowland and upland areas in the Project Area, and may occupy portions of sand dunes, arid playas, swales, and alluvial flats. The Great Basin Saltbrush Scrub areas are dominated by alkaline-adapted plant species such as shadscale (*Atriplex confertifolia*), greasewood, and Gardner's saltbush (*Atriplex gardneri*). This arid landscape is very sensitive to multiple inputs. Extreme grazing pressure, by any animal, extended dry or wet cycles, and unsuccessful reclamation can lead to increases in weeds such as Russian thistle, cheatgrass, and the toxic halogeton (Chapman et al. 2004)

Open Water

One open water area was identified in the GAP data at the northern edge of the Project Area. This area is a small reservoir of approximately one acre in size, directly east of Burma Road. Open water areas have the potential to support a limited number of waterfowl species, and also provide freshwater to livestock and wildlife.

Semi-Desert Nonvascular & Sparse Vascular Vegetation

One macrogroup was identified within this Subclass: Intermountain Basin Cliff, Scree & Rock Vegetation. This system is centered on the Colorado Plateau on steep cliff faces, narrow canyons, on slickrock, and open tablelands of predominantly sedimentary rocks, such as sandstone, shale, and limestone. Plants growing in these places are found in crevices, cracks, or pockets within the rocks and cliffs where small amounts of soil accumulate. The appearance is of very open tree canopy or scattered trees and shrubs with a sparse grasses or herbs. Common species include juniper spp., littleleaf mountain-mahogany, and other short-shrub and herbaceous species, utilizing moisture from cracks and pockets where soil accumulates (USGS 2011).

Intermountain Basin Cliff, Scree & Rock Vegetation occurs primarily in the west-central and northwest of the Project Area. It occupies 5,178 acres (3.7 percent) of the Project Area. This community has the potential to support a number of BLM special status plant species (see Table 3-55).

Temperate and Boreal Shrubland & Grassland

Based on GAP data for Wyoming (USGS 2011), three herbaceous wetland/riparian/mesic communities comprise the Temperate & Boreal Shrub & Grassland Subclass: (1) Cool Semi-Desert Alkali-Saline Wetland; (2) Great Plains Brackish Marsh & Saline Wet Meadow; and (3) Great Plains Wet Meadow, Wet Prairie & Marsh. Not all areas within these mapping units would be technically classified as wetlands but all are mesic or moist areas. These communities occur primarily in the central and eastern portions of the Project Area.

The USGS (2011) describes Cool Semi-Desert Alkali-Saline Wetland as permanent and seasonal wetlands, found in the closed basins of the intermountain west, or in other dry areas where water evaporates before it can run off. These wetlands are often associated with seasonal or playa lakes, or occur on permanent lakes in closed basins. They are flat, sometimes large, sometimes small, usually dominated by sedges, rushes, and alkaline-tolerant grasses. Shrubs or trees are rarely found in these wetlands, except for occasional willows on lake or stream margins, and greasewood when these are found in poorly drained floodplains.

Great Plains Brackish Marsh & Saline Wet Meadow are described by USGS (2011) as salty or alkaline wetlands found throughout the western Great Plains. They can include shallow lakes and depressions, which usually hold water for part of the year, and for which water evaporates rather than runs off, creating salty conditions. Salt encrustations can occur on the surface in some examples of this system, and the soils are severely affected and have poor structure. Species that typify this system are salt-tolerant species such as saltgrass, alkali sacaton, and foxtail barley. During exceptionally wet years, an increase in precipitation can dilute the salt concentration in the soils of some examples of this system, which may allow for less salt-tolerant species to occur. Conversion to agriculture and pastureland can impact this system, especially when it alters the hydrology of the system.

Great Plains Wet Meadow, Wet Prairie & Marsh communities are typically found along creeks and streams or in depressions. They can be adjacent to floodplains but do not receive regular flooding from the river or stream. They can range from having water in the soil just below the soil surface to water a few feet deep. These areas tend to have fine textured soils, often silty, dense clays or muck. The vegetation is typically dense and characterized by prairie cordgrass, numerous large sedges, and, in wetter areas, spikerush. Other tall marsh species such as cattail can be associated with this system. Some parts of this system may be saline and have species such as saltgrass and saltmarsh clubrush (USGS 2011).

The USFWS National Wetlands Inventory (NWI) maps (USFWS 2012c) are also used to describe the distribution and abundance of wetland communities within the Project Area. Based on the USFWS NWI maps, less than one percent (107 acres) of the Project Area is composed of wetland habitat (Map 26). Based on the climatic conditions within the Project Area and BLM records, actual size and presence of these communities may be substantially less than reported in GIS data that has not been field-verified. Refer to Section 3.18.2 (*Riparian and Wetland Communities*) for more information.

Great Plains Floodplain Forest

This system represents the streamside woodlands, shrublands, and gravel flats found along the rivers and streams in the northwestern Great Plains. It occurs in habitats ranging from deep-cut ravines to wide braided river-beds. Cottonwood, willows, silver sage, and grasses are the most common dominant species within the Great Plains Floodplain Forest vegetation community (USGS 2011). This vegetation type is scattered more or less evenly throughout the Project Area along small to medium drainages. These areas comprise 3,778 acres (3 percent) within the Project Area. Based on the climatic conditions within the Project Area and BLM records, actual size and presence of these communities may be substantially different than reported in GIS data that has not been field-verified.

3.18.2 Riparian and Wetland Communities

3.18.2.1 Overview

In general, riparian and wetland communities are ecosystems where water saturation is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin et al. 1979). Three criteria are required for an area to qualify as a wetland: hydric soil, permanent or periodic hydrology during the growing season, and hydrophytic vegetation. Areas that meet these three criteria are subject to regulation by the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA). Wetlands provide valuable functions to groundwater recharge, flood-flow attenuation, erosion control, and water quality improvement. Additionally, they provide habitat for many plants and animals, including threatened and endangered species.

Riparian habitat generally includes wetlands and nonwetlands whose vegetation depends on river- or lake-influenced groundwater for growth and reproduction (Tiner 1999). Riparian zones are often transitional ecosystems located between wetlands, or other aquatic habitats, and uplands. In arid and semiarid regions, these areas can be especially important for wildlife because they can provide excellent refuge, critical wildlife habitat for local species and migrants, abundant water, and migration routes (Mitsch and Gosselink 2000; Tiner 1999). Additionally, both riparian and wetland areas serve a wide variety of functions and values including aquifer recharge, flood attenuation, flow moderation, water filtration, wildlife and stock forage, and streambank stabilization (Tiner 1999).

3.18.2.2 Laws, Ordinances, Regulations, and Standards

The USACE regulates discharge of dredged or fill material into waters of the United States including wetlands under Section 404 of the CWA. Wetlands are defined by the USACE (33 CFR 328.3, 1986) and the EPA (40 CFR 230.3, 1980) as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." "Discharge of fill material" is defined as the addition of fill material into waters of the United States including, but not limited to, the following: placement of fill that is necessary for the construction of any structure or impoundment requiring rock, sand, dirt, or other material for its construction; site-development fills for recreational, industrial, commercial, residential, and other uses; causeways or road fills; fill for intake; and outfall pipes and sub-aqueous utility lines (33 CFR 323.2(f)). The CWA requires the USACE to review and issue, or deny, a permit for discharge of dredged or fill material into such waters. Guidelines promulgated under CWA Section 404(b)(1) require that permits for discharges of dredged or fill material into waters of the United States and wetlands authorize only the least environmentally damaging practicable alternative.

Wetlands and floodplains are also protected by two EOs. EO 11990, *Protection of Wetlands* (42 FR 26961, 3 CFR, 1977), states that federal agencies should "avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative." EO 11988, *Floodplain Management* (42 FR 26951, 3 CFR, 1977), states that federal agencies should "avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative."

Wetlands in Wyoming, regardless of whether they are protected by federal statutes and regulations, are protected as surface waters of the state (W.S. 35-11-308 through 35-11-311; Wyoming Water Quality Rules and Regulations, Chapter 1, Section 12). In accordance with this policy, point or nonpoint sources of pollution must not cause the destruction, damage, or impairment of naturally occurring wetlands except when mitigated through an authorized wetlands mitigation process. When approving mitigation, the Wyoming DEQ may consider both the ecological functions and the wetland value of the disturbed wetland.

3.18.2.3 Existing Conditions

As mentioned previously, based on the GAP data, herbaceous wetland/riparian mesic communities (comprised of Cool Semi-Desert Alkali-Saline Wetland, Great Plains Brackish Marsh & Saline Wet Meadow, Great Plains Wet Meadow, Wet Prairie & Marsh) are estimated to be present on approximately 1,187 acres (0.8 percent) of the Project Area. Forested riparian communities (comprised of Great Plains Floodplain Forests) are estimated to be present on 3,778 acres (3 percent) of the Project Area (Map 26) (USGS 2011). Based on USFWS NWI Maps, wetland habitats and vegetation communities are estimated to be present on approximately 107 acres (less than 1 percent) of the Project Area (Map 26) (USFWS 2012c).

Wetland habitats in the Project Area are primarily composed of palustrine emergent wetlands associated with ephemeral swales, ditches, and areas of ponded water. Wetlands in the Project Area have not been field-verified to determine size, extent, or if mapped locations meet the three diagnostic criteria described above for protection under Section 404 of the CWA. Additionally, size and extent of present riparian habitat has not been confirmed. Some wetland areas may expand or contract in response to drought and/or groundwater withdrawals in the vicinity of the Project Area. The Project Area is within an arid, semi-desert climate that receives little annual precipitation and high volumes of sun that are not conducive to riparian or wetland establishment. Based on the arid desert climatic conditions within the Project Area, lack of annual precipitation, and BLM records, actual size and presence of riparian and wetland communities may be significantly less than projected from GIS information. For the purposes of this analysis, mapped riparian and wetland habitats and acreages serve as approximate locations for these communities. Site-specific wetland delineations and riparian habitat surveys may be required for improved accuracy in impact analysis where future surface-disturbing activities intersect mapped riparian/wetland locations.

Mapped herbaceous and forested riparian locations in the Project Area are primarily adjacent to ephemeral draws, swales, and other water bodies that are periodically influenced by flooding. Wetland locations in the Project Area primarily occur in small, isolated areas containing high moisture, which may include ephemeral waterways, livestock stock ponds, or natural springs or seeps that support wetland herbaceous vegetation.

There are no perennial waterways present in the Project Area; however, some intermittent and ephemeral streams are present, including Alkali Creek and its tributaries in the northwestern part of the Project Area, though they are not considered major water sources for domestic or stock use. In general, ephemeral streams and drainages typically do not support riparian or wetland habitats due to the infrequency of available water and lack of continually saturated soil conditions. Based on the lack of perennial waterways, the source of riparian areas and wetland hydrology in the Project Area is likely from overland flow/runoff following precipitation events and perennial livestock water sources.

3.18.3 Invasive Species and Noxious Weeds

3.18.3.1 Overview

Several species of invasive and noxious weeds have the potential to occur within the Project Area. Noxious weeds are Federal-, state-, and county-designated invasive species that have invasive habits and/or the potential to become monocultures that can degrade land value, native ecosystems, agricultural lands, wildlife habitat, and aesthetic and visual values of land. Presence of invasive and noxious weed species generally results in increased competition with native plant species for habitat, sunlight, nutrients, and water. Most noxious weeds are early successional species that thrive in surface-disturbed areas following ground-disturbance activities, wildfires, human developments, and surface erosion. Introduction and establishment of noxious and invasive plants in the Project Area would likely occur in untreated surface-disturbed areas. Introduction of these species can occur through wind-blown seeds and accidental transfer from vehicles or machinery, livestock, wildlife species, and humans. Because cheatgrass is not listed as a prohibited weed as part of Wyoming’s weed-free forage programs, purchasing certified weed-free hay might not ensure the absence of cheatgrass seed (University of Wyoming and Colorado State University 2013).

3.18.3.2 Laws, Ordinances, Regulations, and Standards

Federal policy (Section 403 of the Plant Protection Act [7 U.S.C. 7701 et seq.]) defines noxious weeds as “any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment."

The Plant Protection Act prohibits the import, introduction, export, or movement in interstate commerce of any noxious weed, "unless the importation, entry, exportation, or movement is authorized under general or specific permit and is in accordance with such regulations as the Secretary [of Agriculture] may issue to prevent the introduction of plant pests into the United States or the dissemination of plant pests within the United States."

In 1973 the Wyoming State Legislature enacted the Wyoming Weed and Pest Control Act for controlling designated weeds and pests. EO 13112, *Invasive Species*, was signed by President Clinton in 1999 to prevent the introduction of invasive species, to provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause. Amendments to EO 13112, including EO 13751, *Safeguarding the Nation from the Impacts of Invasive Species*) provide further guidance on controlling invasive species.

EO 13112 also directs federal agencies to prevent and control the introduction of invasive species in a cost-effective and environmentally sound manner. The EO established the National Invasive Species Council (NISC), which is composed of federal agencies and departments, and a supporting Invasive Species Advisory Committee (ISAC) composed of non-Federal stakeholders at the state, local, and private levels. The NISC and ISAC prepared a national invasive-species management plan that recommends objectives and measures to implement the EO and to prevent the introduction and spread of invasive species. The EO requires consideration of invasive species in NEPA analyses, including their identification and distribution, their potential impacts, and measures to prevent or eradicate them.

Sublette County and other local counties have the authority to identify and manage for noxious weeds and invasive species in their counties. The Sublette County Weed and Pest District has a mission to serve as responsible stewards of Sublette County by aiding in the protection and preservation of the land, water, and resources from the degrading impact of noxious weeds. Sublette County has authority to regulate and manage declared noxious weeds in the County if the noxious weeds are not listed on the Wyoming Weed and Pest Control Act Designated Weed List.

3.18.3.3 Existing Conditions

Based on the 2015 Wyoming Weed and Pest Council Declared List of Weed and Pest Species, Sublette County contains populations of six documented noxious and invasive weed species (WYO Weed 2015). Noxious and invasive species identified as possibly occurring within the Project Area include Austrian fieldcress (*Rorippa austriaca*), scentless chamomile (*Matricaria perforate*), and field scabiosa (*Knautia arvensis*). Additionally, the USDA identifies 25 species of introduced, invasive, and noxious plants that are known to occur in the State of Wyoming. Table 3-54 identifies designated noxious weeds and invasive plant species that may occur within the Project Area.

Weeds in the Project Area are present primarily in areas of disturbance, including along roadsides, in areas of oil and gas development, and in livestock concentration areas. Invasive and noxious plants are typically very aggressive and therefore require special management to prevent the spread of existing infestations and the introduction of noxious plant seeds from outside sources. Several species of noxious weeds and invasive plant species can potentially be toxic if consumed by sheep or cattle.

Other weed species not officially designated as noxious could be present within the Project Area, which can also be disruptive to native plant communities and other natural resources. These additional species include halogeton (*Halogeton glomeratus*), which is highly toxic to both sheep and cattle, and Russian thistle (*Salsola* spp.).

Cheatgrass (*Bromus tectorum*) has become a significant problem species directly east, west, and southwest of the Project Area. To date, this species has invaded several million acres of rangeland in Wyoming and other western States, and may eventually expand into the Project Area

Table 3-54. Designated Noxious Weeds and Invasive Plant Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Wyoming Noxious Weed List	Sublette County Weed List	Potential to Occur in Project Area
Austrian fieldcress	*Rorippa austriaca*		X	X
Black henbane	*Hyoscyamus niger*	X		X
Canada thistle	*Cirsium arvensis*	X		X
Cheatgrass/downy brome	*Bromus tectorum*		X	X
Common burdock	*Arctium minus*	X		
Common St. John's wort	*Hypericum perforatum*	X		
Common tansy	*Tanacetum vulgare*	X		
Dalmatian toadflax	*Linaria dalmatica*	X		X
Diffuse knapweed	*Centaurea diffusa*	X		
Dyers woad	*Isatis tinctoria*	X		X
Field bindweed	*Convolvulus arvensis*	X		X
Field scabiosa	*Knautia arvensis*		X	X
Hoary alyssum	*Berteroa incana*		X	X
Hoary cress	*Cardaria draba, C. pubescens*	X		X
Houndstongue	*Cynoglossum officinale*	X		X
Leafy spurge	*Euphorbia esula*	X		X
Musk thistle	*Carduus nutans*	X		X
Ox-eye daisy	*Chrysanthemum leucanthemum*	X		X
Perennial pepperweed	*Lepidium latifolium*	X		X
Perennial sowthistle	*Sonchus arvensis*	X		X
Plumeless thistle	*Carduus acanthoides*	X		
Purple loosestrife	*Lythrum salicaria*	X		
Quackgrass	*Agropyron repens*	X		
Russian knapweed	*Centaurea repens*	X		X
Russian olive	*Elaeagnus angustifolia*	X		X
Saltcedar	*Tamarix spp.*	X		X
Scentless chamomile	*Matricaria perforate/ Tripleurospermum inodorum*		X	X
Scotch thistle	*Onopordum acanthium*	X		
Skeletonleaf bursage	*Franseria discolor Nutt.*	X		

Table 3-54. Designated Noxious Weeds and Invasive Plant Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Wyoming Noxious Weed List	Sublette County Weed List	Potential to Occur in Project Area
Spotted knapweed	*Centaurea maculosa*	X		
Western water hemlock	*Cicuta douglasii*		X	
Yellow toadflax	*Linaria vulgaris*	X		X

Source: WYO Weed 2015.

3.18.4 Special Status Plant Species

3.18.4.1 Overview

This section identifies documented and potential plant species in the Project Area that are protected or considered for protection under the Endangered Species Act (ESA) or classified as a sensitive species by the BLM PFO and RSFO.

Three Federally listed threatened and endangered ESA plant species and 17 BLM sensitive species plants are found within Sublette County and the BLM RSFO and PFO. Three special status plant species were observed during baseline surveys in 2010 and 2011 and three additional special status plant species have been historically documented within the Project Area. A potential-to-occur determination, based on habitat requirements, elevation range, and geographic range of each special status plant species has been made for the remaining species that could potentially occur within the Project Area.

3.18.4.2 Laws, Ordinances, Regulations, and Standards

The USFWS has jurisdiction over plant species listed as threatened or endangered under Section 9 of the Federal ESA (16 U.S.C. 1536), which provides for the protection of listed species. Section 7 of the ESA of 1973, as amended, requires federal agencies to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of threatened or endangered species, or result in the destruction or adverse modification of their critical habitats. The ESA and 50 CFR 402 direct each Federal agency to confer or consult with the USFWS on any action that is likely to jeopardize or affect the continued existence of any species or its habitat.

The BLM Wyoming also maintains a statewide sensitive species list that includes species of conservation interest for the BLM within the State of Wyoming that are monitored and protected to ensure that Federal actions do not result in an ESA listing of those species. Each BLM field office also maintains a list of sensitive species that occur within its planning area.

3.18.4.3 Existing Conditions

Three federally listed threatened and endangered plant species and 17 BLM vegetative special status species have the potential to occur within the Project Area. Table 3-55 identifies federally listed and BLM sensitive plant species considered for the Project Area, their habitat associations, and potential for occurrence in the Project Area. Subsequent sections provide additional information.

Table 3-55. Potential and Documented Occurrence of Special Status Plant Species in the Project Area

Species	Habitat Preference and Geographic Range[1]	Potential Occurrence[2]	ESA Status[3]
USFWS ESA Listed Species			
Ute ladies'-tresses *Spiranthes diluvialis*	Moist drainages persisting through summer months, soils are sandy loams, sands, loams, and silt loams. Occurs generally under 7,000 feet elevation rangewide. In Wyoming, the highest known occurrence is at 5,420 feet elevation. Currently known from extant occurrences in western Nebraska, southeastern Wyoming, northwest and north-central Colorado, northeastern and southern Utah, east-central Idaho, southwestern Montana, south-central Nevada, and north-central Washington. Surveys have been conducted in south-central Sublette County and were negative (Heidel 2007). In Wyoming, populations occur along the Antelope Creek, Horse Creek, and Niobrara River watersheds in Converse, Goshen, Laramie, and Niobrara counties (Fertig and Heidel 2007).	Unlikely. Most occurrences in Wyoming are in the southeastern portion of the state at substantially lower elevations than the Project Area. Perennial streams do not appear to occur and seeps/springs appear to be limited.	Threatened
Western prairie fringed orchid *Platanthera praeclara*	Riparian areas, mesic to wet prairies and swales, typically in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota at elevations of between 200 and 800 meter (660–2,625 feet elevation). A single, isolated occurrence in Wyoming occurs at a much higher elevation (1,600 meters / 5,249 feet) (FNA 2013) in Natrona County.	Highly Unlikely. Elevation range where species occurs in Wyoming is lower than the Project Site. Isolated Natrona County occurrence indicates presence in Wyoming may be relictual. Limited presence of mesic prairie and riparian areas in the Project Area.	Threatened
Whitebark pine† *Pinus albicaulis*	Subalpine to alpine sites between 8,000 and 11,000 feet elevation in Wyoming. They are found in pure whitebark pine stands, mixed limber pine/whitebark stands, and mixed conifer stands with lodgepole pine, subalpine fir, and Engelmann spruce. These stands range from open, high-elevation woodlands to dense whitebark and limber pine stands to heavily forested mixed stands. Geographic range in Wyoming predicted to extend into the upper elevation areas of west-central Wyoming and likely, Sublette County (USFWS 2010).	Possible. Some higher elevations of the Project Area occur over 8,000 feet. Although there is limited to no coniferous vegetation documented in the GAP data in the Project Area, project-specific vegetation data may identify small stands of coniferous vegetation communities.	Candidate
BLM Sensitive Species			
Beaver Rim phlox *Phlox pungens*	Sparsely vegetated slopes of limestone, volcanic-rich sandstone, siltstone, or red-bed clays.	Historical/Possible	-
Cedar Mountain Easter daisy *Townsendia microcephala*	Exposed, west-facing upper slopes and ridges on shallow, sandy soils at 8,200–8,500 feet, apparently restricted to Oligocene age Bishop Conglomerate (Markow et al. 2001). Endemic to southwestern Wyoming; known only from the northern foothills of the Uinta Range in Sweetwater and Uinta counties.	Possible. Limited surveys have been performed for this species and it is a very diminutive, easily overlooked species. Elevation range is appropriate for the Project Area. Habitat conditions also probable on site.	-

Table 3-55. Potential and Documented Occurrence of Special Status Plant Species in the Project Area

Species	Habitat Preference and Geographic Range[1]	Potential Occurrence[2]	ESA Status[3]
Cedar Rim thistle *Cirsium aridum*	Barren slopes and draws, sparsely vegetated openings within Wyoming big sagebrush grasslands.	Documented.	-
Dune wildrye *Elymus simplex luxurians*	Drifting sand dunes at 7,130 feet. Known only from northern Sweetwater County in the Upper Green River basin.	Possible. Limited surveys have been performed for this species and grass identification can be problematic. Elevation range is appropriate for the Project Area. Habitat conditions (sand dunes) also probable on site.	-
Green River greenthread *Thelesperma caespitosum*	In Wyoming, occurs in sparsely vegetated cushion plant communities on bleached, white or brownish, limey-slate ridgetops and upper slopes of the Eocene-age Green River Formation (Fertig 1999). In Wyoming, it is restricted to two small populations on the east and west sides of the Green River about two air miles southeast of the city of Green River. The entire state population is restricted to less than 25 acres of habitat in an area of approximately 2.5 square miles.	Unlikely. Geographic range appears to be restricted in Wyoming. Soil conditions may not be present within the Project Area.	-
Large-fruited bladderpod *Lesquerella macrocarpa*	Sparsely vegetated slopes dominated by sagebrush or high cover of grasses, soils = fine textured clays and shales.	Documented.	-
Limber pine *Pinus flexilis*	Mountain areas up to timberline. Similar to habitats described for whitebark pine, a similar species.	Possible within higher elevations of the Project Area. Although there is limited to no coniferous vegetation documented in the GAP data in the Project Area, project-specific vegetation data may identify small stands of coniferous vegetation communities.	-
Meadow pussytoes *Antennaria arcuata*	In Wyoming, it is known in the Sweetwater River watershed from the continental divide (Sublette County) to Jeffrey City (Fremont County), and in the Upper Green River watershed (Sublette County) (Fertig and Heidel 2013). Found in sub-irrigated meadows within broad stream channels. Soils are alkaline and clay high in organic matter. Elevations range from 6,840 to 8,000 feet.	Possible. Habitats possible on site, although limited. Soil conditions probable on site. Elevation and geographic range is appropriate for the Project Area.	-
Ownbey's thistle *Cirsium ownbeyi*	Sparsely vegetated slopes in sage and juniper communities, primarily on semi-barren rims or steep slopes of broken gray slate below shaley cliffs. In Wyoming, species only documented from the Flaming Gorge area of the Green River Basin in Sweetwater County. Elevations from 6,440 to 8,200 feet.	Unlikely. Although dominant plant communities required by the species are present, the species appears to require highly specialized edaphic conditions that may or may not be present in the Project Area.	-

Table 3-55. Potential and Documented Occurrence of Special Status Plant Species in the Project Area

Species	Habitat Preference and Geographic Range[1]	Potential Occurrence[2]	ESA Status[3]
Precocious milkvetch *Astragalus proimanthus*	Occurs in sparsely vegetated cushion plant/bunchgrass communities, along rims and gullied upper slopes of benches, bluffs, and mesa-like ridges. Soils are rocky clays mixed with shale. Species is a narrow endemic restricted to the bluffs of the Henry's Fork River and vicinity of McKinnon in the southern Green River Basin in southwestern Sweetwater County. Elevations range from 6,400 to 7,200 feet.	Unlikely. Although dominant plant communities required by the species are present, the species appears to require highly specialized edaphic conditions that may or may not be present on site, and species is also a narrow endemic not documented in Sublette County.	-
Small rock cress *Arabis pusilla*	Crack/crevices in sparsely vegetated granite/pegmatite outcrops in sage-grasslands. State endemic restricted to the southern Wind River Range (South Pass area) in Fremont County, Wyoming.	Possible. Macro habitat conditions (sagebrush-grasslands) present on site. Micro-habitat conditions (cracks/crevices in rock outcrops) probable within the Project Area. Although restricted to Fremont County, it is unlikely that this is the only area in the state where this species occurs.	-
Stemless beardtongue *Penstemon acaulis*	Species is found on dry, open, sparsely vegetated rocky slopes, tops of ridges, ledges, among flagstones, or gravelly soils, and deposition fans from eroded steep slopes. Vegetation communities include: bunch grasses, cushion plants, shrubby *Artemisia nova*, big sagebrush, and pinyon-juniper communities. Occurrences straddle the Wyoming/Utah border.	Possible. Vegetation communities in which the species have been documented match those that occur within the Project Area. Probability is low, however; the species has only been documented from the Utah/Wyoming border.	-
Trelease's milkvetch *Astragalus racemosus treleasei*	Outwash flats and fluted Badlands slopes derived from shale at 6,500 to 7,500 feet and less occasionally to 8,300 feet elevation. In Wyoming, known only from the Green River Basin and the eastern foothills of the Wyoming Range (Sublette and Uinta counties). Occurrences appear to be stable in the absence of major habitat disturbances (Heidel and Fertig 2003).	Historical/Possible	-
Tufted twinpod *Physaria condensata*	Dry, rocky calcareous knolls and ridges, clay banks, shaley hills in sparsely vegetated sagebrush grasslands. Tufted twinpod is endemic to the southern Overthrust Belt and lower Green River Basin in Lincoln, Uinta, and Sublette counties, Wyoming (Fertig 2002).	Historical/Possible	-
Uinta greenthread *Thelesperma pubescens*	Occurs within sparsely vegetated cushion plant communities and sagebrush grasslands, on benches and ridges on coarse, cobbly soils of Bishop Conglomerate. Endemic to foothills of southern Green River Basin and northern Uinta Range in southwest Wyoming (Uinta and Sweetwater counties).	Possible. Vegetation communities in which the species have been documented match those that occur within the Project Area. Probability is low, however; the species has only been documented in far southwestern Wyoming.	-

Table 3-55. Potential and Documented Occurrence of Special Status Plant Species in the Project Area

Species	Habitat Preference and Geographic Range[1]	Potential Occurrence[2]	ESA Status[3]
Watson's prickly phlox *Linanthus watsonii*	Discontinuous distribution along rocky crevices, cliff habitats on limestone substrates, and in rocky canyons.	Documented.	-
Wyoming tansymustard *Descurainia torulosa*	Sparsely vegetated sandy slopes at base of cliffs of volcanic breccia or sandstone. Geographic distribution north and south of the Project Area at elevations from 7,700 to 10,500 feet.	Possible. Micro-habitat conditions (sandy slopes are base of cliff of volcanic breccia or sandstone) possible, but undetermined, within the Project Area. Species occurs at elevations that are present within the Project Area.	-

[†]Species also listed on the BLM Sensitive Species list.
[1]Obtained from USFWS recovery plans (USFWS n.d.) and state species abstract (WyNDD n.d.).
[2]Documented = species was documented within the Project Area or 1.0-mile buffer during baseline surveys (2010–2011); Historical = species has been documented within the Project Area prior to 2010 (WGFD 2012c; WyNDD 2012); Possible = species has never been recorded in the Project Area, but its range overlaps the Project Area and appropriate habitat(s) are present or suspected to be present within the Project Area; Unlikely = species occurrence would be a rare sighting; Highly unlikely = based on species range and habitats present, the species is not expected to occur in the vicinity of the Project Area.
[3]Source: USFWS 2012b.

ESA Endangered Species Act of 1973, as amended
GAP Northwest Gap Analysis Program
m meters

3.18.4.3.1 Federally Listed Plant Species

There are currently three Federally listed plant species on the Endangered, Threatened, Proposed, and Candidate Species list issued by the USFWS for Sublette County. Ute ladies'-tresses (*Spiranthes diluvialis*) and western prairie fringed orchid (*Platanthera praeclara*) are unlikely to occur in the Project Area (Table 3-55 (USFWS 2012b).

The whitebark pine (*Pinus albicaulis*), a candidate species, occurs in high-elevation (above 8,000 feet) or high-latitude areas in the Coastal Mountain Ranges and Rocky Mountain Ranges (USFWS 2012b). Some higher elevations of the Project Area occur over 8,000 feet. Although there is limited to no coniferous vegetation documented in the GAP data in the Project Area, project-specific vegetation data may identify small stands of coniferous vegetation communities in which this species could occur.

3.18.4.3.2 BLM Wyoming Sensitive Species Plants

The BLM has identified 40 plant species as sensitive within the State of Wyoming, meaning specific management efforts are implemented toward maintaining adequate habitats for these species (BLM 2010a). Seventeen of these plants are listed for the BLM PFO and RSFO areas (BLM 2010b). Based on baseline studies for the NPL Project, historical Wildlife Observation System (WOS) and Wyoming Natural Diversity Database (WyNDD) data, Cedar Rim thistle (*Cirsium aridum*) has documented populations in the Project Area. Two plant species, Watson's prickly phlox (*Linanthus watsonii*) and large-fruited bladder pod (*Lesquerella macrocarpa*), have suitable habitat within the Project Area and have been documented within one mile of the Project Area. Beaver Rim phlox (*Phlox pungens*), Trelease's milkvetch (*Astragalus racemosus treleasei*) and tufted twinpod (*Physaria condensata*) have historically occurred in the Project Area (Table 3-55) (WGFD 2012c; WyNDD 2012). Based on recent studies that resulted in positive occurrences of Beaver Rim phlox in or near the Project Area (Heidel 2009), stable habitat trends for Trelease's milkvetch documented by the WyNDD (Heidel and Fertig 2003), and documented occurrences of Tufted twinpod in Sublette County as recently as 1993, these three species likely still persist within the Project Area. Eight additional BLM Sensitive plant species may occur within the Project Area (Table 3-55). Focused surveys for these species may be warranted per the Resource Protection Measures outlined in Appendix B (*Resource Protection Measures*).

3.19 Visual Resources

3.19.1 Overview

Visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of water (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). These elements of the landscape can be described in terms of their form, line, color, and texture. Normally, the more variety of these elements in a landscape, the more interesting or scenic the landscape becomes, if the elements exist in harmony with each other. The BLM manages landscapes and scenic values for varying levels of protection and modification, giving consideration to other resource values and uses and the scenic quality of the landscape. The analysis area for visual resources is the Project Area and areas from which the NPL Project could be visible within 15 miles.

3.19.2 Laws, Ordinances, Regulations, and Standards

The BLM is responsible for identifying and protecting scenic values on public lands under several provisions of the FLPMA and NEPA. The BLM Visual Resource Management (VRM) system was developed to facilitate the effective discharge of that responsibility in a systematic, interdisciplinary manner. The VRM system provides the methodology to inventory existing scenic quality; assign visual resource inventory classes based on a combination of scenic values, visual sensitivity, and viewing distances; and assign visual management objectives. Four VRM classes have been established to serve as both an inventory tool portraying the relative value of existing visual resources, and a management tool portraying visual management objectives for the respective classified lands. Management objectives for each of the VRM classes are described as follows.

- **VRM Class I.** The objective is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and should not attract attention.
- **VRM Class II.** The objective is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- **VRM Class III.** This objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should

repeat the basic elements found in the predominant natural features of the characteristic landscape.

- **VRM Class IV.** The objective is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and may be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic elements of the landscape (BLM 1986a).

As described in BLM Manual 8410, the Visual Resource Inventory (VRI) process provides the BLM with a means for determining visual values based on scenic quality, viewer sensitivity, and a delineation of distance zones (BLM 1986a). The inventory establishes the baseline, current scenic quality in the visual analysis area, which is used to measure the potential changes to scenic quality. The purpose of a VRI classification is different from VRM class objectives; VRI classes are a tool for portraying the relative value of visual resources and are used to consider visual values in the RMP process. VRM classes are a management tool used to portray visual management objectives. The BLM Pinedale Approved RMP and ROD (BLM 2008a) and the BLM Green River Approved RMP and ROD (BLM 1997a) establishes the VRM Classifications in the analysis area.

3.19.3 Characteristic Landscape

The Project Area is generally remote, largely undeveloped, and within a high-elevation, semi-arid, cold desert ecosystem over variable terrain within the Rolling Sagebrush Steppe and Salt Desert Shrub Basin Ecoregions of Wyoming (Chapman et al. 2004). The Project Area generally has a dry, arid climate and contains expanses of barren land/rock outcrops, deep canyons, periods of high winds, large draws, and various soil types, including saline (increased salt content) soils. Highly erodible soils have exposed multicolored bands in sedimentary bedrock outcrops, creating contrasts in color and form that increase the visual complexity of the landscape.

The landscape is largely undeveloped, with lines, forms, and colors consistent with the natural scenery of the landscape, sparsely contrasted with previous and ongoing development. Existing development, including approximately 55 producing oil and gas wells and other infrastructure, accounts for 1,573 acres of existing surface disturbance, or only 1.1 percent of the Project Area. Most of the existing oil and gas infrastructure is concentrated around the JIDPA (Map 3). Range improvements and unimproved roads associated with livestock grazing and range management are distributed throughout the Project Area.

3.19.4 Existing Conditions

The Project Area contains 22,617 BLM-administered acres of VRM Class III, all occurring within the BLM PFO, and 113,038 acres of VRM Class IV, occurring in the BLM PFO and RSFO (BLM 2008a; BLM 1997a) (Map 27). VRM Class III areas allow project facilities, surface disturbance, and activities that contrast enough to attract viewer attention and are evident in the landscape, but are constructed in a manner that reflects the lines, forms, colors, and textures of the characteristic landscape, so as not to dominate the landscape. Whenever possible, existing topography and vegetation should be used to screen project activities and facilities. VRM Class IV areas allow activities and facilities as dominant visual features in the landscape and may dominate the view of the casual observer; however colors and textures should blend with the landscape and use existing screening possibilities. Even though VRM Class III and IV allocations allow for modification of the landscape to accommodate natural gas production, all surface-disturbing activities, regardless of the VRM Class, are required to be mitigated to reduce visual impacts by blending surface facilities with surroundings to the extent feasible (BLM 1986b).

The Project Area is visible from U.S. Highway 191, a major corridor for travelers and tourists through the area. A one-mile corridor allocated as VRM Class II exists around U.S. Highway 191 but does not overlap the Project Area. Existing natural gas facilities are visible within the Project Area from U.S. Highway 191. Other existing oil and gas development effects visible from U.S. Highway 191 include nighttime lights, occasional smoke plumes, and haze events.

The Sublette Cutoff, a branch of the California NHT, travels in an approximate east-west direction directly south of the southern boundary of the Project Area, just below the Sublette/Sweetwater county line with views of the Project Area (Map 8). The North Sublette Meadow Spring Variant, a variant of the Sublette Cutoff, runs east-west through the southern portion of the Project Area en route to and from North Sublette Meadow Spring (Juel Spring), which is immediately adjacent to the southeastern boundary of the Project Area (Map 8). Other sensitive viewing locations in the analysis area include the following (Map 14):

- The Lander Cutoff of the Oregon and California NHTs
- The Wind River Front and Ross Butte MAs
- The Green and New Fork Rivers and Wind River Front SRMAs

3.20 Water Resources

3.20.1 Overview

Surface water and groundwater resources within the Project Area are integrally related to larger water systems that extend well beyond the boundaries of the project area. The analysis area for water resources includes:

- The entire extent of the 15 Hydrologic Unit Code[31] (HUC)-12-digit watersheds that intersect the Project Area, including the surface runoff and channel discharge points identified in Appendix J (*AGWA Technical Report*);
- Aquifers underlying the Project Area and potential migration/transport pathways outside of the Project Area; and,
- Groundwater at the supply wells that will be used for the NPL Project and, that are located outside of and within the Project Area, including the area of influence of these wells.

The Project Area is located on a surface water drainage divide between two sub-basins of the Green River Basin (GRB): the Upper Green River, approximately 5 to 10 miles to the west, and the Big Sandy River, approximately 5 miles to the east. The Project Area overlaps 15 HUC-12 watersheds, which comprise five HUC-10 watersheds as shown on Map 29. All drainages in the Project Area are ephemeral and intermittent, which do not hold surface water year-round, and most streams only flow following snowmelt and precipitation events (WWDC 2014).

[31] *Hydrologic Unit Codes (HUC) are designations for watershed areas with a single flow outlet delineated to nest in a multi-level, hierarchical drainage system. HUC-12 level watersheds represent the finest resolution of delineated watersheds. A HUC-10 watershed contains multiple HUC-12 watersheds.*

Water uses in the analysis area include agriculture, livestock-related uses, and oil and gas development. The primary aquifers in the analysis area are typically low-yielding sequences of thousands of feet of sandstone, shale, and carbonate with interbedded fine-grained confining layers. Most groundwater is under confined (artesian) conditions, resulting in flowing artesian wells in some locations. In some areas, more recent unconsolidated sand and gravel alluvium with varying amounts of less-permeable silts and clays form a surficial aquifer; however, these deposits are mainly limited to areas adjacent to main riverbeds and washes.

Appendix K (*Water Resource Support Appendix*) provides additional targeted information on surface water and groundwater conditions in the analysis area.

3.20.2 Laws, Ordinances, Regulations, and Standards

A combination of state (for applicable actions under state jurisdiction) and federal laws, regulations, and orders governs the use and protection of water resources in the analysis area, as described below.

3.20.2.1 Water Rights

The Wyoming Constitution (Article 8, Section 1) establishes water as state property and indicates, "The water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the state, are hereby declared to be the property of the state." The State Engineer's Office (SEO) is the water rights administrator and is responsible for the appropriation, distribution, and management of the surface water and groundwater throughout the state. A permit from the State Engineer is required to use water in the state of Wyoming. The state of Wyoming issues the following types of permits:

- Appropriation of groundwater and surface water rights for beneficial use
- Transport of water through ditches or pipelines
- Storage of water in reservoirs
- Storage of water in smaller (under 20 acre-feet of capacity and a dam height less than 20 feet) reservoir facilities for stock water or wildlife purposes
- Drilling and completion of water wells and diversions or improvements to springs for water supply
- Enlargements to existing ditches or storage facilities
- Instream flow purposes

Water rights holders are limited to withdrawals necessary for the purpose stated in the water right adjudication and are subject to conditions or limitations stipulated in a water right (Wyoming SEO 2012). Water rights may be obtained for specific beneficial uses including domestic, agricultural, livestock, municipal, industrial, or miscellaneous uses. Miscellaneous use includes temporary water supplies for oil and gas drilling and dust abatement activities.

For water rights purposes, surface water and groundwater are considered hydrologically separate unless a hydrologic connection is found between the two sources. Furthermore, springs producing more than 25 gallons per minute are treated as surface water, and those producing less than 25 gallons per minute are treated as groundwater. The state of Wyoming, through the SEO, issues groundwater rights for the same beneficial uses as surface water rights.

3.20.2.2 BLM Onshore Oil and Gas Order Number 2 and 43 CFR 3160 (Onshore Oil and Gas Operations)

BLM (Onshore Order No. 2) considers any groundwater from fresh (<1,000 mg/l) to moderately saline (<10,000 mg/l) as usable water, which is to be protected. Regulations from 43 CFR Section 3160, specifically 43 CFR 3162.5-2(d), require that the operator shall isolate freshwater-bearing and other usable water containing 5,000 ppm or less of total dissolved solids (TDS) and other mineral-bearing formations and protect them from contamination. Tests and surveys of the effectiveness of such measures must also be conducted by the operator using procedures and practices approved or prescribed by the BLM AO. Fresh water is defined by 43 CFR 3160.0-5 as "water containing not more than 1,000 ppm of TDS, provided that such water does not contain objectionable levels of any constituent that is toxic to animal, plant, or aquatic life, unless otherwise specified in applicable notices or orders".

3.20.2.3 Federal Clean Water Act

The CWA (33 USC 1251 et seq.) is the primary federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. In accordance with the CWA, any discharge of pollutants into the nation's waters is prohibited unless specifically authorized by a permit. Permit review is the CWA's primary regulatory tool. These permits require regular reporting of discharges, making it possible to identify any violations. The applicable sections of the CWA are further discussed below.

3.20.2.3.1 National Pollutant Discharge Elimination System (Section 402)

Section 402 of the CWA establishes the National Pollutant Discharge Elimination System (NPDES) permit program to regulate point source discharges of pollutants into waters of the U.S. The U.S. EPA has authorized the State of Wyoming to assume permitting and enforcement responsibilities under the Wyoming Pollutant Discharge Elimination System (WYPDES) Program. Through this program, point source discharge operators are required to obtain permits, which include limitations and conditions that will assure that the state's surface water quality standards are protected.

3.20.2.3.2 Water Quality Impairments (Section 303)

The CWA requires states to designate uses of surface water and to establish water quality standards to protect those uses. Sections 303(d) and 305(b) of the CWA requires states to provide a list of impaired waters that do not meet, or are expected to not meet, their designated uses or water quality standards. Waters that are impaired by pollutant sources and require the development of total maximum daily loads (TMDLs) are identified in the 303(d) List. TMDLs help reveal the maximum amount of pollutants that can be discharged into a waterway and still achieve applicable water quality standards. The state also uses the TMDLs to allocate the load to point and non-point sources. The WDEQ Water Quality Division (WQD) updates this list every two years and includes it in Wyoming's 305(b) Integrated Water Quality Assessment Report (WDEQ 2014a).

3.20.2.4 Wyoming Water Quality Regulations

Drinking water in Wyoming is regulated under the CWA and responsibilities for implementation are shared by the WDEQ WQD and EPA Region 8. Surface water and groundwater quality are regulated by the WDEQ. WDEQ has designated four major classes of surface water bodies, each with subclasses.

Water quality criteria have been established for fisheries and for drinking water for a variety of priority and non-priority pollutants. Reaches of all main streams within the State of Wyoming have been designated (WDEQ 2013a). Regulations relevant to the NPL Project are summarized below.

3.20.2.4.1 Wyoming Surface Water Quality Standards

The following are the main water classes designated by the WDEQ WQD, along with information on stream ratings in the Project Area. Subcategories of each can be found in Chapter 1 of the Water Quality Rules and Regulations (WDEQ 2013a):

- **Class 1 – Outstanding Waters.** Class 1 waters are surface waters for which no further water quality degradation will be allowed by point source discharges. Nonpoint sources of pollution must be controlled through implementation of appropriate best management practices. Pursuant to Section 7 of these regulations, the water quality and physical and biological integrity that existed in the water at the time of designation will be maintained and protected. In designating Class 1 waters, the Environmental Quality Council shall consider water quality, aesthetic, scenic, recreational, ecological, agricultural, botanical, zoological, municipal, industrial, historical, geological, cultural, archaeological, fish, and wildlife values; the presence of significant quantities of developable water; and other values of present and future benefit to the people. There are no subcategories of Class 1 waters. There are no Class 1 waters in the analysis area.
- **Class 2 – Fisheries and Drinking Water.** Class 2 waters are waters, other than those designated as Class 1, that are known to support fish or drinking water supplies, or where those uses are attainable. Class 2 waters may be perennial, intermittent, or ephemeral and, depending on their characteristics and uses, are designated into five subcategories for protection. Class 2 waters are present in the analysis area, including the Green River (Class 2AB) and the Big Sandy River (Class 2AB) (WDEQ 2013a).
- **Class 3 – Aquatic Life Other than Fish.** Class 3 waters are waters, other than those designated as Class 1, that are intermittent, ephemeral, or isolated waters, and because of natural habitat conditions, lack the potential to support fish populations or spawning. Class 3 waters can also include certain perennial waters that lack the natural water quality to support fish (e.g., geothermal areas). Class 3 waters provide support for invertebrates, amphibians, or other flora and fauna that inhabit waters of the state at some stage of their life cycles. Uses designated for Class 3 waters include aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value. Generally, waters suitable for this classification have wetland characteristics, and such characteristics are a primary indicator used in identifying Class 3 waters. There are four subcategories of Class 3 waters. Class 3 waters are present in the analysis area, including, but not limited to, Alkali Creek (Class 3B).
- **Class 4 – Agriculture, Industry, Recreation and Wildlife.** Class 4 waters are waters, other than those designated as Class 1, where it has been determined aquatic life uses are not attainable pursuant to the provisions of Section 33 of these regulations. Uses designated on Class 4 waters include recreation, wildlife, industry, agriculture, and scenic value. There are three subcategories of Class 4 waters (WDEQ 2013a). Class 4 waters are present in the analysis area.

3.20.2.4.2 Wyoming Groundwater Quality Standards

Groundwater in Wyoming is classified according to the ambient quality of the groundwater as defined by the concentrations of various dissolved constituents provided in the Groundwater Quality Standards

(WDEQ 2015). Classes of groundwater sources in the NPL Project Area are discussed throughout this chapter and in further detail in Appendix K (*Water Resource Support Appendix*). These classes include the following:

- **Class I Groundwater** is suitable for domestic use.
- **Class II Groundwater** is suitable for agricultural (irrigation) use where soil conditions and other factors are adequate.
- **Class III Groundwater** is suitable for stock use.
- **Class Special (A) Groundwater** is suitable for fish and aquatic life.
- **Class IV Groundwater** is suitable for industry use and is further subdivided based on TDS content: Class IV (A) has less than 10,000 mg/L, and Class IV (B) has greater than 10,000 mg/L TDS.
- **Class V Groundwater** has commercial deposits of hydrocarbons or other minerals, or is considered a geothermal resource.
- **Class VI Groundwater** may be unusable or unsuitable for use because of its location (depth), excessive TDS concentration, or technical and economic feasibility of treatment.

3.20.2.5 Salinity Standards/Criteria for the Colorado River Basin

Compliance with Section 303 (a) and (b) of the CWA is required by the 1973 establishment of the Colorado River Basin Salinity Control Forum by the Colorado River Basin states. The State of Wyoming is a member of the Colorado River Basin Salinity Control Forum, which has adopted a salinity control program for the basin. This salinity control program has been adopted as Chapter 6 of the Wyoming Water Quality Rules and Regulations (CRBSCF 2011).

The Colorado River Basin Salinity Control Forum has established water quality criteria relating to concentrations of dissolved salts at select points along the main stem of the Colorado River in the Lower Basin states. Recently, the Forum published its 2014 *Review, Water Quality Standards for Salinity, Colorado River System*, which reaffirmed policies that will affect some existing and future water development activities in Wyoming's GRB (CRBSCF 2011). These policies provide for the following:

- Implementation of the Colorado River Salinity Standards through the NPDES Permit Program. This policy applies to industrial and municipal discharges.
- Use of Brackish and/or Saline Water for Industrial Purposes. This policy applies to industrial water use.
- Implementation of the Colorado River Salinity Standards through the NPDES Permit Program for Intercepted Ground Water. This policy applies to mines and wells that discharge intercepted ground water.
- Implementation of the Colorado River Salinity Standards through the NPDES Permit Program for Fish Hatcheries. This policy applies to discharges from fish hatcheries (CRBSCF 2011).

3.20.2.6 SDWA and Underground Injection Program

As part of the SDWA, the EPA regulates injection of fluids into the subsurface through the Underground Injection Control Program. The EPA has delegated the authority for the Underground Injection Control Program to the State of Wyoming through the WDEQ and Wyoming Oil and Gas Conservation Commission (WOGCC). There are currently six classifications of underground injection wells. Wells used to inject produced waste fluids associated with oil and gas production by individual operators are categorized as Class II injection wells and are regulated by the WOGCC. Class I commercial disposal wells, which accept and dispose of oil and gas production waste fluids from outside oil and gas operators are regulated by WDEQ-WQD. Most of the formation fluids injected by Class II wells is salt water (brine), which is brought to the surface from the production of oil and natural gas. In addition, brine and other fluids are injected to enhance oil and gas production. There are approximately 144,000 Class II wells in operation in the United States that inject over 2 billion gallons of formation fluids every day (EPA 2012c). Class II wells are anticipated to be used in development of the NPL Project for disposal of oilfield waste. Class II wells can also be used for enhanced oil recovery, as described below, though this use is currently not proposed for the NPL Project.

- **Disposal of Oilfield Waste.** These wells inject brines and other fluids associated with the production of oil and natural gas or natural gas storage operations. When oil and gas are produced, brine is also brought to the surface. The brine is separated from the oil and is then injected into the same underground formation or a similar formation. Class II disposal wells can only be used to dispose of fluids associated with oil and gas production in zones that are not USDWs.
- **Enhanced Oil and Gas Recovery.** Wells used for this purpose inject brine, water, steam, polymers, or carbon dioxide into oil-bearing formations to recover residual oil and, in some limited applications, natural gas. This is also known as secondary or tertiary recovery. The injected fluid thins (decreases the viscosity) or displaces extractable oil and gas, which are then available for recovery.

3.20.2.7 Regulations for Release of Oil and Hazardous Substances into Waters of the State of Wyoming

Regulations for release of oil and hazardous substances govern non-permitted discharges that may pose a threat to public health or welfare, or aquatic life or wildlife due to quantity, concentration, hazardous characteristics, or radioactivity. Regulated substances include crude oil and condensates, fuels, lubricants, waste oils, and mixtures with non-hazardous wastes. In particular, Chapter 4 of the WDEQ (2013b) Water Quality Rules and Regulations requires that the WDEQ be notified of spills or releases of chemicals and petroleum products. Further, any impacts to soils, groundwater or surface water must be addressed. Refer to Section 3.7 (*Hazardous Materials and Solid Waste*) for more information.

3.20.3 Physical Setting

The Project Area is located in the GRB, a structural basin resulting from several tectonic events. The Project Area topography follows the undulations of the underlying Precambrian basement rock, and is characterized by low rolling hills interspersed with buttes, rock outcrops, large draws, and deep canyons (WSGS 2010). The Project Area consists primarily of shrub-steppe habitat, dominated by Wyoming big sagebrush and grasses.

The Project Area lies in a semi-arid, cold desert climate and is dotted with ephemeral washes and playas (Trihydro 2011). Precipitation in the Project Area is representative of a high desert region and the area generally receives between approximately 7 and 11 inches of precipitation annually. Monthly precipitation ranges from around 0.2 to 1.7 inches (Table 3-56). The highest precipitation rates occur in May through September, although average amounts of rainfall are generally very low and consistent throughout the year. The area is subject to short, intense storms, which have resulted in the incised topography. In this type of arid environment, the majority of precipitation would runoff though the ephemeral washes that cross the landscape. Between 1999 and 2007, the GRB experienced an overall decrease in average annual precipitation (Bartos and Hallberg 2010). In 2012 and 2013, significant areas of Wyoming were under drought conditions (see Section 4.2.4 – *Depth to Groundwater* in Appendix K, *Water Resource Support Appendix*).

Precipitation throughout the GRB is greatly influenced by topography, with higher amounts of rain and snowfall in mountainous areas surrounding the basin. The majority of water in the Project Area comes from precipitation and snowmelt from the mountains. The highest rates of runoff are anticipated in the spring, with little to no flow in the late summer season, and some flow beginning during the winter when evaporation rates are reduced with the cooler weather. Due to the arid climate, evaporation potential is approximately four times higher than annual precipitation (Geomatrix 2008). Given the low precipitation and high evaporation rates, little water is available for surface water runoff or infiltration through soils for groundwater recharge. Most groundwater recharge occurs through surface infiltration at the base of mountains along the perimeter of the basin.

Table 3-56. Average Monthly Precipitation for Towns near the Project Area

	Average Monthly Precipitation (inches)												Average Annual Precipitation (inches)
	January	February	March	April	May	June	July	August	September	October	November	December	
Big Piney, WY[1]	0.31	0.35	0.43	0.51	0.83	0.79	0.71	0.71	0.79	0.51	0.20	0.31	6.45
Pinedale, WY[2]	0.59	0.59	0.75	0.94	1.69	1.22	1.02	1.02	1.30	0.83	0.71	0.71	11.37
Farson, WY[3]	0.35	0.31	0.51	0.75	1.42	0.87	1.02	0.67	0.94	0.67	0.39	0.35	8.25

[1]US Climate Data 2015a
[2]US Climate Data 2015b
[3]US Climate Data 2015c

WY Wyoming

3.20.4 Surface Water

Due to the low amount of precipitation or runoff there are no permanent surface water features in the Project Area and drainage occurs mainly through ephemeral streams that receive runoff during spring snowmelt and rare storm events. Snowmelt from highlands surrounding the GRB watershed is the primary source of water to the basin. The meltwater drains off the mountain bases around the edges of the basin; however, the Project Area is located in the interior of the basin on a topographical divide between the Upper Green River and the Big Sandy River and does not receive much melt water.

Four groundwater springs are known to exist within the analysis area: two unnamed springs within the Project Area, and two named springs, the North Sublette Meadow Spring and Juel Spring, located outside the Project Area boundary (Map 29). The two unnamed springs within the Project Area are located in the Lower Alkali Creek and Long Draw watersheds of the Project Area, while the North Sublette Meadow Spring and Juel Spring are located just east of the Project Area boundary in the Jonah Gulch watershed. Although these springs express groundwater to the surface, the source of the water and the contribution area has not been identified. None produce perennial surface flows that reach other surface waters. Field observation has indicated the presence of several shallow seeps and springs in the Teakettle Dune Field Area (Drucker 2016); however, these areas have not been mapped. The characteristics and water quality of springs are discussed in Section 3.20.5.8 (*Groundwater Quality*) below and in Appendix K (*Water Resource Support Appendix*), where data are available.

According to the 2011 Groundwater Characterization report for the NPL Project (Trihydro 2011), the North Sublette Meadow Spring is assumed to be sourced by an alluvial aquifer due to its presence within a drainage. Water quality samples from 2011 and 2013 for the North Sublette Meadow Spring indicated the presence of total petroleum hydrocarbons diesel range organics and oil range organics, as well as high levels of bacteria (Trihydro 2011, 2013). The high levels of bacteria in the North Sublette Meadow Spring is assumed to be the result of its use as a stock watering pond for cattle (Trihydro 2011). Refer to Attachments B and C in Appendix K (Water Resource Support *Appendix*) for more information on water quality results from the North Sublette Meadow Springs well (well reference #45). This information represents the best available existing information for water quality in springs, additional information may be collected prior to and during development, as appropriate.

Fifteen HUC-12 watersheds intersect the Project Area and contribute to five HUC-10 watersheds in the analysis area: Alkali Creek, Eighteenmile Canyon, Green River, Sublette Flat, and Upper Big Sandy Watersheds (Map 29). In general, watersheds overlapping the western portion of the Project Area drain to tributaries of the Green River, while those overlapping the eastern portion of the Project Area drain towards the Big Sandy River, which ultimately discharges to the Green River approximately 28 miles south of the Project Area. The extent to which each of the HUC-10 and their contributing HUC-12 watersheds overlap the Project Area is presented in Table 3-57.

Table 3-57. Watersheds and Acreages in the Project Area

Watershed	Total Watershed Acreage	Acreage within Project Area	Percent of Project Area in Watershed	Percent of Watershed in the Project Area
Alkali Creek (HUC 1404010106)	103,985	48,739	34.60%	46.87%
Granite Reservoir (HUC 140401010603)	12,212	8,626	6.12%	70.64%
Lower Alkali Creek (HUC 140401010605)	26,132	16,269	11.55%	62.26%
North Alkali Draw (HUC 140401010604)	15,911	652	0.46%	4.10%
Sand Draw Reservoir Number 4 (HUC 140401010601)	22,932	190	0.13%	0.83%
Upper Alkali Creek (HUC 140401010602)	26,798	23,002	16.33%	85.84%
Eighteenmile Canyon (HUC 1404010303)	211,311	35,025	24.86%	16.57%
Lower West Buckhorn Draw (HUC 140401030303)	19,292	249	0.18%	1.29%
Upper Eighteenmile Canyon (HUC 140401030301)	35,213	23,170	16.45%	65.80%
Upper West Buckhorn Draw (HUC 140401030302)	21,746	11,605	8.24%	53.37%
Birch Creek-Green River (HUC 1401040111)	233,326	5,601	3.98%	2.40%
Chapel Canyon (HUC 140401011106)	14,357	2,036	1.45%	14.18%
Reardon Draw (HUC 14041011105)	12,363	3,453	2.45%	27.93%
Spring Creek-Green River (HUC 140401011104)	30,117	112	0.08%	0.37%
Sublettes Flat (HUC 1404010404)	151,074	45,172	32.07%	29.90%
Jonah Gulch (HUC 140401040401)	22,652	14,081	10.00%	62.16%

Table 3-57. Watersheds and Acreages in the Project Area

Watershed	Total Watershed Acreage	Acreage within Project Area	Percent of Project Area in Watershed	Percent of Watershed in the Project Area
Little Colorado Well No 9 (HUC 140401040403)	41,997	13,637	9.68%	32.47%
Teakettle Butte (HUC 140401040402)	24,559	17,454	12.39%	71.07%
Upper Big Sandy River (HUC 1404010401)	247,889	6,322	4.49%	2.55%
Long Draw (HUC 140401040108)	18,522	6,273	4.45%	33.87%
Bull Draw-Big Sandy River (140401040109)	19,761	49	0.03%	0.25%

Source: USGS 2015e.

HUC Hydrologic Unit Code

3.20.4.1 Surface Water Quality

Although limited available data on ephemeral stream water quality are available for southwestern Wyoming, surface water quality can be both spatially and temporally variable in the arid high plains. No surface water quality data from within the Project Area were identified; however, general surface water quality can be inferred from the receiving perennial waters of the drainage area, which are the Green and Big Sandy Rivers. During a record search, no spills that had contacted the surface water, that would have been reportable to the BLM, were found. If a spill did occur, it would be required to be cleaned to WDEQ standards. The quality of runoff is largely dependent upon the amount of salts, sediments, and organic materials that accumulate in dry stream channels during periods of runoff. The degree to which these materials build up between runoff events is influenced seasonally by physical characteristics of the soils (described in Section 3.15 – *Soil Resources*) and land uses occurring within the watershed. The Green and Big Sandy Rivers experience the highest flows during spring snowmelt, and in the summer following thunderstorm events. The average monthly discharge of the Green River and the Big Sandy River are identified in Table 3-58.

The Green and Big Sandy River are classified by the WDEQ WQD as Class 2AB water-bodies (WDEQ 2013a), which are known to support game fish populations or spawning and nursery areas at least seasonally and are protected for nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value uses (WDEQ 2013a). Neither the Big Sandy River nor the Green River appears on the State 303(d) list of impaired waters, and neither have existing TMDLs (WDEQ 2014a).

In general, TDS is a water quality concern in the GRB and in the larger context of the Colorado River drainage area. However, TDS measurements for the Green River are relatively low (500 mg/L), although high TDS values (up to 3,000 mg/L) have been reported in downstream reaches of the Big Sandy River (Wyoming Water Development Office 2012). Surface water quality is generally better near the mountain ranges than in the lowlands. As runoff flows downstream from mountain ranges and over alkali soils in the basin flatlands, dissolved solids are accumulated and are transported downstream. Additional sources of dissolved solids may include agricultural runoff and other human activities.

The Green River is the largest tributary to the Colorado River, and is part of the Colorado River Compact of 1922. The Colorado River Basin Salinity Control Program monitors and controls salinity in the Green

River. The Wyoming portion of the Green River has few salinity issues. Salinity in the Green River generally results from agricultural irrigation runoff, and measures to control salinity from this source have been implemented in the Big Sandy subbasin (WDEQ 2014a). In addition to agricultural runoff, the USGS began monitoring energy development runoff in 1999 in response to concerns that energy development may increase TDS concentrations in the Colorado River Basin. The USGS report did not draw conclusions regarding temporal trends or the impacts from energy development, but did note that TDS concentrations ranged from 187 to 594 mg/L in samples collected from the Green River during water years 1999–2008 (USGS 2009).

Table 3-58. Average Monthly Discharge of Perennial Rivers near the Project Area

	Average Monthly Discharge (cfs)											
	January	February	March	April	May	June	July	August	September	October	November	December
Big Sandy River near Farson, WY[1]	11	12	22	60	233	405	171	47	30	30	21	13
Green River near LaBarge, WY[2]	450	478	718	1,340	2,690	5,360	3,280	1,330	821	793	707	511

[1]Data ranges from 1914 to 2014. Discharge data for the months of October-March are not included for the years 1972-2011 due to sampling restrictions, and discharge data are unavailable for November-March for the years 2012-2013, and October-February for the year 2014. (USGS 2015a).
[2]Data ranges from 1963 to 2014. Discharge data include only the months of October-December for the year 1963 and January-October for the year 2014 (USGS 2015b).

cfs cubic feet per second

3.20.4.2 Proper Functioning Condition

The proper functioning condition (PFC) assessment is a method for assessing hydrology, vegetation, and erosion/deposition attributes to determine the condition of riparian and/or wetland areas along a stream reach at a point in time (Dickard et al. 2015). The PFC assessment is qualitative and is based on a checklist to make a relatively quick determination of condition. Following completion of the assessment, the stream segment is placed in one of the following categories:

- **PFC:** A lotic riparian area is considered to be in PFC, or “functioning properly” when adequate vegetation, landform, or large woody material is present to dissipate stream energy, filter sediment, capture bedload, maintain channel characteristic, stabilize streambanks against erosion, improve floodwater retention, and aid floodplain development.
- **Functional – At Risk (FAR):** Riparian areas that are in functional condition, but an existing landform, water, or vegetation attribute makes them susceptible to degradation.
- **Nonfunctional (NF):** Riparian areas that clearly are not providing adequate vegetation, landform, or large woody material to dissipate stream energy associated with high flows, and thus are not reducing erosion, improving water quality, etc.

The BLM has performed PFC assessments for portions of two waterbodies in the analysis area: Alkali Creek and the Big Sandy River (Map 30). In 1998 and 2001, a total of approximately 5.5 miles of Alkali Creek were assessed in Sections 32 and 33 of T30N, R110W. All 5.5 miles of Alkali Creek assessed were determined to be FAR due to poor riparian vegetation cover, excessive erosion, and headcutting. Between 1994 and 2010, approximately 51 miles of the Big Sandy River were assessed using the PFC methodology; some of the assessed segments were located adjacent to the NPL Project Area (Map 30). The majority (approximately 28.5 miles) of the segments assessed for the Big Sandy River were determined to be in PFC, with approximately 18.8 miles FAR and another 3.8 miles unrated. Portions of the Big Sandy River adjacent to the NPL Project Area rated FAR exhibited high width to depth ratios, narrowing riparian vegetation cover, bank instability and high sedimentation rates at the time of the assessments.

3.20.4.3 Automated Geospatial Watershed Assessment Modeling

The Automated Geospatial Watershed Assessment (AGWA) tool is a GIS interface that automates the Soil Water Assessment Tool (SWAT) and the KINematic Runoff and EROSion (KINEROS2) to facilitate hydrologic modeling and watershed assessments at multiple temporal and spatial scales. The BLM chose the AGWA tool for the hydrologic modeling of the NPL Project because it was designed to assess the trends and magnitudes of hydrologic changes associated with surface disturbance activities, such as oil and gas development, especially in regions with limited runoff and climate data. Additionally, the AGWA tool can identify areas that are susceptible to changes in land cover, surface-disturbing activities, and/or climate.

The *AGWA Technical Report* (Appendix J) identified 435 miles of stream channels within eight Watershed Modeling Units, encompassing all of the Project Area and portions of all 15 HUC-12 watersheds comprising the water resources analysis area. Approximately 197 miles of these stream channels are represented by ephemeral drainages within the Project Area. Hydrologic response to large rainfall events were modeled for four land cover change scenarios that address the range of alternatives for the project over a 10-year period. The results of the scenarios were used to assess potential changes to surface runoff and channel discharge resulting from the NPL Project. Appendix J (*AGWA Technical Report*) provides a detailed description of the methods and models used for the AGWA analysis.

According to the AGWA analysis, most of the Project Area is generally flat, and channel discharge is categorized as very low to low under pre-development conditions. Pre-development conditions represent conditions in existence prior to any surface disturbances and are exclusive of existing oil and natural gas development in the analysis area. Areas susceptible to minimal effects of surface runoff and channel discharge in the pre-development setting occur in the Upper-West Buckhorn Draw, Teakettle Butte, Jonah Gulch, and Long Draw Watersheds. Areas that show moderate to high effects to surface runoff and channel discharge under pre-development conditions occur in portions of the Lower Alkali Creek, Chapel Canyon, Spring Creek – Green River, Reardon Draw, Jonah Gulch, Long Draw, and Little Colorado Watersheds.

In general, areas of watersheds showing minimal impact ratings for channel discharge consist of eolian deposits and slope alluvium from weathered sandstone and shale escarpments with slopes greater than or equal to 15 percent along stream channels. Areas within watersheds showing moderate to high impact ratings for channel discharge consist of badlands and weathered shale escarpments with slopes of 20 to 100 percent along stream channels.

The present (existing conditions) analysis contained in Appendix J (*AGWA Technical Report*) includes disturbances associated with the JIDPA and all natural gas wells drilled and developed in the Project Area. Present conditions represent the baseline from which all channel discharge impacts are analyzed for the analysis area. Table 3-59 presents the channel discharge analysis categories used in the AGWA analysis and summarizes the total mileage of stream channels within each impact category under existing conditions.

Table 3-59. Channel Discharge Categories and Miles of Stream Channel

Impact Category	Miles per Impact Category within the AGWA Analysis Area (All Watersheds)	
	Water Yield (cfs)	***Total (miles)***
1 – Very Low	0.00 – 0.03	314.15
2 – Low	0.03 – 0.07	61.48
3 – Minimal	0.07 – 0.13	36.59
4 – Moderate	0.13 – 0.27	9.90
5 – High	0.27 – 0.61	12.96
Total Miles		**435.08**

Source: Appendix J (*AGWA Technical Report*).

cfs cubic feet per second

3.20.5 Groundwater

The sections below provide a summary of existing groundwater conditions in the analysis area. Refer to Appendix K (*Water Resource Support Appendix*) for additional information on the existing condition of groundwater resources in the analysis area, including supporting figures, data tables, and other information.

3.20.5.1 Regional Hydrogeology

Topography in the Greater GRB follows undulations of the underlying Precambrian basement, which was folded and faulted from compressive stress beginning in the Jurassic period, approximately 140 million years ago. Parts of the basin were downwarped into structural lows, and other areas were upwarped into mountains, uplifts, structural arches, and ridges. The higher features were eroded over time, depositing thousands of feet of sediment within the basins. These thick sequences of shale, carbonate rock, and sandstone contain the primary aquifers for the area. In some areas, more recent unconsolidated sand and gravel alluvium with varying amounts of less permeable silts and clays form a surficial aquifer; however, these deposits are mainly limited to areas adjacent to the main riverbeds and washes. The structural GRB is a smaller basin that resides within the Greater GRB and was formed during the Laramide and Sevier orogenies, when regional compressive stresses folded and faulted the Precambrian Basin (Trihydro 2011). Similarly, groundwater conditions are highly variable in the Upper Green River Watershed due to variable geologic and hydrogeologic conditions (see WWDC 2014 for more information on the Upper Green Watershed conditions). Refer to Section 3.6 (*Geology and Mineral Resources*) for more information on subsurface geology in the analysis area.

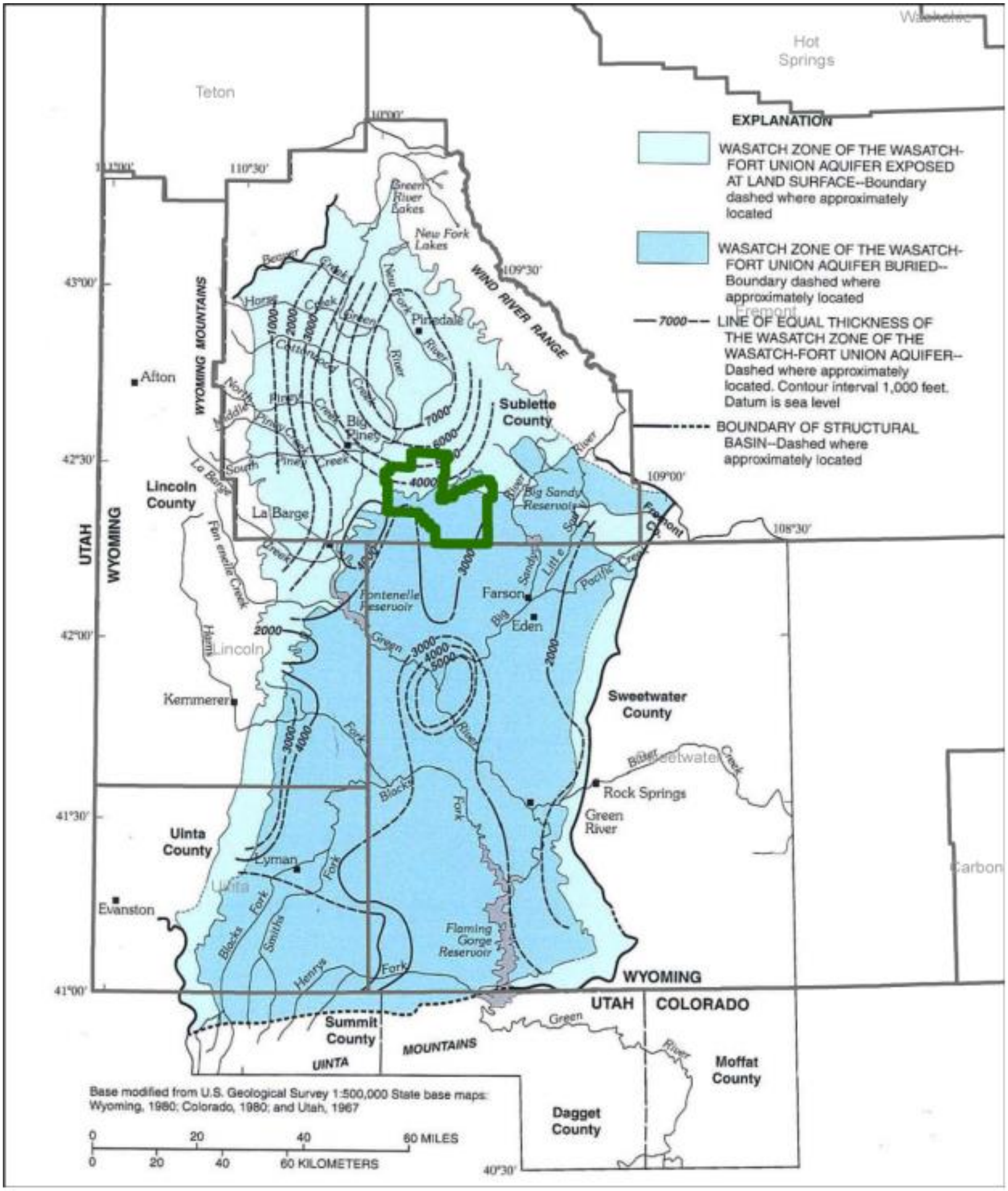
The Cenozoic age hydrogeologic units are the most heavily used of the four major hydrogeologic divisions of the region (Bartos and Hallberg 2010). The Cenozoic hydrogeologic units are subdivided into Quaternary, upper Tertiary, and Lower Tertiary hydrogeologic units, with the sedimentary rocks of the Tertiary units having the most abundant and widely used shallow aquifers in the GRB (Bartos and Hallberg 2010). Interfingered members and tongues of the Green River, Wasatch, and Bridger Formations compose the Green River Basin Lower Tertiary Aquifer system. The main aquifer in the analysis area for stock, agriculture, and potable use lies within the Wasatch Formation (Bartos and Hallberg 2010). The upper Laney Member of the Green River Formation contains interbedded and permeable sandstone beds that form an aquifer south and east of the Project Area. The sandstone beds of the Wasatch Formation form aquifers in the central basin areas, while the Fort Union sandstone beds are major aquifers around the basin margins (Bartos and Hallberg 2010). Approximately 10,000 to 15,000 feet of Mesozoic age rock underlie the Lower Tertiary aquifers. This sequence includes interbedded sandstone and confining shale units.

More recent alluvial deposits form localized saturated zones and are mainly limited to areas in the bottomlands along the Green River on the west side and the Big Sandy River on the east side of the Project Area. Discontinuous alluvial aquifers exist to a limited extent in the floors of intermittent stream valleys in the Tea Kettle Butte Watershed located at the eastern portion of the Project Area (Map 29) (Bartos and Hallberg 2010). Additional information on the regional hydrogeology of the GRB is provided in Appendix K (*Water Resource Support Appendix*). Refer to Section 3.20.4 (*Surface Water*) for more information on surface water features in the analysis area and refer to Section 3.18.2 (*Riparian and Wetland Communities*) for more information on wetlands and riparian habitat in the Project Area.

The major water-bearing units underlying the analysis area include the alluvial aquifer and the Tertiary aquifer systems. The alluvial aquifers are confined to areas along the Green River to the west and the Big Sandy River to the east of the Project Area (Trihydro 2011). The Wasatch and Fort Union Aquifers (units of the tertiary aquifer system) underlie all of the Project Area (Figure 3-22). The Laney Member of the Green River Formation is present in the central and southern portion of the Project Area. The sections below describe the aquifers and target zones in the analysis area that could be affected by the NPL Project. Information presented in the sections below comes primarily from the Wyoming Water Development Commission and Wyoming State Geological Survey (Bartos and Hallberg 2010; Clarey 2010; Clarey and Copeland 2010; Clarey and Thompson 2010; WSGS 2010) and are generalized in nature. The Wasatch and Fort Union Formations have been designated as a single aquifer unit by the USGS (Martin 1996) and Wyoming Water Development Commission (Clarey 2010), but are hydrologically described as separate zones within the aquifer. In this assessment, the broader terminology of the Wasatch Aquifer and Fort Union Aquifer are used and reflect the Wasatch Zone and Fort Union Zone of the Wasatch-Fort Union Aquifer. These sources represent the best readily available existing information, which is regional in nature and not specific to the NPL Project Area.

Additional information for the hydrogeology of the analysis area is provided in Appendix K (*Water Resource Support Appendix*). A cross-section of the formations described below is included in Section 3.6, *Geology and Mineral Resources* (Figure 3-17), and in Figure K-4 in Appendix K (*Water Resource Support Appendix*).

Figure 3-22. Wasatch Aquifer – Areal Extent and Thickness (including Project Area)



Source: Bartos and Hallberg 2010.

3.20.5.1.1 Laney Aquifer

The Laney Member of the Lower Tertiary Green River Formation was mapped by Winterfeld (2011) in the central, southern, and eastern parts of the Project Area (Map 9). The Laney Aquifer is thickest in the southern portions of the GRB, thinning out to less than 200 feet thick in the Project Area, and transitioning to the Wasatch Formation discussed below (Bartos and Hallberg 2010). Where the Laney Aquifer occurs at depth and is fractured and saturated, it is used as a groundwater source, typically under confined conditions. The Laney Member is known to contain oil shales, which contain solid organic matter but no free oil. Within the Project Area, the Laney is not fractured and is not considered an important water-bearing zone, although a few stock wells draw from the aquifer (see Attachment B in Appendix K for existing available information for water supply wells in and around the Project Area). A wide range of hydraulic conductivity and well yield has been estimated based on modeling and field measurements (Table 3-60). The Laney Aquifer discharges primarily to Big Sandy and Green Rivers.

Table 3-60. Hydraulic Characteristics of the Lower Tertiary Aquifers

Hydrogeologic Unit	Range of Hydraulic Conductivity (feet per day)			Well Yields (gpm)
	Simulated		Measured	Measured
	Vertical	*Horizontal*	*Horizontal*	
Laney Aquifer	0.00001	0.04 – 17.3	2 – 1,400	2 – 2,250 (median = 17)
Wasatch Aquifer	0.001 – 4	0.04 – 6.5	0.03 – 2,100	2 – 302 (median = 20)
Fort Union Aquifer	0.00001 – 0.01	0.00001 – 0.3	0.02 – 1,100	5 (only one measurement)

Source: Bartos and Hallberg 2010.

gpm gallons per minute

3.20.5.1.2 Wasatch Aquifer

The Wasatch Aquifer is the main source of groundwater in the region, and the majority of water wells that would be used for the NPL Project would draw water from this formation. Wasatch strata are present at ground surface (i.e., outcrops) in the northernmost, westernmost, and northeasternmost portions of the NPL Project Area (Map 9) (Winterfeld 2011) and are buried in the southern portions of the NPL Project Area, as shown on Figure 3-22 (Bartos and Hallberg 2010). The Wasatch Formation is a sequence of a fluvial sandy shale and siltstone with few channel sands and coal deposits. The sandstone lenses are spatially limited and are generally not able to be correlated between two adjacent wells. The hydraulic characteristics of the Wasatch Aquifer reported by Bartos and Hallberg (2010) for a broad area of the GRB indicate large variations in groundwater flows and well yields, representing the heterogeneity of the aquifer (Table 3-60) (Bartos and Hallberg 2010). Variations in hydraulic conductivity within the Wasatch were observed in studies at the Pinedale Anticline Project Area (PAPA) (AMEC 2013a) and the JIDPA (HydroGeo 2004). The range of hydraulic conductivity values for the Wasatch Aquifer reported by Bartos and Hallberg (2010) is consistent with the results used for the PAPA and JIDPA numerical models and is expected to be representative of the Wasatch in the NPL Project Area. The hydraulic conductivity decreases in the deeper portion of the Wasatch due to an increased amount of silt and clay and fewer permeable sand lenses (AMEC 2013a). Water for livestock and potable uses is drawn from the shallower depths of the formation because water quality generally decreases with depth.

3.20.5.1.3 Fort Union Aquifer

Throughout the analysis area, the Fort Union Formation underlies the Wasatch Formation and is mainly composed of fluvial sandstones, sandy shales, and siltstones interbedded with channel sands, lignite, and coal. The Fort Union Formation is approximately 4,000 feet thick and is not exposed at the surface in the analysis area. Estimates of hydraulic characteristics of the Fort Union Aquifer were developed based on both field data within the GRB and a basin scale groundwater model simulation (Martin 1996) and are not specific to the NPL Project Area. There is no information at this time on transmissivity specific to the NPL Project Area. As indicated in Table 3-60, estimates of hydraulic characteristics vary widely due to the heterogeneity of the lithology, and the simulated hydraulic conductivities derived for the Fort Union Aquifer are orders of magnitude lower than those of the Wasatch Aquifer. There are very few wells that draw from the aquifer, and only one value of five gallons per minute (flowing) is reported for the Fort Union (Bartos and Hallberg 2010).

3.20.5.1.4 Mesaverde Aquifer

The Mesaverde Aquifer is continuous with and considered part of the Lower Tertiary Aquifer system, although it is stratigraphically below the Lower Tertiary and is Mesozoic age (Cretaceous). The aquifer includes the Lance-Fox Hills Aquifer, the Lewis Confining Unit, and the Mesaverde Aquifer. It is underlain by the Baxer-Mowry Confining Unit, which is 5,000 to 12,000 feet thick in the GRB (Bartos and Hallberg 2010). The saturated thickness of the Mesaverde Aquifer is over 2,000 feet thick in the Project Area. The Mesaverde aquifer is below the Lance Pool and could be a potential source of produced formation fluids if wells are completed below the Lance Pool.

3.20.5.2 Groundwater Flow

The NPL Project Area is in the northwestern part of the GRB, and regional groundwater flows from the northern basin margins, where recharge occurs, southward to the center of the basin. Groundwater flow estimated from a potentiometric contour map of the lower Tertiary Aquifer (equivalent to the Wasatch Aquifer in the NPL Project Area) (USGS 2015c) indicates that groundwater flows mainly from the highlands of the Wind River Range, northeast of the analysis area, towards the west-southwest to the Green River (Figure 3-23). Based on regional flow patterns, it is likely that a portion of groundwater flows through the PAPA and JIDPA before entering the NPL Project Area. There is also a component of flow directed towards the Big Sandy River to the southeast. Locally within the Project Area, the direction of groundwater flow may differ from regional flow due to the heterogeneity of the rocks and the fluvial nature of the channel sand deposits within the Wasatch and Fort Union Formations. The potentiometric map and groundwater flow presented in this section represent the best available existing information as no NPL Project Area specific groundwater flow data have been collected at the time of this report.

Figure 3-23. Potentiometric Surface of the Lower Tertiary Aquifer System

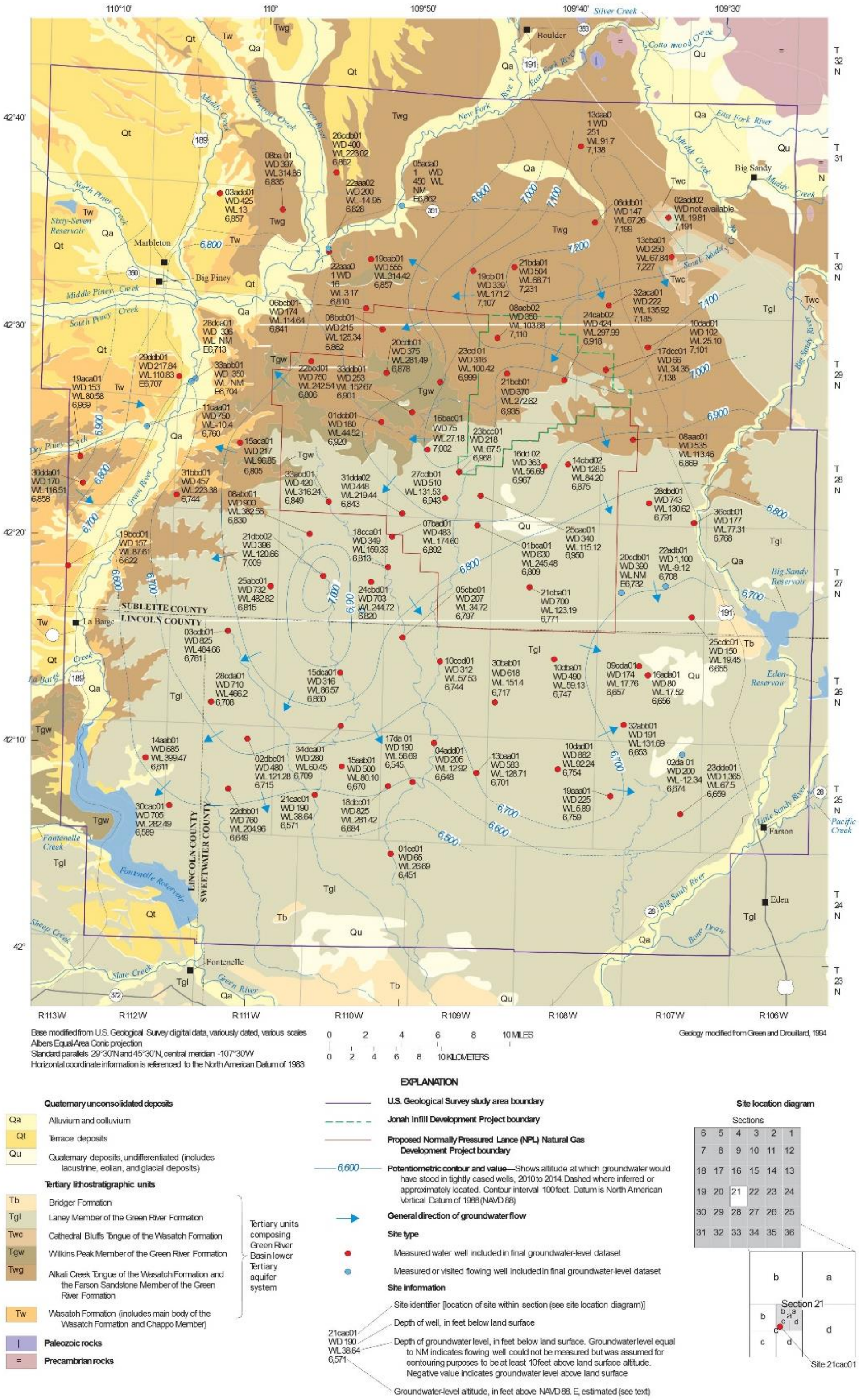


Figure 10. Generalized potentiometric surface of the Green River Basin lower Tertiary aquifer system, 2010–14, northern Green River structural basin, Wyoming.

Source: USGS 2015c.

3.20.5.3 Depth to Groundwater

Groundwater is typically under confined (artesian) conditions in the GRB and NPL analysis area, and although groundwater may occur at great depth, the potentiometric surface of the water under pressure is often near ground surface. In the surficial aquifer, and where the saturated Tertiary Aquifer beds occur at shallow depth, groundwater may be unconfined (Bartos and Hallberg 2010). In general, the groundwater depths in both confined and unconfined wells in the GRB are within 200 feet of ground surface (Bartos and Hallberg 2010, USGS 2015c). Map 31 identifies three flowing artesian wells in the Project Area that have been drilled into the aquifer where the pressure causes the groundwater to naturally rise to the surface without the use of pumps (American Geosciences Institute 2005). Non-flowing artesian wells are wells where the water is under enough natural pressure to rise above the top of the aquifer but may not reach the surface.

In general, the depths to groundwater can be inferred to be approximately 50 to 100 feet below ground surface in the northwest portion of the Project Area and 100 to 200 feet below surface in the remaining parts of the Project Area (Hamerlinck and Arneson 1998). A small area near Tea Kettle Butte is mapped as having groundwater between 10 and 50 feet below ground surface. Well measurements taken south of the Project Area boundary, as part of the operator's 2011-2013 annual sampling and analysis programs, showed a range of depths from 9 to 485 feet bgs, indicating that depth to groundwater may be greater in the southern portion of the Project Area (Trihydro 2011, 2013, 2014a). Depth to water measurements made by USGS between 2010 and 2014 show a similar depth range (USGS 2015c).

3.20.5.4 Sources of Groundwater Recharge and Discharge

Groundwater recharge is the amount of water falling as precipitation that percolates into and through the soil and underlying rock to eventually migrate into the aquifer. Recharge is determined by precipitation, permeability of the surface and subsurface formations, the vertical hydraulic conductivity, the depth of the aquifer, and the access of the aquifer to surface infiltration (i.e., if there is a confining layer between the ground surface and the aquifer). In addition, evaporation at the ground surface in dry climates and surface vegetation uptake (transpiration) can remove water from soils resulting in low or negative recharge rates. In the analysis area, recharge rates range from five inches per year to negative values due to low precipitation and high evaporation (Clarey and Copeland 2010; WWC Engineering et al. 2010). Within the Project Area only the Tea Kettle Butte area shows a positive recharge value of less than one inch per year. This is likely due to the permeable surface soils in the area. Refer to Figure K-14 in Appendix K (*Water Resource Support Appendix*) for a map that depicts net recharge amounts in the analysis area.

The Laney Member has a gradational contact within the upper part of the Wasatch Formation, and groundwater moving south in the Wasatch freely moves across the boundary and may be a source of recharge for the Laney Aquifer in the southern part of the NPL Project Area (Martin 1996). A minor amount of discharge from the Laney may occur from wells and springs whose source is the Laney, but most discharge is to the Big Sandy and Green Rivers outside of the Project Area (Map 31) (Bartos and Hallberg 2010).

The primary source of recharge to the Wasatch Aquifer is from areas on the flanks of the aquifer, in particular the foothills of the Wind River Range to the northeast and the Wyoming Range to the northwest, which receive snowmelt and precipitation from the mountains (HydroGeo 2004) (Figure K-14 in Appendix K). The greatest amount of discharge from the lower Tertiary Aquifer system, including the Wasatch and Fort Union Aquifers, is to the Green and New Fork Rivers upstream of the Fontenelle Reservoir, which is west-southwest of the Project Area (Clarey and Copeland 2010). As shown in Figure

K-14 (Appendix K) net recharge is near zero throughout most of the Project Area and is not expected to provide significant input to the aquifer. However, the permeable area near Tea Kettle Butte comprises approximately 5.7 square miles, and, assuming one percent of the recharge reaches the aquifer, the Wasatch receives approximately 27 acre-feet of recharge per year.

3.20.5.5 Aquifer Sensitivity

The sensitivity of aquifers to contamination from surficial sources is influenced by precipitation, the permeability of surficial materials, and depth to groundwater. Aquifer sensitivity in the GRB was evaluated by Clarey and Copeland (2010) based on initial models for Wyoming developed by Hamerlinck and Arneson (1998) and is depicted on Map 34. The majority of the Project Area is mapped as being not highly sensitive to contamination at the surface, primarily due to low precipitation, impermeable surface soils and rock, and depth to groundwater. The surficial alluvial aquifer mapped in the Tea Kettle Butte Watershed has relatively high sensitivity to contamination at the surface due to the permeable nature of the surficial soils (Map 34). The aquifer sensitivity is high outside the NPL Project Area near the Green and Big Sandy Rivers, where the aquifers are shallower and sand and gravel alluvium are at the surface (Map 34).

WDEQ, in association with the USGS and the University of Wyoming, identified 33 priority areas for monitoring in six geologic basins in Wyoming including two areas within the GRB near Pinedale and Big Piney (Bedessem et al. 2005). Within the NPL Project Area and the JIDPA, no aquifers were identified as high priority for groundwater monitoring (Map 35). The nearest high priority aquifers for monitoring are within the Green River Valley near Big Piney and the northern portion of the PAPA (Map 35). Both areas are approximately six miles from the NPL Project Area.

To assist with the identification and mitigation of point source pollution related to activities from oil and gas development, the BLM Pinedale Field Office Approved Resource Management Plan and ROD (BLM 2008) includes management requiring groundwater monitoring programs in areas designated as high and moderately high priority by WDEQ.

3.20.5.6 Groundwater Use

Public water supplies in Wyoming are primarily from groundwater sources. In 2007, the EPA reported that of the 768 active public water supply systems in Wyoming, 84 percent received their water from groundwater (EPA 2014a). The municipal well closest to the Project Area is located in Big Piney, approximately eight miles northwest of the Project Area. The municipal water well in Big Piney draws from alluvial sediments in the Green River floodplain and is not likely to be influenced by any activities in the NPL Project Area due to the distance from the NPL Project Area and the water source (alluvial sediments in Green River floodplain).

Water use in the analysis area is primarily associated with livestock (sheep, cattle, horses) based on the SEO records[32] of permitted beneficial use. Many of the water wells within the Project Area were drilled by the BLM or the USGS and are currently maintained by ranchers permitted to graze livestock on BLM land (permittees) (Trihydro 2011). Existing water wells in the analysis area are depicted on Map 31. A total of 281 water wells are located in the analysis area, of which 90 are identified as “domestic or domestic/stock wells”, and 24 are identified as “existing industrial supply wells”. The remaining 167

[32] *Wyoming SEO records are updated regularly, and permitting information included at the time of this report is based on current information.*

water wells are listed as having "miscellaneous" use. The "miscellaneous" use category includes temporary industrial use for oil and gas drilling.

Most of the groundwater wells in the Greater GRB are medium- to low-yielding wells (average yield of approximately 25 gpm) and are installed at depths less than 300 feet, with two-thirds of depths shallower than 100 feet (Bartos and Hallberg 2010). The shallow sandstones in the upper part of the Wasatch are the most likely source for future groundwater development. Depletion of groundwater resources has not occurred to date that would require groundwater control areas (Bartos and Hallberg 2010). Changes in groundwater levels are typically seasonal, although their effects can be exacerbated during drought conditions. During the drought of 1999-2007, groundwater levels across Wyoming decreased anywhere from a few feet to tens of feet (WSGS 2010). Data show that in 2012 and 2013, significant areas of Wyoming again reached severe and exceptional drought conditions. The data for 2014 (currently available through May) shows no areas of Wyoming in drought conditions above "Moderate" (National Drought Mitigation Center 2014). Refer to Section 4.2.4 in Appendix K (*Water Resource Support Appendix*) for more information on Wyoming drought conditions and effects on groundwater levels. During extreme drought events, industries may work with senior water rights holders to acquire temporary water use agreements and meet the demand for water supplies (WSGS 2010).

Groundwater levels can change over time in response to long term weather patterns and water use. Historic depth to water measurements made in existing wells can be compared to recent water levels in the same wells to identify changes over time. USGS (2015c) evaluated data from 27 wells in 2012-2014, mostly in the southern part of the study area, in which previous measurements had been taken in the 1960s and 1970s. The differences in water levels ranged from an increase of 5.5 feet to a decrease of 86.9 feet. Seventy-four percent of the wells showed a decrease in groundwater levels with declines ranging from 0.1 to 86.9 feet.

Wyoming SEO permits[33] (Wyoming SEO 2014), USGS data (USGS 2013), and well sampling reports by Trihydro (2011, 2013, 2014a, 2014b) were used to develop a comprehensive list of water wells and groundwater uses within the NPL Project Area. Map 31 depicts the location of existing water supply wells, and Attachment B (*Water Supply Wells in and around the NPL Project Area*) in Appendix K (*Water Resource Support Appendix*) identifies all existing water supply wells in and around the Project Area and their uses. Based on available data, there are 31 stock water wells and no domestic water supply wells within the NPL Project Area (Map 31). Most of the wells appear to produce water from the Wasatch Aquifer; however, at least four wells produce water from the Laney and one produces water from an alluvial aquifer. SEO records do not report any irrigation, industrial, or municipal wells within the NPL Project Area. Seven wells were identified in the NPL Project Area as miscellaneous (MISC) use and are used for oil and gas operations by the JIDPA; however, only two wells, Holmes Federal 5-1 and Jonah Workforce Facility, operated in 2013. The volume of water used from the Holmes Federal 5-1 is not reported in the SEO database or by Jonah Energy (the operator) to the BLM. It is assumed that the well uses the average amount calculated for JIDPA supply wells, 235,591 barrels/year (30.4 acre-feet). In 2013, the Jonah Workforce Facility well withdrew 128,800 barrels (16.6 acre-feet) of water (Encana 2014).

Historic water withdrawal records were not available for stock wells in the NPL Project Area; therefore, an estimate of water use was developed using the methods and default use values outlined in the PAPA Numerical Groundwater Model (AMEC 2013a) to estimate groundwater use for stock wells at 19.2 acre-

[33] *Wyoming SEO records are updated regularly, and permitting information included at the time of this report is based on current information.*

feet/year. No wells were identified as domestic supply wells in the NPL Project Area; however, if any are present, each would be assumed to supply one household, with an average of 2.47 persons per household (as cited in AMEC 2013a). The PAPA analysis assumed that only 10 percent of the domestic water withdrawn is consumed and 90 percent is returned; therefore, the consumptive use of groundwater for domestic purposes is estimated at 0.021 acre-feet/year per well. Based on these estimates, total annual groundwater use within the NPL Project Area is estimated at 513,353 barrels (66.2 acre-feet) per year (Table 3-61).

Table 3-61. Annual Groundwater Use Estimates within the NPL Project Area

Water Use	Volume (barrels)	Volume (acre-feet)
Stock	148,962	19.2
Domestic	0	0
Miscellaneous (oil and gas operations)	364,391	47.0
Total	**513,353**	**66.2**

Source: AMEC 2013a and methods described in text above.

General consumptive water use in the Upper Green River Basin primarily includes irrigation and stock watering, with irrigation water being mostly obtained from surface water diversions (WWDC 2014). There are seven irrigation wells in the Green River Basin (WWDC 2014), although well data reveal no irrigation wells are within the Project Area (see Attachment B in Appendix K [*Water Resource Support Appendix*] for a full list of wells in the Project Area).

Groundwater use in the JIDPA is tracked and recorded in accordance with the requirements of the JIDPA ROD (BLM 2006b). In 2013, Jonah Energy and Linn Energy reported 20 wells in the JIDPA withdrew a total of 607.3 acre-feet of water (Linn Energy 2014). These wells range in depth from 575 to 1,100 feet below ground surface and obtain water from the Wasatch Aquifer. The amount of water used for drilling and completion in 2013 is likely less than the average water use for the JIDPA drilling program. BLM records show that between 2008 and 2014, operators drilled and completed between 52 and 155 gas wells per year, with an average of 102 gas wells per year (BLM 2015f). In 2013, 69 gas wells were drilled and completed, approximately 30 percent less than the average number of gas wells drilled since 2008.

3.20.5.7 Formation Fluids Produced in the NPL Project Area and the JIDPA

During operation, gas wells produce water along with natural gas and petroleum liquids. The water is brought to the surface, separated from the gas and other liquids and is either beneficially reused or disposed of in permitted surface locations or injected into subsurface locations. Formation fluids coming from the Lance Formation in the JIDPA are re-injected into the Fort Union Aquifer, as described above, or piped or trucked to a central recycling facility to be reused for drilling and other field operations. In the JIDPA, an average of 1,372,373 bbls of formation fluids has been produced each year since 1978 (through November 2015), and formation fluids spiked in 2010 at 12,298,414 bbls. Most recent data (through November 2015) indicate that the Jonah wells have cumulatively produced 52,150,184 barrels (approximately 6,722 acre-feet) of formation fluids (Table 3-62) (WOGCC 2014).

Gas wells within the Project Area (not designated as within the Jonah Field) have cumulatively produced an estimated 217,186 barrels (28 acre-feet) of water from 1997 through April 2014 (more current data were not available at the time of this report) (Table 3-62) (WOGCC 2014). These values are estimates as some wells within the NPL Project Area are categorized by WOGCC as being within the JIDPA; therefore the field statistics for JIDPA include some NPL Project Area wells, and as a result, formation fluids volumes for the JIDPA are likely lower than shown, and the Project Area values are likely higher than shown (Table 3-62). In general, over time, gas wells tend to produce more water, and some wells are shut in or abandoned if water production is excessive. USGS found that gas-water ratios from the Jonah and Pinedale fields do not change over time (Nelson et al. 2010). The reservoir characteristics in the NPL area have not been evaluated and there is uncertainty as to whether the gas-water ratios will remain the same over time, like nearby structurally controlled fields, or if they will decrease over time.

Table 3-62. Total Estimated Formation Fluids Produced from Existing Oil and Gas Wells in the Jonah Field and NPL Project Area

Field/Area	Total Formation Fluids Volume (bbls)
Jonah Field[1]	52,150,184
NPL Project Area[2]	217,186

Source: WOGCC 2014.

[1]Total volume includes all formation fluids from 1978 through November 2015.
[2]Total volume includes all formation fluids from 1997 through April 2014.

bbls barrels

3.20.5.8 Groundwater Quality

The sections below provide a summary of the best available existing information for water quality for wells in and around the NPL Project Area (Map 31). The water quality presented in this section focuses on the key analytes, parameters, and water quality characteristics for wells that target the alluvial aquifer, Laney Aquifer, and the Wasatch Aquifer and the Fort Union Aquifer. Map 32 depicts the location of water wells that have been tested for certain water quality analytes by the operator's sampling and analysis program and water supply wells in the JIDPA that have been sampled as part of ongoing sampling in the JIDPA.

In addition, select water quality information from water wells for the most recent year sampled prior to 2014 is also presented in Map 33 for representative wells (i.e., wells that covered the geographical range of the analysis area and had a detectable level of one or more analyte). Map 33 depicts the concentrations of methane, total dissolved solids (TDS), benzene, chlorides, total petroleum hydrocarbons – diesel range organics (TPH-DRO), and total petroleum hydrocarbons – gasoline range organics (TPH -GRO) in relation to established standards or limits. These standards and limits were chosen for comparison based on primary uses in the analysis area (e.g., there is high prevalence of livestock water use around the analysis area, therefore the WDEQ Class III – Livestock Use Suitability standard was chosen (WDEQ 2015), safety standards (e.g., certain thresholds of methane are established due to risk of an explosion), and groundwater cleanup levels. Some of these standards overlap with EPA Primary or Secondary Drinking Water Standards, which are also described here as appropriate or where other standards do not exist. Data for wells sampled through 2014 by Trihydro (2011, 2013, 2014a, 2014b) as part of the NPL Groundwater Monitoring Program have been identified in the following sections. Refer to Attachment C in Appendix K (*Water Resource Support Appendix*) for detailed information including measurements that have exceeded regulatory standards and limits.

Water quality information from wells presented in Attachment C in Appendix K (*Water Resource Support Appendix*) was gathered from AECOM 2014; AMEC 2014; Trihydro 2011, 2013, 2014a, 2014b; and the Wyoming State Engineer's Office (SEO 2014). This information represents existing conditions and is depicted on Map 33. From these data, select wells, which are presented in Figure K-8 of Appendix K, indicate several trends, including:

- Methane was detected in wells located in the central- to south-eastern portion of the analysis area, with four wells exceeding 5 mg/L (Map 33). Concentrations of methane above 5 mg/L warrant isotope analysis to help identify potential sources. There are no drinking water or groundwater standards established for methane.
- TDS was detected in wells throughout the analysis area but in larger concentrations throughout the western portion of the analysis area. Only one well exceeds the WDEQ Class III – Livestock Use Suitability standard of 5,000 mg/L (WDEQ 2015) (Map Reference #50 on Map 33). This standard was chosen for purposes of comparison because of the high prevalence of livestock water use in and around the Project Area. The primary component of TDS is sulfate.
- Benzene was detected in three water supply wells in the central-north portion of the analysis area (Map 33). Only one (Corona 2-14, Map Reference #61 on Map 33) exceeded the EPA Primary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 5 µg/L. These are the only standards available for benzene, which is health concern in drinking water. This exceedance has been attributed to a leaking reserve pit and the site has been entered into the WDEQ-administered Voluntary Remediation Program and is undergoing active remediation.
- Chlorides were detected in wells throughout the analysis area, with the largest concentrations found throughout the southeastern portion (Map 33). Two wells exceed the EPA Secondary Drinking Water Standard, Wyoming Groundwater Cleanup Level, and WDEQ Class I – Domestic Use Suitability standard of 250 mg/L (WDEQ 2015) (Map Reference #3 and 43 on Map 33). These standards are presented because WDEQ Class III – Livestock Use Suitability standard is 2,000 mg/L (WDEQ 2015), and no wells exceeded this standard.
- TPH-DRO (hydrocarbon) was detected in six wells at very low concentrations, with the majority of wells with detected levels being in the western portion of the analysis area (Map 33). None of the wells exceed the Wyoming Groundwater Cleanup Level of 1.1 mg/L (if benzene is present) or 10 mg/L (if benzene is absent). There are no additional established drinking water standards for DRO.
- TPH-GRO (hydrocarbon) was detected in eight wells at very low concentrations, with the majority of wells with detected levels to the northwestern portion of the analysis area (Map 33). None of the wells exceeded the Wyoming Groundwater Cleanup Level of 7.3 mg/L. There are no additional established drinking water standards for GRO.

Refer to Attachment C in Appendix K (*Water Resource Support Appendix*) for more information on water quality for all wells where data are available and a summary of regulatory standards or limits for water quality parameters.

3.20.5.8.1 Alluvial Aquifer

Most wells in the NPL Project Area and JIDPA are completed in the upper 1,100 feet of the Wasatch Formation (see section below) due to the favorable hydrologic properties in the upper strata; however, some wells and springs are interpreted to have source zones in the Alluvial Aquifer. Wells and springs are identified as alluvial sources if they were shallow (less than 150 feet) and adjacent to a river or stream (Trihydro 2011). No field or hydrological studies have been conducted to verify the water source relationships for the sampling points interpreted to be alluvial from the operator's sampling and analysis program. Sampling and analysis of existing wells and springs in the NPL Project Area (Map 32) (Trihydro 2011, 2013, 2014a, 2014b) provide the best available data for assessing water quality from the alluvium. Some alluvial aquifers may be recharged by underlying or adjacent zones including the Wasatch and Laney. Alluvial sources with water quality data include the following wells in or adjacent to the NPL Project Area: NA1, P9437, and McGinnis2. North Sublette Meadow Spring, located immediately adjacent to the east boundary of NPL Project Area, is also likely sourced from the alluvium (Map 29). Attachment B in Appendix K (*Water Resource Support Appendix*) provides available water quality information for alluvial sources noted above, and Map 33 provides a summary of water quality from water supply wells in the analysis area.

Water quality in the Alluvial Aquifer is similar to the Wasatch, as described below. The water is a sodium sulfate to sodium bicarbonate composition. Elevated TDS, pH, sulfate, iron, and manganese are present in some wells and springs above U.S. EPA Primary Drinking Water Standards (EPA 2009). North Sublette Meadow Spring (Map Reference #45 on Map 33) contained detectable levels of total petroleum hydrocarbons – diesel range organics (TPH – DRO) in 2011, 2013, and 2014 (Trihydro 2011, 2014a, 2014b), and well NA1 exhibited a low concentration of total petroleum hydrocarbons – gasoline range organics (TPH – GRO) in 2013 (Trihydro 2014a). Refer to Attachment C in Appendix K (*Water Resource Support Appendix*) for more information on water quality, by well.

3.20.5.8.2 Wasatch Aquifer

The Wasatch Aquifer would provide water for the NPL Project from existing water supply wells in the JIDPA and NPL Project Area (Map 31) and potential new water supply wells in the NPL Project Area. Water quality data for the Wasatch Aquifer is described below for the upgradient area (JIDPA and PAPA), the NPL Project Area, and the areas adjacent to the NPL Project Area on the south, east, and west boundaries of the NPL Project Area. Water quality data for the Wasatch Aquifer were obtained from water supply wells in the JIDPA that draw from the Wasatch Aquifer and are summarized in Table 3-63 and detailed in Attachment C of Appendix K (*Water Resource Support Appendix*).

Table 3-63. Summary Statistics for Jonah Water Supply Wells, 2013

	Well Depths (ft. bgs)	Water Level (ft. bgs)	Temp °C	pH	Conductivity (µS/cm)	Total Dissolved Solids (mg/L)
Min	510	70	8.0	8.4	557	286
Max	2,310	360	16.3	10.5	5,660	4,370
Average	869	180	10.9	9.4	1,534	945

Source: AMEC 2014; AECOM 2014; Trihydro 2014a; USGS 2013; Wyoming SEO 2014.

°C degrees Celsius
ft. bgs feet below ground surface
mg/L milligrams per liter
µS/cm micro Siemens per centimeter

Note: Data used to generate these statistics are found in Table K-5 in Appendix K (*Water Resource Support Appendix*).

Water quality, represented by the TDS content, generally decreases in the deeper parts of the aquifer (Bartos and Hallberg 2010). Analysis of well log data (Phillips 2013) from the Wasatch in the JIDPA (well SHB 1-20, located in T29N, R108W, Section 20) shows high resistivity in the upper sands (0 to 1,000 feet below surface), indicating they contain water with low TDS, and low resistivity in water bearing sands in the lower Wasatch (2,500 to 4,000 feet below surface) indicates higher TDS content. The BLM's Onshore Order No. 2 considers any groundwater from fresh (<1,000 mg/L) to moderately saline (<10,000 mg/L) as usable water, which is to be protected. Regulations from 40 CFR Section 144.3 indicate that all groundwater with TDS less than or equal to 10,000 mg/L are presumed to be an underground source of drinking water (USDW) and must be protected unless an aquifer exemption has been granted under the Safe Drinking Water Act (SDWA). Water samples from the underlying Fort Union at depths of 5,000 to 7,700 feet below surface have TDS concentrations of approximately 50,000 mg/L. The downward increase in TDS from the low TDS water in the upper Wasatch water to Class IV (B), or lower water quality, is demonstrated; however, the exact depth at which the water exceeds a TDS concentration of 10,000 mg/L (the BLM criteria for usable water) has not been established. For the purpose of the analysis of potential impacts, it is assumed that all of the water bearing zones of the Wasatch in the analysis area contain usable water (TDS concentration less than 10,000 mg/L) unless otherwise demonstrated, and is protected in accordance with Onshore Order No. 2. It is also considered an USDW and is protected under the SDWA.

The operator's sampling and analysis program in the NPL Project Area is conducted annually for a limited number of parameters including specific conductivity, pH, TDS, methane, alkalinity, chloride, barium, calcium, iron, magnesium, sodium, benzene, toluene, ethylbenzene, and xylenes (BTEX), TPH – DRO and TPH – GRO (Trihydro 2011, 2013, 2014a, 2014b). The wells and springs included in the sampling program were not specifically designed for groundwater monitoring and therefore the sampling results may not represent ambient groundwater conditions. Drilling practices, well construction materials, and well construction may affect the representativeness for the samples. In addition, diesel or gasoline powered generators were used to power pumps at some of the well locations, and operation and maintenance of these generators could result in releases of petroleum hydrocarbons, and as a result, affect the water samples. Water quality results from the operator's sampling and analysis program is presented as the best available existing information for water quality in the NPL Project Area.

Four rounds of annual sampling and analysis of water wells and springs have been conducted in and adjacent to the NPL Project Area (Trihydro 2011, 2013, 2014a, 2014b)[34]. Between 2011 and 2013, 50 samples were collected from 30 wells and springs (Trihydro 2014a). Most of the sampled wells are used for livestock watering and a few are used for domestic water supply. There are no industrial, agricultural, monitoring, or observation wells in the NPL Project Area. A subset of all wells in the area was sampled each year: 26 wells were sampled in 2011, 11 wells were sampled in 2012, and 13 wells were sampled in 2013, with some wells being sampled in multiple years. Under the revised WOGCC Baseline Water Quality Sampling Plan, 21 wells were sampled in 2014. Water samples were initially analyzed for a wide range of analytes including general parameters, dissolved metals, general organics, dissolved gases, radiological, bacteria, alcohols, and glycols. Subsequent rounds of sampling events include a more limited list of indicator analytes with a provision to expand the analyte list if indicator compounds exceed established thresholds (Trihydro 2013). Fluoride was not sampled in 2011 (Trihydro 2011) but was added and included in the 2012 through 2014 analyte lists (Trihydro 2013, 2014a, 2014b). Arsenic was analyzed in 2011 and 2012 but was not analyzed subsequently. Volatile organic compounds were analyzed using EPA Method 8260B, a gas chromatography/mass spectroscopy (GC/MS) method that is less likely to result in the misidentification of benzene, which may occur when using GC-only analytical methods such as EPA Method 8021B (AMEC 2013b). Results of the sampling and analysis program are summarized below, and results are presented by well in tabular format in Attachment C in

[34] *Note that the dates referenced are the dates of the sampling and analysis reports. The actual sampling and analysis was conducted annually in 2011, 2012, 2013 and 2014.*

Appendix K (*Water Resource Support Appendix*). Refer to the Trihydro Sampling and Analysis Reports for piper diagrams of water chemistry for wells sampled in 2011-2014 (Trihydro 2011, 2013, 2014a, 2014b).

Select water quality parameters (based on the highest frequency of detected values and those parameters with established drinking water and groundwater standards from the EPA (2009) and WDEQ (2013b)) for wells sampled in 2013 are presented in Figures K-10, A-L in Appendix K (*Water Resource Support Appendix*) as boxplots by field to show the variation, median (i.e., typical value), minimum and maximum observations, and outliers.

3.20.5.8.3 Petroleum Hydrocarbons

As part of the operator's sampling and analysis program in the NPL Project Area, wells were also sampled for general hydrocarbons (TPH-DRO and TPH-GRO using EPA Method 8015C). As indicated in Attachment C (Water Quality Results from Water Wells in and Around the Project Area) in Appendix K (*Water Resource Support Appendix*), DRO was detected in four wells in 2013 in the NPL Project Area and two wells outside of the Jonah and NPL Project Area, with values ranging from 0.033 to 0.084 mg/L and 0.038 to 0.042 mg/L, respectively (Trihydro 2014a). GRO was detected in one well in the NPL Project Area, and two wells outside of the JIDPA and NPL Project Area in 2013 (Trihydro 2014a). These levels ranged from 0.011 to 0.326 mg/L. One of these sampling locations outside of the JIDPA and NPL Project Area is a spring – the North Sublette Meadow Spring. There are no EPA Primary or Secondary Drinking Water Standards for DRO or GRO. Wyoming has established Groundwater Cleanup Levels for DRO at 1.1 mg/L if benzene is present or 10 mg/L if benzene is not present, and for GRO at 7.3 mg/L (WDEQ 2013b). None of the wells with detectable levels of DRO or GRO exceed these levels. It should be noted that the reporting levels for GRO and DRO were higher in 2011 and 2012 than in 2013; therefore DRO and GRO may have been present in the earlier sampling years, but in concentrations too low for detection or reporting (Trihydro 2011, 2013, 2014a). In 2014, 10 out of 16 wells in the NPL Project Area and four out of five wells outside of the NPL and Jonah Fields had detectable levels of DRO (Trihydro 2014b). No wells sampled in 2014 had detectable levels of GRO (Trihydro 2014b).

In 2013, low concentrations of petroleum hydrocarbons (including BTEX and TPH – GRO) were detected at JIDPA in five of the 24 wells sampled by Linn Energy and Encana (Corona 2-14, Stud Horse Butte 16-20, Stud Horse Butte 11-20W [Map References 61, 62, and 64, respectively, on Figure K-8 of Appendix K], Corona 7-19, and Stud Horse Butte 10-32W [not mapped]). These wells are located in the west central portion of the JIDPA and are hydrologically upgradient from the NPL Project Area (Map 31). Petroleum components have been detected in previous sampling rounds in other wells, but none were above U.S. EPA Primary Standards.

Petroleum hydrocarbons have been detected north of the JIDPA in the PAPA at concentrations above the U.S. EPA Primary Standards (AMEC 2013b). The water supply wells where organic constituents have been consistently detected at concentrations greater than applicable groundwater standards have been, or are currently, under regulatory oversight by the WDEQ through the Voluntary Remediation Program (AMEC 2013a). Extensive analysis of the presence of hydrocarbons at the PAPA concluded that there is no evidence that oil and gas operations have resulted in widespread impacts to groundwater in the PAPA (AMEC 2013b). Hydrocarbons detected in the wells are the result of the following factors:

- Low level volatile organic compounds are largely attributable to upward seepage of natural gas from deep, underlying gas reservoirs over time into overlying geologic layers where groundwater occurs;

- The source of low level semivolatile organic constituents is not readily apparent but likely originates from substances introduced into water wells during drilling, installation, and operation of the well; or
- Naturally occurring organic matter in groundwater or associated with particles suspended in well water during sample collection (AMEC 2013b).

3.20.5.8.4 Total Dissolved Solids and Iron

TDS concentrations above the U.S. EPA secondary standards are present in many water supply wells in the JIDPA (Map 33) (Trihydro 2011, 2013, 2014a, 2014b). Elevated iron is also present in some wells. Elevated TDS and iron concentrations are a naturally occurring condition common within the Wasatch Formation (Bartos et al. 2010). The ranges of TDS are similar between the Jonah and NPL Fields, with the typical (i.e., median) value for Jonah being the lowest among the group. In 2013, seven of the eight samples in the NPL Project Area indicate TDS levels above the EPA Secondary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 500 mg/L for TDS (EPA 2009; Trihydro 2014a; WDEQ 2013b), and in 2014, 14 out of the 16 samples exceeded these levels (Trihydro 2014b). Seventeen of the 27 samples for the JIDPA in 2013 indicated TDS levels above these standards, with an outlier at 4,370 mg/L and the next highest observation at 2,460 mg/L. All ten samples outside of the NPL and Jonah Fields (i.e., "other") in 2013 and 2014 indicated TDS levels above the standards, with a range of 570-1,540 mg/L. One well exceeds the WDEQ Class III – Livestock Use Suitability standard of 5,000 mg/L (WDEQ 2015) (Map Reference #50 on Map 33).

The typical ranges of total iron are similar among all the fields; however there are several significant outliers in the JIDPA, with the highest sample reaching 28.9 mg/L in 2013 (Trihydro 2014a). This sample is well above the EPA Secondary Drinking Water Standard of 0.3 mg/L and above the Wyoming Groundwater Cleanup Level of 25.5 mg/L for iron (EPA 2009; WDEQ 2013b). Nine of the 19 samples in the JIDPA in 2013 are above the EPA Secondary Drinking Water Standard and two are above the Wyoming Cleanup Level (Trihydro 2014a). In 2013, two of the six samples for the NPL Project Area and two of the five samples outside of the Jonah and NPL Fields are also above EPA standards, none of which are above Wyoming Groundwater Cleanup Levels. The minimum observations among the samples in the NPL Project Area and JIDPA are similar, with total iron values around 0.03-0.04 mg/L. Total iron was not part of the analyte list for wells tested in 2014 (Trihydro 2014b). Dissolved iron was only sampled in 12 wells in the JIDPA in 2013, with concentrations ranging from 0.03 to 3.8 mg/L (Trihydro 2014a). Dissolved iron was sampled in all wells inside the NPL Project Area and all wells outside of the NPL and Jonah Fields in 2014; 11 out of 21 wells tested had detectable levels of dissolved iron, with concentrations ranging from 0.0105 to 1.15 mg/L (Trihydro 2014b). There are no drinking water or groundwater standards for dissolved iron.

3.20.5.8.5 Fluoride

Results of sampling and analysis of water supply wells show concentrations of fluoride above the EPA Primary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 4.0 mg/L in three of the eight wells sampled in the NPL Project Area and two of the five wells sampled outside of the NPL Project Area and JIDPA (i.e., "other") in 2013 (EPA 2009; Trihydro 2014a; WDEQ 2013b). However, it should be noted that fluoride is known to be high and natural occurring in this area (WSGS 2010). The ranges of detected fluoride in both sampling areas in 2013 are similar, with minimum observations of 0.69 and 0.8 mg/L and maximum observations of 9.8 and 8.8 mg/L for the NPL Project Area and other area, respectively (Trihydro 2014a). Fluoride was detected in eight out of 16 wells in the NPL Area and two out of five wells outside of the NPL and Jonah Fields at levels greater than the drinking water and groundwater cleanup level of 4.0 mg/L (Trihydro 2014b). No wells in the JIDPA were sampled for fluoride in these analyses.

3.20.5.8.6 Sulfate and PH

As indicated in Attachment C in Appendix K (*Water Resource Support Appendix*), sulfate and pH exceeded U.S. EPA Secondary Drinking Water Standards in several wells over the four-year period (Trihydro 2011, 2013, 2014a, 2014b). The NPL Project Area and JIDPA have samples that exceed the upper range of the EPA Secondary Drinking Water and Wyoming Groundwater Cleanup Level of pH 6.5-8.5 (EPA 2009; WDEQ 2013b) in 2013, with samples in the JIDPA having some of the highest observations of up to pH 10.5 (Trihydro 2014a). These high levels may be due to pH being measured in Jonah samples from AMEC (2014) in the laboratory, rather than the field; however, some of these samples with lower pH levels are similar to those in the other fields. Overall, 25 of the 27 wells in the JIDPA, five of the eight wells in the NPL Project Area, and three of the five wells in other areas exceed the upper limit (pH 8.5) of the EPA and Wyoming standards in 2013. In 2014, nine out of 16 wells in the NPL area and three out of four wells outside of the NPL and Jonah Fields exceeded the upper pH limit of 8.5 (Trihydro 2014b).

3.20.5.8.7 Metals

As indicated in Attachment C in Appendix K (*Water Resource Support Appendix*), in 2011, 2012, and 2013, wells in the NPL Project Area were tested for a variety of metals, including arsenic, boron, manganese, and selenium (Trihydro 2011, 2013, 2014a). In 2014, wells were tested for boron, manganese, and selenium. One well had a detectable concentration of arsenic in 2011 at 0.0901 mg/L, which is above the EPA Primary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 0.01 mg/L. Two wells in 2012, one well in 2013, and two wells in 2014 had boron concentrations above the Wyoming Groundwater Cleanup Level of 0.75 mg/L (Trihydro 2013, 2014a, 2014b). Eight wells in 2011 and four wells in 2014 had detectable levels of manganese above the EPA Secondary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 0.05 mg/L (EPA 2009; WDEQ 2013b). One well in 2011 had a detectable level of selenium at 0.157mg/L, which is above the EPA Primary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 0.05 mg/L.

3.20.5.8.8 Benzene, Toluene, Ethylbenzene, Xylenes

As indicated in Attachment C in Appendix K (*Water Resource Support Appendix*), benzene was detected in four wells in the JIDPA, with concentrations ranging from 1 to 11.8 µg/L in 2013 (Map 33). The EPA Primary Drinking Water Standard and Wyoming Groundwater Cleanup Level for benzene is 5 µg/L (EPA 2009; WDEQ 2013b), and one of these four wells (Corona 2-14, Map Reference #61 on Map 33) with detectable levels of benzene exceeded these standards in 2013 with a concentration of 11.8 µg/L (Trihydro 2014a). This exceedance has been attributed to a leaking reserve pit. The site has been entered into the WDEQ-administered Voluntary Remediation Program and is undergoing active remediation.

Toluene was detected in seven wells in the JIDPA in 2013 ranging from 0.44 to 38 µg/L. One sample outside of the JIDPA and NPL Project Area had a detectable concentration of toluene at 7.4 µg/L in 2013 (Trihydro 2014a). No wells with detectable levels of toluene exceed the EPA Primary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 1,000 µg/L (EPA 2009; WDEQ 2013b). There were no wells in the NPL Project Area with detectable levels of toluene in 2013. Ethylbenzene was detected in two wells in the JIDPA in 2013 with values of 0.3 and 3.2 µg/L, both of which are well below the EPA Primary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 700 µg/L (EPA 2009; Trihydro 2014a; WDEQ 2013b). Xylenes were detected in four wells in the JIDPA in 2013, with values ranging from 0.85 to 35 µg/L (Trihydro 2014a). None of the wells with detectable levels of total xylenes exceed the EPA Primary Drinking Water Standard and Wyoming Groundwater Cleanup Level of 10,000 µg/L (EPA 2009; WDEQ 2013b). Ethylbenzene and xylenes were not detected in any of the wells in the NPL Project Area or outside of the NPL Project Area and JIDPA (Trihydro 2011, 2013, 2014a). In 2014, there were no wells in the NPL Project Area or outside the NPL and Jonah Fields with detectable levels of benzene, toluene, ethylbenzene, or xylenes (Trihydro 2014b).

3.20.5.8.9 Methane

As indicated in Attachment C in Appendix K (*Water Resource Support Appendix*), dissolved methane levels were detected in water samples from five wells in the NPL Project Area and four wells in the area outside of the NPL Project Area and JIDPA in 2013. Methane was not analyzed in samples from JIDPA. The highest concentration detected in the NPL Project Area in 2013 was 5 mg/L (Map 33) (Trihydro 2014a). In 2014, 13 wells in the NPL Project Area and four wells outside of the NPL and Jonah Fields had detectable levels of methane (Trihydro 2014b). There are no drinking water or groundwater standards for methane; however, concentrations greater than 10 mg/L and less than 28 mg/L warrant investigation, and concentrations greater than 28 mg/L warrant immediate action due to risk of an explosion (Eltschlager et al. 2001). None of the detected concentrations of methane exceed these guidelines. Dissolved gas samples were collected from all wells and subjected to further isotopic analysis if the methane concentration exceeded 1.0 mg/L. Isotopic analysis of carbon and hydrogen in methane samples has been used to interpret the origin of methane gas to differentiate between biogenic gas, created by biological processes near or below the surface, and thermogenic gas, generally associated with thermal generation of oil and gas in the deep subsurface (Whiticar 1999). Over the four year sampling period (Trihydro 2011, 2013, 2014a, 2014b) methane was detected in 21 wells, and nine wells were at concentrations greater than 1.0 mg/L. All samples with concentrations greater than 0.1 mg/L are located in the eastern portion of the sampling area.

Eight methane samples from five wells (TKB, WFF, ETW, Err1, and Midland 2011-2) from the operator’s sampling and analysis program were submitted for isotopic analysis between 2011 and 2014 to aid in determination of the source of the methane (Trihydro 2011, 2013, 2014a, 2014b). When plotted, samples from TKB and Err1 wells fell within the general range of thermogenic gas, and samples from Midland 2011-2, WFF, and ETW wells plotted near, but not within the biogenic near-surface region. Trihydro (2011, 2014a, 2014b) interpreted the results of the methane analyses as potentially representative of methane from coal seams within the Wasatch; however, additional evidence has not been provided to support this interpretation. AMEC (2013b) found that the coal seams in the PAPA were not mature enough to generate a thermogenic hydrocarbon signature. In addition to Wasatch coal seams, the dissolved methane gas could be from a number of different sources including:

- Mixing of gases of different origins (e.g., microbial and thermogenic gas);
- Mixing of thermogenic gases with different maturities or complicated thermogenic histories; and,
- Microbial methane produced through biodegradation of hydrocarbon-containing compounds present in the Wasatch Formation, whether from natural or anthropogenic sources (AMEC 2013b).

In 2016 and 2017, Jonah Energy compared results of production gas from the Jonah Field (Harris et al., 2013), to the dissolved methane found in NPL groundwater wells (field samples). The dissolved gas in groundwater did not match the production gas composition, concentration, or isotopic data; indicating that dissolved gas in groundwater was not production gas.

3.20.5.9 Fort Union Aquifer

In the GRB, water quality in the Fort Union Aquifer (the target zone for formation fluids injection) varies both laterally and vertically as a general function of transport distance from the recharge areas and subsurface depth (Bartos and Hallberg 2010). Water quality data for the Fort Union Aquifer within the NPL Project Area are not available; however, data from several nearby JIDPA injection wells completed in the upper Fort Union were obtained from WOGCC (2014) and are summarized in Table K-6 in Appendix K (*Water Resource Support Appendix*). Data from these wells represent the best available existing information for water quality in the Fort Union Aquifer. The chemical composition of the water is uniformly calcium chloride with some wells exhibiting high sodium concentrations. The sulfate and bicarbonate levels are very low compared to chloride. One well, on the southeastern side of the JIDPA, exhibited detectable concentrations of VOCs; however, no samples exceeded EPA (2009) MCLs for VOCs. Within the JIDPA, the porous sands in the upper Fort Union Aquifer have consistently higher salinities than the underlying lower Fort Union, Lance, and overlying Wasatch Formations. Jonah Energy has targeted these high salinity zones in the upper Fort Union Aquifer as the proposed injection interval.

The EPA Secondary MCL for drinking water for TDS is 500 mg/L and chloride is 250 mg/L (EPA 2009) and WDEQ Class III water (suitable for livestock use) standard for TDS is 5,000 mg/L (WDEQ 2015). Data from JIDPA wells in the Fort Union Aquifer indicate TDS values from approximately 30,000 to 55,000 mg/L. Groundwater in the target injection zone has concentrations of TDS and chloride two orders of magnitude higher than drinking water standards for both parameters, and one order of magnitude higher than the Class III water standard, indicating that this is not a source of water for most applications. WDEQ groundwater regulations (WDEQ 2015) would likely classify the Fort Union Aquifer as either Class IV (B) water, which is water with TDS greater than 10,000 mg/L and suitable for industrial use or, more likely, Class VI water, which is unusable or unsuitable for use. The upper Fort Union Aquifer proposed for injection does not contain usable water, as defined by Onshore Order #2, due to TDS content, and it does not meet the EPA definition of an USDW. Because of the high TDS content, injection into the upper Fort Union would not require an aquifer exemption from WOGCC (WOGCC 2014). TDS concentration in the lower Fort Union is considerably lower than in the upper portion. Water quality data from several injection wells in the Jonah Field completed in the lower Fort Union show less than 10,000 mg/L TDS. If the lower Fort Union is used for injection, it would require an aquifer exemption. Several injection wells in the Jonah Field use the lower Fort Union as the injection interval, and the EPA and WDEQ have determined that due to the combination of depth and water quality, this interval is not a source of drinking water and would qualify for an aquifer exemption (WOGCC 2014).

3.20.5.10 Mesaverde Aquifer

Water quality data for the Mesaverde aquifer was obtained from 74 produced water samples in the Green River Basin (Bartos and Hallberg 2010). TDS concentrations range from 1,330 to 38,900 mg/L with a median concentration of 8,350 mg/L. In many samples TDS, chloride, sulfate and pH exceed aesthetic standards for domestic use. In the Project Area the Mesaverde aquifer is unlikely to be used as a source of drinking water due to its depth, quality, and availability of higher quality water at much shallower depths.

3.21 Wild Horses

3.21.1 Overview

The American feral horses originated from the Spanish explorers settling the Americas. Over time, unwanted horses and those that escaped from farmers and ranchers became wild and grew to be known as mustangs in the western United States. In 1971, the Federal government declared wild horse populations as "living symbols of the historic and pioneer spirit of the West" and enacted the Wild Free-roaming Horses and Burro Act for their protection (BLM 2011d). Under BLM authority, wild horses are managed within designated Herd Management Areas (HMAs) on public lands to achieve Appropriate Management Levels (AMLs), which is the point where wild horse population sizes are consistent with the land's capacity to support them. The BLM and RSFO are responsible for management of existing wild horse HMAs within the Project Area. The analysis area for wild horses is the Project Area, including the Little Colorado HMA.

3.21.2 Laws, Ordinances, Regulations, and Standards

The Wild Free-roaming Horses and Burro Act (Public Law 92-195) of 1971 was established by Federal rulemaking to protect existing populations of wild horses on BLM-administered public lands from capture, branding, harassment, or death. The BLM is responsible for the protection, management, and control of wild horses on public lands, while striving to maintain rangeland health.

The BLM manages wild horses based on established AMLs, with the intent of maintaining healthy wild horse populations in balance with other natural resources on public lands. If an AML is exceeded, excess wild horses are gathered and either prepared for adoption through the BLM Adopt-A-Horse Program or transported to long-term pastures (BLM 2011d).

3.21.3 Existing Conditions

The only HMA present on BLM-administered lands within the Project Area is the Little Colorado Wild Horse HMA in the BLM RSFO.

Wild horses were previously removed from the BLM PFO management areas in the early 1990s to decrease competition for forage and water resources. The Little Colorado Wild Horse HMA encompasses approximately 525,803 BLM-administered acres, 59,516 BLM-administered acres of which are within the southern portion of the Project Area (Map 36). The majority of this HMA is unfenced, with the exception of the boundary fence between the RSFO and PFO and along U.S. Highway 191 (BLM 2011e). The BLM RSFO manages this HMA with an AML range of 69 to 100 horses. BLM surveys conducted in the Little Colorado HMA during February and April of 2015 identified 259 and 128 wild horses, respectively (BLM 2015d). Both counts exceeded the AML range for the HMA. Actual population size may be larger due to the tendency for the direct count method, which was used during the 2015 surveys, to undercount the individuals present (U.S. Government Accountability Office 2008). Wild horses were observed predominantly in the southern portion of the Project Area, in the BLM RSFO. However, a few wild horses were also documented within the remaining portion of the Project Area in the BLM PFO planning area.

3.22 Wildlife and Fisheries

3.22.1 Mammals

3.22.1.1 Big Game

Big game species are managed by the WGFD, with migration and range designations for each species delineated across the entire state. Big game species including moose (*Alces alces*), elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), and pronghorn (*Antilocapra americana*) have been documented in the general wildlife analysis area (Project Area including 1-mile buffer) (Map 37). The WGFD big game range designations used across all species and relevant to the Project Area include the following definitions (WGFD 2012d):

- Out—Areas that are part of a herd unit, but are used by so few animals that the area is not considered sensitive habitat, or the habitat features within are of little importance to the species.
- Spring/Summer/Fall—A population or portion of a population of animals use the documented habitats within this range annually only (from the previous winter) to the onset of persistent winter conditions (variable, but commonly this period is between 5/1 and 11/30 or shorter in Wyoming).
- Crucial Winter/Yearlong—A population or a portion of a population of animals makes general use of the documented suitable habitat within this range on a year-round basis. But during the winter months there is a significant influx of additional animals into the area from other seasonal ranges, which has been documented as the determining factor in a population's ability to maintain itself at a certain level (theoretically at or above the WGFD population objective).

Mule deer, elk, and moose either have no range designation, an Out range designation, or a combination of both within the analysis area. Due to their limited occurrence and/or the lack of appropriate habitat (including migration routes), these species are discussed only briefly below.

3.22.1.1.1 Pronghorn

Pronghorn occur in the analysis area year-round, and three different WGFD range designations are delineated within the Project Area. Approximately 20,688 acres of crucial winter/yearlong habitat, essential for the long-term viability of the population, are located throughout the north-central portion of the Project Area, with additional smaller areas along the southwestern Project Area boundary (Map 37). The majority of the Project Area comprises spring/summer/fall range for pronghorn, totaling approximately 104,822 acres. Approximately 15,350 acres of winter/yearlong pronghorn range also exist in the eastern portion of the Project Area. Two herds of 25 and 100 pronghorn were recorded during the 2010 winter in the central portion of the Project Area (ACC 2010). Numerous additional sightings of pronghorn were documented in Crucial Winter/Yearlong range during winter flights conducted by the BLM PFO (Map 37).

The pronghorn population within the Project Area is managed as part of the Sublette Pronghorn Antelope Herd (Herd Unit 401). The Project Area falls entirely within the Herd Unit 401 management area. Herd Unit 401 is approximately 6,845,707 acres and contains the entire Upper Green River Basin north of I-80, the Upper Hoback drainage, and Upper Gros Ventre drainage. From 2009 to 2013, pronghorn population estimates for Herd Unit 401 averaged 45,560 individuals and was estimated to be

31,300 individuals in 2014, which is approximately 34.8 percent below the management objective of 48,000 individuals (WGFD 2014a). Harsher than average conditions during winter 2010–2011 were attributed as a possible factor in the population decrease. The 2014 hunting season saw the lowest harvest recorded in the Sublette herd since 2001 which was due, in part, to the herd being estimated below objective and the subsequent reduced number of licenses issued.

Pronghorn in the analysis area make some of the longest seasonal migration movements documented for the species (Sawyer et al. 2005). Migration studies (Sawyer et al. 2005; Berger et al. 2006; Seidler et al. 2014) in the region have recorded pronghorn seasonal movements between Grand Teton National Park and the Upper Green River Basin of 72 to 160 miles (Sawyer et al. 2005). Pronghorn radiomarked in the Grand Teton National Park do use the winter ranges present within the Project Area. There are three pronghorn migration routes[35] that cross the analysis area; one which bisects the western end of the analysis area from north to south, one which ends at the northernmost tip of the analysis area, and one which bisects the eastern end of the analysis area and ends midway through the Project Area (Map 37). Recent population analyses also show high use areas during migration in the western portion, southeastern portion, and north-central extent of the analysis area. In 2009, new migration routes just east of Eighteen Mile Canyon along the southern margin of the general wildlife analysis area were identified (Seidler and Beckmann 2013). Habitats associated with the analysis area are important to pronghorn year-round, including during migration, when large herds of the species are moving long distances between seasonal ranges. There are no WGFD-designated pronghorn migration corridors in the NPL Project Area.

High levels of pronghorn utilization of habitat in the southwest corner of the Project Area during spring migrations was observed during a study on long-distance mammal migrations between 2005 and 2009; in contrast, pronghorn showed low levels of use in the adjacent developed JIDPA and PAPA fields. The study also showed that the section of U.S. Highway 191 located east of the Project Area may be a complete barrier to pronghorn migration (Seidler et al. 2014). As a result, pronghorn utilizing habitat in the Project Area would migrate north through the Project Area instead of migrating east across U.S. Highway 191 to reach seasonal ranges to the north of current oil and gas development.

3.22.1.1.2 Mule Deer

The only range designation for mule deer within the Project Area is "*Out*". Although no mule deer crucial range designations exist within the Project Area, Crucial Winter/Yearlong mule deer range has been identified along the Green River to the west and northwest of the Project Area. There are no mule deer migration routes in the analysis area; however, migration routes for mule deer exist to the northeast, northwest, and west of the analysis area with a high concentration of mule deer migration routes along the Green River west of the analysis area (Map 37).

WGFD manages the mule deer population within the Project Area as part of the Sublette Mule Deer Herd Unit (Herd Unit 104). From 2009 to 2013, mule deer population estimates for Herd Unit 104 averaged 22,715 individuals and was estimated to be 26,337 individuals in 2014, which is approximately 17.7 percent below the management objective of 32,000 individuals (WGFD 2014b). WGFD population

[35] *Migration routes are not an official WGFD designation, but are used in this analysis to identify migration pathways consistently used by wildlife to make seasonal movements between winter and summer ranges. Migration routes are identified based on the expert opinion of WGFD biologists and telemetry data collected from radio-collared animals. Migration corridors are areas of the landscape that a substantial portion of the herd or herd segment uses consistently to move between seasonal habitats. There are no WGFD-designated migration corridors in the NPL Project Area.*

estimates for the Sublette Herd Unit from 2001 through 2012 indicated a negative trend over the 11-year period with an average decrease of 1,020 deer per year and a 30 percent decline in abundance (Sawyer and Nielson 2013).

As expected, numerous mule deer observations were documented during winter aerial surveys in the riparian areas along the Green River and in the breaks and buttes east of the Green River and west of the Project Area (ACC 2010) (Map 37). Wintering mule deer were documented during baseline surveys and BLM winter flights, predominantly in the western and northwestern extent of the Project Area (Woolwine 2013a), even though it has not been designated as crucial winter range. A few observations were also documented elsewhere (BLM 2011m; ACC 2010; ACC 2011a).

3.22.1.1.3 Elk

Approximately 2,049 acres of elk crucial winter range occurs in the eastern portion of the analysis area (Project Area plus a one-mile buffer), with 134 acres occurring within the Project Area (Map 37). The analysis area is designated as "Out" for elk and there are no identified elk migration routes within the analysis area; however, a resident elk herd is known to use the general area (mostly south of the analysis area). Elk were recorded within the Project Area and nearby vicinity during the baseline inventory (ACC 2010; ACC 2011a) and BLM flights (BLM 2011l; BLM 2011m; BLM 2011n) (Map 37). The majority of these observations occurred during the winter months and were concentrated in and around Buckhorn Draw and East Buckhorn Draw, located within and just outside of the south-central portion of the general wildlife analysis area. It is not currently known how many of these individuals were winter-only inhabitants and how many were residents. Most likely, the resident population is not as high as the winter population. Spring observations were also not uncommon during the previously mentioned flights and surveys. Calves were recorded south of the Project Area, indicating the potential for limited use for parturition.

3.22.1.1.4 Moose

No crucial or seasonal ranges for moose exist within the Project Area, and one moose observation was documented in the general wildlife analysis area during the baseline period (ACC 2010). Only a few additional moose observations have historically occurred (WGFD 2012a) in the general wildlife analysis area, and no moose were documented in the Project Area during the BLM winter flights in 2011 (BLM 2011). Similar to mule deer, the WGFD has designated Crucial Winter/Yearlong range for moose along the Green and New Fork River corridors west and northwest of the analysis area. The limited occurrence of moose in the Project Area is not unexpected, as limited aquatic habitats exist.

3.22.2 Other Mammals

A variety of mammals either occur or have the potential to occur in or near the Project Area (WyNDD 2012; WISDOM 2012; ACC 2010; ACC 2011a; WGFD 2012d; Clark and Stromberg 1987). Other mammal species documented (including historical and recent baseline data) within the general wildlife analysis area include:

- Five mesopredator/furbearer species: American badger (*Taxidea taxus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), long-tailed weasel (*Mustela frenata*), and striped skunk (*Mephitis mephitis*).
- Three bat species: big brown bat (*Eptesicus fuscus*), little brown myotis (*Myotis lucifugus*), and long-eared myotis (*Myotis evotis*).

- Twelve rodents: deer mouse (*Peromyscus maniculatus*), least chipmunk (*Neotamias minimus*), North American porcupine (*Erethizon dorsatum*), northern grasshopper mouse (*Onychomys leucogaster*), olive-backed pocket mouse (*Perognathus fasciatus*), sagebrush vole (*Lemmiscus curtatus*), southern red-backed vole (*Clethrionomys gapperi*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), Uinta ground squirrel (*Spermophilus armatus*), western harvest mouse (*Reithrodontomys megalotis*), white-tailed prairie dog (*Cynomys leucurus*), and Wyoming ground squirrel (*Spermophilus elegans*).
- Three lagomorph (rabbits and hares) species: mountain cottontail (*Sylvilagus nuttallii*) pygmy rabbit (*Brachylagus idahoensis*), and jackrabbits (*Lepus* spp.).

Of these 23 species, three are BLM sensitive species (long-eared myotis, pygmy rabbit, and white-tailed prairie dog) and four are WGFD Species of Greatest Conservation Need (SGCN) (big brown bat, little brown myotis, long-eared myotis, and olive-backed pocket mouse).

The gray wolf (*Canis lupus*) was delisted as threatened under the ESA in the State of Wyoming on September 10, 2012 (USFWS 2012d). Two years later, the U.S. District Court for the District of Columbia vacated the delisting of gray wolf, reinstating federal protection under the ESA and regulating the gray wolf as a nonessential experimental population in Wyoming under a final rule issued February 20, 2015 (80 FR 9218). In the spring of 2017, the United States Court of Appeals for the District of Columbia Circuit mandated the removal of federal protections for the gray wolf under a final rule issued May 1, 2017 (82 FR 20284). As a result, gray wolves in Wyoming are no longer protected under the ESA and are therefore no longer designated as a nonessential experimental population No wolves or wolf packs have been documented in or near the analysis area according to WGFD records (WGFD et al. 2015).

On June 30, 2017, the USFWS issued a final rule that the Greater Yellowstone Ecosystem population of grizzly bears (Ursus arctos horribilis) had recovered and no longer meets the definition of an endangered or threatened species under the ESA (82 FR 30502). The closest suitable grizzly bear habitat is at least 15 miles northeast of the Project Area; grizzly bear is not expected to occur in the Project Area.

3.22.3 Birds

3.22.3.1 Raptors

As with most avian species, raptors (hawks, eagles, and owls) are protected under the MBTA (16 U.S.C. § 703 – 712), with additional protections for eagles included under the BGEPA.

Habitats throughout the general wildlife analysis area are predominantly sagebrush-steppe, although rock outcrops, buttes, canyons, and draws are also present. These features are generally associated with Alkali Creek, Alkali Draw, and the adjacent ridges and buttes, located in the western portion of the general wildlife analysis area. Although wooded riparian areas are limited within the Project Area, the unique topographical features mentioned above provide ample nesting sites for golden eagles, ferruginous hawks (*Buteo regalis*), American kestrels (*Falco sparverius*), prairie falcons (*Falco mexicanus*), and, potentially, peregrine falcons (*Falco peregrinus*) (Map 39). Some species, such as the ferruginous hawk, also utilize open sagebrush habitats and nest along minor topographical features (e.g., drainage banks, knolls, gentle ridgelines) found throughout the majority of the Project Area (Map 39). Despite the limited availability of some nesting substrates (primarily trees), an abundant prey base (i.e., lagomorphs and rodents) exists within the Project Area and provides good foraging habitat for species that may nest beyond the Project Area (e.g., along the riparian corridors of the Green and New

Fork Rivers to the west and north) (Map 39). Generally, the Project Area hosts good nesting and foraging habitat for a wide variety of raptor species.

Fifteen species of raptors have been documented (including historical and recent baseline data) in the general wildlife analysis area (ACC 2010; ACC 2011a; WGFD 2012b; WyNDD 2012). These species include the American kestrel, bald eagle, burrowing owl, ferruginous hawk, golden eagle, long-eared owl (*Asio otus*), merlin (*Falco columbarius*), northern harrier (*Circus cyaneus*), osprey (*Pandion haliaetus*), peregrine falcon, prairie falcon, red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), short-eared owl (*Asio flammeus*), and Swainson's hawk (*Buteo swainsoni*). Of these 15 species, four (bald eagle, burrowing owl, ferruginous hawk, and peregrine falcon) are BLM PFO and BLM RSFO sensitive species and WGFD SGCN. The merlin, short-eared owl, and Swainson's hawk are also listed as WGFD SGCN. Bald eagle, ferruginous hawk, and peregrine falcon are USFWS Birds of Conservation Concern (USFWS 2008). Birds of Conservation Concern include species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA. Refer to Section 3.22.6 (*Special Status Wildlife Species*) for additional information on these species.

Although 15 different raptor species are known to occur within the general wildlife analysis area, only six of the species were recorded nesting within the general wildlife analysis area during the baseline inventory period (ACC 2010; ACC 2011a). A summary of all nesting raptor species and their levels of nesting activity during that period is provided below in Table 3-64. In addition to the nesting population, the BLM has also observed migrating winter raptors, including golden eagle and rough-legged hawk, as well as prairie falcon and northern harrier, in the Project Area (Woolwine 2016).

Table 3-64. Nesting Raptor Species within the NPL Survey Area from 2010 through 2011

Species	2010 Nest Total	2010 Occupied	2011 Nest Total	2011 Occupied
Ferruginous hawk	69	5	147	6
Burrowing owl	17	8	42	11
Prairie falcon	10	5	16	5
American kestrel	10	0	14	0
Golden eagle	6	2	5	2
Red-tailed hawk	0	0	1	0
Unknown raptor	2	0	16	0
Total	**114**	**20**	**241**	**24**

Source: ACC 2011a.

Note: Survey area included the Project Area and 1.0-mile buffer minus the Pinedale Anticline Project Area overlap.

3.22.3.2 Game Birds

One species of upland game bird, the Sage-Grouse, has been documented within the Project Area. The Sage-Grouse is a BLM PFO and BLM RSFO Sensitive Species. Sage-Grouse is also listed as a WGFD SGCN and managed as a game species by the WGFD throughout the state. Refer to Section 3.22.6 (*Special Status Wildlife Species*) for a complete discussion of the species' status, its occurrence, display, and mating sites (i.e., leks), and population trends related to the Project Area.

Although several waterfowl game birds have been documented within the Project Area, the limited availability of aquatic habitats throughout the Project Area is inadequate to host large concentrations of these species on a regular basis.

3.22.3.3 Other Birds

Aside from raptors, upland game birds, and mountain plover, a variety of other bird species occur or have the potential to occur within the Project Area (ACC 2010; ACC 2011a; WGFD 2012b; WyNDD 2012). Other avian species documented (including historical and recent baseline data) within the general wildlife analysis area include:

- Nineteen shorebirds and waterfowl: American avocet (*Recurvirostra americana*), bufflehead (*Bucephala albeola*), Canada goose (*Branta canadensis*), common goldeneye (*Bucephala clangula*), great blue heron (*Ardea herodias*), green-winged teal (*Anas crecca*), killdeer (*Charadrius vociferus*), long-billed curlew (*Numenius americanus*), long-billed dowitcher (*Limnodromus scolopaceus*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), sandhill crane (*Grus canadensis*), snow goose (*Chen caerulescens*), spotted sandpiper (*Actitis macularius*), trumpeter swan (*Cygnus buccinator*), whooping crane (*Grus americana*), Wilson's phalarope (*Phalaropus tricolor*), and Wilson's snipe (*Gallinago delicata*).
- Two goatsucker species: common nighthawk (*Chordeiles minor*) and common poorwill (*Phalaenoptilus nuttallii*).
- Northern flicker (*Colaptes auratus*).
- Three flycatchers: Say's phoebe (*Sayornis saya*), western kingbird (*Tyrannus verticalis*), and willow flycatcher (*Empidonax traillii*).
- Two shrikes: loggerhead shrike (*Lanius ludovicianus*) and northern shrike (*Lanius excubitor*).
- Three corvid species: American crow (*Corvus brachyrhynchos*), Clark's nutcracker (*Nucifraga columbiana*), and common raven (*Corvus corax*).
- Horned lark (*Eremophila alpestris*).
- Three swallows: barn swallow (*Hirundo rustica*), tree swallow (*Tachycineta bicolor*), and violet-green swallow (*Tachycineta thalassina*).
- Black-capped chickadee (*Poecile atricapillus*).
- Rock wren (*Salpinctes obsoletus*).
- Mountain bluebird (*Sialia currucoides*).
- Two mimid species: northern mockingbird (*Mimus polyglottos*) and sage thrasher (*Oreoscoptes montanus*).
- American pipit (*Anthus rubescens*).
- Two warblers: yellow warbler (*Dendroica petechia*) and yellow-rumped warbler (*Dendroica coronata*).
- Western tanager (*Piranga ludoviciana*).
- Nine sparrows or related species: Brewer's sparrow (*Spizella breweri*), chipping sparrow (*Spizella passerina*), dark-eyed junco (*Junco hyemalis*), green-tailed towhee (*Pipilo chlorurus*), lark sparrow (*Chondestes grammacus*), sage sparrow (*Amphispiza belli*), song sparrow

(*Melospiza melodia*), vesper sparrow (*Pooecetes gramineus*), and white-crowned sparrow (*Zonotrichia leucophrys*).

- Four blackbirds or related species: Brewer's blackbird (*Euphagus cyanocephalus*), common grackle (*Quiscalus quiscula*), red-winged blackbird (*Agelaius phoeniceus*), and western meadowlark (*Sturnella neglecta*).

Of the 56 documented species listed above, six (long-billed curlew, trumpeter swan, loggerhead shrike, Brewer's sparrow, sage sparrow, and sage thrasher) are BLM PFO and BLM RSFO Sensitive Species, and one (whooping crane) is listed as endangered by the USFWS. With the exception of the loggerhead shrike, the species listed above are also WGFD SGCN. Four additional species (sandhill crane, great blue heron, willow flycatcher, and northern pintail) are listed as only WGFD SGCN. Seven of the species listed above (long-billed curlew, yellow-billed cuckoo, willow flycatcher, loggerhead shrike, sage thrasher, Brewer's sparrow, and sage sparrow) are USFSWS Birds of Conservation Concern (USFWS 2008). Refer to Section 3.22.6.1.1 (*Federally Listed Species*) for additional information on these species.

3.22.4 Amphibians and Reptiles

Specific surveys for amphibians and reptiles were not conducted for the NPL Project; however, historical records and incidental sightings documented during the baseline inventories indicate that the Project Area is utilized by at least a few amphibian and reptile species. Aquatic features such as vernal pools, perennial waters, and playas are generally lacking throughout the Project Area, but one amphibian species, the boreal chorus frog (*Pseudacris maculata*), has been documented (a single record; WGFD 2012c) within the Project Area. In addition, the WGFD (2013b) indicated that the following amphibian species are known or likely to occur within the Project Area: blotched tiger salamander (*Ambystoma tigrinum melanostictum*), Great Basin spadefoot (*Spea intermontana*), and northern leopard frog (*Rana pipiens*). Three reptile species were also recorded in the Project Area, including the wandering garter snake (*Thamnophis elegans vagrans*), northern sagebrush lizard (*Sceloporus graciosus*), and greater short-horned lizard (*Phrynosoma hernandesi*) (ACC 2010; ACC 2011a; WGFD 2012c). The greater short-horned lizard is also listed as a WGFD SGCN. Based on baseline inventories and historical accounts, this lizard is relatively abundant throughout the Project Area (ACC 2010; ACC 2011; WGFD 2012c).

3.22.5 Fisheries

The Project Area does not support any permanent surface water features; however, ephemeral drainages do exist within the Project Area. The Project Area is in the Upper GRB, approximately 4.2 miles east and 4.5 miles west from the Green and Big Sandy Rivers, respectively. WGFD classifies the Green River as a Blue Ribbon trout stream of national importance. Both rivers contain several game and non-game fish species. WGFD SGCN and BLM sensitive species, including the bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), and roundtail chub (*Gila robusta*), are known to occur in these waterways. These species are physically isolated and/or exist at extremely low densities throughout their range, and the conditions of their habitats are declining or vulnerable. Therefore, the WGFD has been directed by the Wyoming Game and Fish Commission to recommend that no loss of habitat function occur as a result of oil and natural gas development. However, some modification of the habitat may occur, provided that habitat function is maintained (i.e., the location, essential features, and species supported are unchanged). A complete discussion of the watersheds associated with the Project Area, and the potential and documented occurrence and status of fish species of concern in the Colorado and Platte River systems are included in Section 3.22.6 (*Special Status Wildlife Species* under *Fish*). A description of riparian and wetland habitats is provided in Section 3.18.2

(*Riparian and Wetland Communities*) and Section 3.20.4 (*Surface Water*) describes the five HUC-10 watersheds that intersect the Project Area.

3.22.6 Special Status Wildlife Species

This section identifies documented and potential wildlife species in the Project Area that are protected or considered for protection under the ESA or classified as a sensitive species by the BLM PFO and RSFO. A list of documented and potentially occurring species for the Project Area was developed based on baseline survey data from 2010 and 2011 for the NPL Project (ACC 2010; ACC 2011a), the WGFD WOS (WGFD 2012c), the WGFD Atlas (Orabona et al. 2012), *The Mammals in Wyoming* (Clark and Stromberg 1987), and WyNDD data (WyNDD 2012).

There are currently three wildlife species listed on the USFWS Endangered, Threatened, Proposed, and Candidate Species List for Sublette County that have potential to occur in the Project Area. There are currently 26 species listed on the BLM PFO and RSFO sensitive species lists that have potential to occur in the Project Area (Table 3-65).

3.22.6.1 Existing Conditions

Table 3-65 identifies federally-listed and BLM sensitive species wildlife considered for the Project Area, their habitat associations, potential for occurrence in the Project Area, and WGFD status. Subsequent sections provide additional information.

Table 3-65. Potential and Documented Occurrence of Special Status Species within the Project Area

Species	Habitat Preference[1]	Potential Occurrence[2]	ESA Status[3]	WGFD Status[4]
USFWS ESA Listed Species				
Mammals				
Black-footed ferret *Mustela nigripes*	Prairie dog colonies/short-grass prairie	Historical	Endangered	1
Canada lynx *Lynx Canadensis*	Boreal forest. Unit 5, Greater Yellowstone Area, critical habitat for this species is located 20 miles west of the Project Area.	Highly Unlikely	Threatened	1
Birds				
Yellow-billed cuckoo[5] *Coccyzus americanus*	Riparian woodland with dense understory. Proposed Unit 77, WY-1 Green River 3, critical habitat is located 23 miles south of the Project Area.	Unlikely	Threatened	3
Fish				
Bonytail chub[6] *Gila elegans*	Arizona, Colorado, Utah	Unlikely	Endangered	N/A
Colorado pikeminnow[6] *Ptychocheilus lucius*	Colorado, New Mexico, Utah	Unlikely	Endangered	N/A
Humpback chub[6] *Gila cypha*	Arizona, Colorado, Utah	Unlikely	Endangered	N/A

Table 3-65. Potential and Documented Occurrence of Special Status Species within the Project Area

Species	Habitat Preference[1]	Potential Occurrence[2]	ESA Status[3]	WGFD Status[4]
Kendall Warm Springs dace *Rhinichthys osculus thermalis*	Wyoming	Highly Unlikely	Threatened	1
Razorback sucker[6] *Xyrauchen texanus*	Arizona, California, Colorado, Nevada, New Mexico, Utah	Unlikely	Endangered	N/A
BLM Sensitive Species				
Mammals				
Fringed myotis *Myotis thysanodes*	Coniferous forests/woodland chaparral	Highly Unlikely	-	2
Idaho pocket gopher *Thomomys idahoensis*	Shallow, stony soils/open sagebrush, sagebrush-grasslands	Possible	-	2
Long-eared myotis *Myotis evotis*	Coniferous forests, wooded riparian areas	Documented	-	2
North American wolverine *Gulo gulo luscus*	Subalpine coniferous forests, especially dense continuous stands in remote areas, and alpine areas	Highly Unlikely	-	N/A
Pygmy rabbit *Brachylagus idahoensis*	Deep loose soils along streams/tall dense sagebrush	Documented	-	2
Spotted bat *Euderma maculatum*	Cliffs over perennial water, juniper shrublands, desert sagebrush-grasslands	Possible	-	2
Swift fox *Vulpes velox*	Grassland	Unlikely	-	2
Townsend’s big-eared bat *Corynorhinus townsendii*	Forests, basin-prairie shrub	Unlikely	-	1
White-tailed prairie dog *Cynomys leucurus*	Sagebrush-grasslands/short to midgrass grasslands	Documented	-	N/A
Wyoming pocket gopher *Thomomys clusius*	Upland ridge tops, gravel-loose soils	Unlikely	-	1
Birds				
Bald eagle *Haliaeetus leucocephalus*	Large mature trees in close proximity to water or other foraging areas	Documented	-	1
Brewer’s sparrow *Spizella breweri*	Sagebrush shrublands	Documented	-	2
Burrowing owl *Athene cunicularia*	Grasslands, basin-prairie shrublands	Documented	-	1
Ferruginous hawk *Buteo regalis*	Flat rolling terrain in sagebrush-grasslands	Documented	-	1
Sage-grouse *Centrocercus urophasianus*	Basin-prairie and mountain foothills, shrublands, wet-moist meadows	Documented	-	1
Loggerhead shrike *Lanius ludovicianus*	Pine-juniper, woodland-chaparral, basin-prairie, mountain foothills shrublands	Documented	-	N/A
Long-billed curlew *Numenius americanus*	Short-grass/mixed-grass prairies, wet-moist meadow grasslands	Documented	-	2
Mountain plover *Charadrius montanus*	Open plains and short grass prairies	Documented	-	1

Table 3-65. Potential and Documented Occurrence of Special Status Species within the Project Area

Species	Habitat Preference[1]	Potential Occurrence[2]	ESA Status[3]	WGFD Status[4]
Northern goshawk *Accipiter gentilis*	Coniferous forest	Unlikely	-	1
Peregrine falcon *Falco peregrinus*	Cliffs in open landscapes	Possible	-	2
Sage sparrow *Amphispiza belli*	Sagebrush shrublands	Documented	-	2
Sage thrasher *Oreoscoptes montanus*	Sagebrush shrublands	Documented	-	2
Trumpeter swan *Cygnus buccinator*	Freshwater marshes, lakes, rivers	Historical	-	2
White-faced ibis *Plegadis chihi*	Shallow marshes, wet-moist meadows	Possible	-	2
Amphibians and Reptiles				
Boreal toad *Anaxyrus boreas*	Wet areas in foothills, montane and subalpine zones	Historical	-	1
Great Basin spadefoot *Spea intermontana*	Sagebrush communities, spring seeps, permanent and temporary waters, sandy-loose soils	Possible	-	1
Midget faded rattlesnake *Crotalus viridis concolor*	Rock outcrops in sagebrush desert	Highly Unlikely	-	1
Northern leopard frog *Rana pipiens*	Permanent water in plains and foothills	Possible	-	3
Spotted frog *Rana luteiventris*	Ponds, sloughs, small streams	Unlikely	-	2
Fish				
Bluehead sucker *Catostomus discobolus*	Colorado River Basin	Possible	-	1
Colorado River cutthroat trout *Oncorhynchus clarkii pleuriticus*	Colorado, Utah, Wyoming	Possible	-	1
Fine-spotted Snake River cutthroat trout *Oncorhynchus clarki spp.*	Snake River drainage	Highly Unlikely	-	2
Flannelmouth sucker *Catostomus latipinnis*	Colorado River Basin	Historical	-	1
Hornyhead chub *Nocomis biguttatus*	Lower Laramie River and North Laramie River	Highly unlikely	-	2
Northern leatherside chub *Lepidomeda copei*	Northeastern portion of the Bonneville Basin and select drainages of the upper Snake River	Unlikely	-	1
Roundtail chub *Gila robusta*	Above Fontenelle Reservoir to Pinedale, WY	Possible	-	1
Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri*	Yellowstone drainage	Highly Unlikely	-	1

Table 3-65. Potential and Documented Occurrence of Special Status Species within the Project Area

Species	Habitat Preference[1]	Potential Occurrence[2]	ESA Status[3]	WGFD Status[4]

[1]Obtained from Orabona et al. 2012 for mammals, birds, amphibians and reptiles; USFWS recovery plans (USFWS n.d.) and BLM (2010a) for fish; and state species abstract (WyNDD n.d.) and USFWS recovery plans (USFWS n.d.) for plants.
[2]Documented = species was documented within the Project Area boundary or 1.0-mile buffer (i.e., project area) during baseline surveys (2010–2011); Historical = species was documented within the Project Area prior to 2010 (WGFD 2012c; WyNDD 2012); Possible = species has never been recorded in the Project Area, but its range overlaps that area and appropriate habitat(s) is present to support the species; Unlikely = species occurrence would be a rare sighting; Highly unlikely = based on species' range and habitats present, the species would not occur in the Project Area.
[3]Source: USFWS 2012b.
[4]Source: WGFD 2010b.
[5]Species also listed on the BLM Sensitive Species list.
[6]The Project Area is within the Area of Influence for potential effects to four species of endangered Colorado River Fish that inhabit waters downstream.

BLM Bureau of Land Management
ESA Endangered Species Act
N/A Not applicable
USFWS U.S. Fish and Wildlife Service
WGFD Wyoming Game and Fish Department

3.22.6.1.1 Federally Listed Species

Currently, 16 wildlife species are listed on the Endangered, Threatened, Proposed, and Candidate Species List issued by the USFWS for Sublette County, including five mammals, five birds, and six fish (USFWS 2012b). Only two of the 16 species have been documented within the Project Area. Historical records include both the black-footed ferret (*Mustela nigripes*) and whooping crane (*Grus americana*); however, present habitats are unlikely to support large numbers of either species and no critical habitat for either species has been designated within the Project Area or surrounding vicinity.

Mammals

The black-footed ferret, an ESA endangered species, is the only ferret species native to North America, with a distribution and persistence intricately linked to the distribution and presence of prairie dog (*Cynomys* spp.) colonies. The black-footed ferret preys almost exclusively on prairie dogs and relies on their colonies for shelter, hunting sites, and parturition sites. Historically, the black-footed ferret range included much of the Western Great Plains, extending north into Canada and as far south as Texas and Arizona. In Wyoming, the black-footed ferret is found in black-tailed (*C. ludovicianus*) and white-tailed (*C. leucurus*) prairie dog colonies, which are commonly found in semi-desert and short- to mid-grass prairies (Esch at al. 2005). The USFWS has established that approximately 75 acres of black-tailed prairie dog and 100-150 acres of white-tailed prairie dog occupied habitat is required to support one female black-footed ferret (USFWS 2013b).

In early 2004, the USFWS issued a block clearance eliminating the need for ferret surveys in all black-tailed and most white-tailed prairie dog colonies throughout Wyoming. The clearance was based on the lack of ferret observations since 1985, when the last wild ferret was believed to have been documented in the state, and the resulting belief that such habitats were unlikely to support black-footed ferrets in the state (USFWS 2004). A few minor exceptions to this clearance were made for specific white-tailed colony locations in Wyoming. In March 2013, the USFWS (USFWS 2013c) block-cleared the entire State of Wyoming in both black- and white-tailed prairie dog towns, relaxing the requirements of Section 7

Consultation. No surveys would be required based on the agreement for block clearance, and it is determined that because wild endangered black-footed ferret populations are no longer present outside of the reintroduced populations ferrets, wild, free-ranging endangered ferrets would not be impacted by this project.

Historical observations of black-footed ferrets were recorded within the Project Area prior to 1985, but there have since been no documented occurrences in the Project Area (WyNDD 2012). There are 24 identified white-tailed prairie dog colonies (5,547 acres) in the Project Area primarily located in the northern and eastern portions of the Project Area (Map 38). Ten of the 24 prairie dog colonies exceeded 200 acres in size. Thirty-four active prairie dog colonies, covering approximately 8,362 non-contiguous acres, have been documented in the larger analysis area (ACC 2011a). The USFWS recommends that project proponents and Federal action agencies protect all prairie dog towns or complexes for their value to the prairie ecosystem and the many species that rely on them, and that they evaluate potentially disturbed prairie dog towns for their value to future black-footed ferret reintroduction (USFWS 2013b, USFWS 2013c).

The other two mammals in Sublette County currently listed under the ESA are the Canada lynx (*Lynx canadensis*) (threatened) and North American wolverine (*Gulo gulo luscus*) (proposed threatened). Both species rely on high-elevation habitats, such as montane to subalpine or alpine forests that are absent within the Project Area and surrounding areas. These habitats are present more than 30 miles west of the Project Area within the Wyoming Range mountains. Consequently, none of these species is expected to occur in the Project Area with any regularity.

Birds

The remaining four avian species listed under the ESA for Sublette County are unlikely to occur near the Project Area, as habitats are presently unsuitable for these species. One historical observation of the whooping crane was recorded within the Project Area in 1979 (WyNDD 2012); however, current habitats within the Project Area are inadequate to host this species on any regular basis. The western Distinct Population Segment (DPS) of the yellow-billed cuckoo (*Coccyzus americanus*) was designated as threatened on November 3, 2014, and is associated with general riparian areas west of the Continental Divide. Limited riparian habitat does exist within the Project Area; however, these habitats do not contain the preferred woodlands and scrubby understory this species typically inhabits. The USFWS proposed two designated critical habitat units in Wyoming; the closest of which is approximately 50 miles south of the Project Area along the Green River in the Seedskadee National Wildlife Refuge in Sweetwater County (79 FR 48548). Due to these factors, yellow-billed cuckoo is unlikely to occur within the Project Area.

Fish

Four endangered Colorado River fish species' habitats are influenced by water flowing from Wyoming into downstream reaches of the Green, Yampa, and Colorado river systems (USFWS 2012b). The Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), bonytail chub (*Gila elegans*), and humpback chub (*Gila cypha*) were all historically found throughout the Colorado River and its tributaries. These populations have declined due, in part, to large mainstream dams, water diversions, habitat modifications, nonnative fish species, and degraded water quality (USFWS 2002). Groundwater underlying the Project Area is contained within the Upper Colorado River Basin aquifer system and is located in the Green River structural basin. Water depletions within Colorado River tributaries, including the Green River in Wyoming, are considered to adversely affect these four species and require ESA Section 7 consultation with the USFWS (USFWS 1995). The Colorado pikeminnow is now limited to the central portions of the Colorado River basin in eastern Utah, western Colorado, and northwestern New Mexico (USFWS 2002). The razorback sucker is rarely found upstream of the Grand Canyon. The bonytail is nearly extinct, if not already extinct, in the Green River drainage and, in recent years, the humpback chub has only been documented in a few portions of the Green River (BLM 2008a). Refer to Appendix O (*Biological Opinion*) for additional information on these special status fish species.

The Kendall Warm Springs dace (*Rhinichthys osculus thermalis*), listed as threatened, has only been documented within the Kendall Warm Springs and associated stream on the east bank of the Green River in the Wind River Range northwest of Pinedale, Wyoming (USFWS 2012b). This species is still believed to inhabit its entire historical range but has not been documented elsewhere (USFWS 2007). Given its specific habitat requirements and limited recorded sightings, this species is unlikely to occur in the vicinity of the Project Area. Therefore, no individuals or their habitat are expected to be impacted by NPL Project-related activities.

3.22.6.1.2 BLM Wyoming Sensitive Species

Currently, there are 43 BLM sensitive species in Wyoming, and specific management efforts are implemented toward maintaining adequate habitats for these species (BLM 2010a). However, only 35 of the 43 sensitive species are listed for the BLM PFO and RSFO areas (BLM 2010b). Of the 35 BLM sensitive wildlife species on the BLM PFO and RSFO lists, 25 species have the potential to occur in the Project Area, including 14 BLM sensitive species (three mammals and 11 birds) that have been documented within the Project Area, three species (one bird, one amphibian, and one fish) that have been historically documented in the Project Area, and eight additional BLM sensitive species that have potential to occur in the Project Area based on available suitable habitat (WyNDD 2012; WGFD 2012c; ACC 2010; ACC 2011a).

Documented Occurrence

Seventeen animal species listed on the BLM PFO and RSFO sensitive species lists have been documented within the Project Area at least once (Table 3-65) (BLM 2010b). Animal species recorded in the Project Area include three mammals, 12 birds, one amphibian, and one fish.

Three mammal species were documented utilizing habitats present within the Project Area. The long-eared myotis was recorded utilizing water sources (i.e., stock tanks or dammed draws) within the Project Area and has been historically (1997) documented in the overlapping JIDPA to the northeast (WyNDD 2012). Numerous observations of pygmy rabbits (*Brachylagus idahoensis*) and/or their sign were documented throughout multiple drainages hosting sufficient sagebrush stands within the Project Area during the baseline survey period (ACC 2011c), as well as during controlled grid surveys conducted by the USGS (Kemper et al 2011). From 2009 through 2011, 425 observations of pygmy rabbits or their sign (pellets and burrows) were recorded in the area, with the majority of locations (320; 75 percent) occurring within the Project Area (ACC 2011b) (Map 38). The USGS study of randomly distributed grids across the Project Area resulted in occupancy rates of 23 percent of the grids sampled in 2010, and 28 percent of the grids sampled in 2011 (Kemper et al 2011). This level of abundance is consistent with historical data (WGFD 2012c; BLM 2011f; BLM 2011g; BLM 2011h) documenting numerous sites of pygmy rabbit occurrence within appropriate habitats throughout the Project Area and region. Existing data indicates 24 active white-tailed prairie dog colonies within the Project Area covering approximately 5,547 acres and 34 active white-tailed prairie dog colonies in the larger analysis area covering 8,362 non-contiguous acres. The highest concentration of prairie dog colonies occurs primarily in the northern and eastern portions of the Project Area (Map 38).

Four species of raptors included on the combined BLM sensitive species list have been recorded within the Project Area (bald eagle, burrowing owl, ferruginous hawk, peregrine falcon). No nesting or roosting habitat is present for bald eagles within the Project Area, but several known nests and roosts occur along the Green River, west of the Project Area. Bald eagles have also been occasionally seen within the Project Area. The Project Area provides potential hunting habitat for bald eagles, primarily along river corridors where they can be seen feeding on road kill or winter-killed big game and jack rabbits.

Burrowing owls have been frequently observed within the Project Area, as the abundance of prairie dog colonies provides suitable nesting habitat and the expansive sagebrush-grasslands offer adequate hunting grounds.

Ferruginous hawks have also been frequently documented within the Project Area, as the mix of sagebrush-grasslands and rolling topography provide suitable habitats for both nesting and hunting. For a complete summary of all potential and confirmed raptor species refer to Section 3.22.3.1 (*Raptors*).

Peregrine falcons have also been observed within the Project Area; however, no nests have been documented and appropriate nesting substrate is extremely marginal and limited to the faces of the buttes along Alkali Draw in the northwestern portion of the Project Area and butte faces further west of the Project Area.

Seven other BLM sensitive species birds have been documented within the Project Area (Table 3-66). Mountain plovers (*Charadrius montanus*) are common throughout the sparse grasslands and in prairie dog colonies. Specific presence/absence surveys were conducted during the baseline inventory period (ACC 2010; ACC 2011a) in which 28 mountain plover sightings, including several nesting pairs, were documented within the general wildlife analysis area. Suitable plover habitat delineated during the baseline inventory surveys and from BLM records (BLM 2011o) include 6,668 acres within the general wildlife analysis area (Map 38). As illustrated, the majority of mountain plover sightings documented during that period occurred in the central and northeast portions of the Project Area (Map 38). A combination of these sightings with agency and historical records (WGFD 2012c; BLM 2011i; BLM 2011j; BLM 2011k) indicate that mountain plovers consistently use the habitats within the Project Area. The sage thrasher, sage sparrow, and Brewer's sparrow are all sagebrush-obligate species that have been recorded historically and during more recent baseline survey efforts conducted throughout sagebrush habitats in the Project Area. Loggerhead shrikes were also observed on several occasions in suitable sagebrush-grasslands habitats. During baseline surveys conducted for the NPL Project, one long-billed curlew was seen near East Buckhorn Draw in the center of the Project Area. This species is known to occur in surrounding areas and has a high potential for utilizing habitats in the Project Area. One historical (2004) record of a trumpeter swan also occurred in the Project Area (WyNDD 2012); however, the limited availability of wetlands and marshes in that area make it highly unlikely that this species would occur more regularly.

Limited data are available for the occurrence of sensitive amphibian and reptile species, and most records result from incidental observations. However, limited habitat to support the boreal toad does occur in the Project Area (WyNDD 2012).

One sensitive fish species, the flannelmouth sucker, has been documented in the Project Area. Two historical records exist for this species, which is associated with the tributaries of the Big Sandy in the extreme eastern portion of the Project Area.

Sage-Grouse

Population Trends

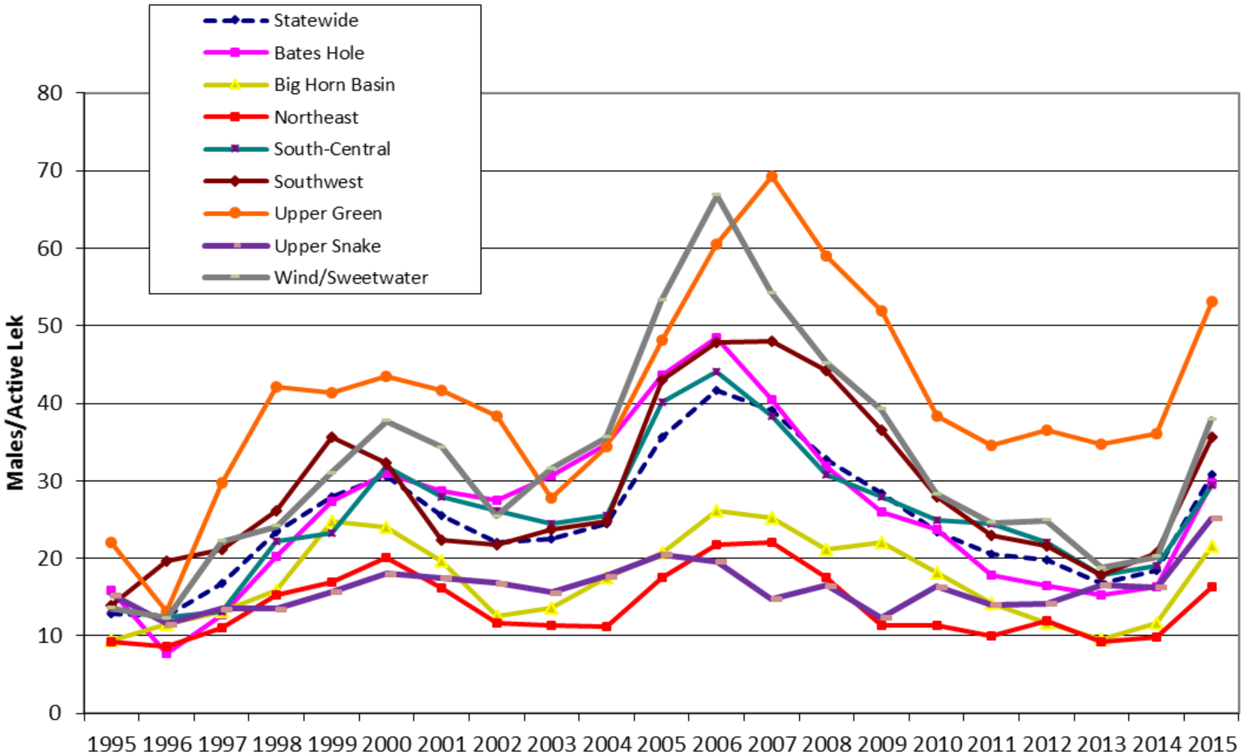
The Sage-Grouse occurs in sagebrush habitats in 11 western United States and two Canadian provinces (USFWS 2013c). Sage-Grouse population levels are generally cyclic, meaning they experience alternating periods of increases and decreases. Statewide population models based on lek data collected since the 1960s suggest that overall populations in Wyoming have declined since counts first began; (Connelly and Braun 1997; Connelly et al. 2004); however, statewide average peak male lek attendance per year has been on the rise since 2013[36] (WGFD 2015c) (Figure 3-24). Eight Local Working Groups (LWGs) established throughout Wyoming maintain local conservation plans and track local Sage-Grouse population trends. The UGRB Sage-Grouse LWG overlaps the analysis area. Using average peak male lek attendance per year in the UGRB, leks in the UGRB generally follow statewide averages in periodicity as well as population fluctuations, thought average peak male lek attendance tends to be higher in the UGRB than the state averages (Figure 3-25). As of 2015, average peak male lek attendance for the UGRB was approximately 53.2, compared to the state average peak male lek attendance of 30.8 (Figure 3-25) (WGFD 2015c).

See the cumulative impacts analysis of Sage-Grouse in Section 4.23.4.21 (*Cumulative Impacts – Wildlife and Fisheries*) of this EIS for additional information on Sage-Grouse populations, trends, and impacts in the region.

See the UGRB LWG Sage-Grouse Conservation Plan (UGRBLWG 2014) and the WGFD Sage-Grouse Job Completion Report (WGFD 2014c) for additional information on Sage-Grouse populations and trends in the analysis area and region. See the Western Association of Fish and Wildlife Agencies Sage-Grouse Population Trends Analysis of Lek Count Databases 1965 – 2015 (WAFWA 2015) for more information on Sage-Grouse populations and trends across the species' range.

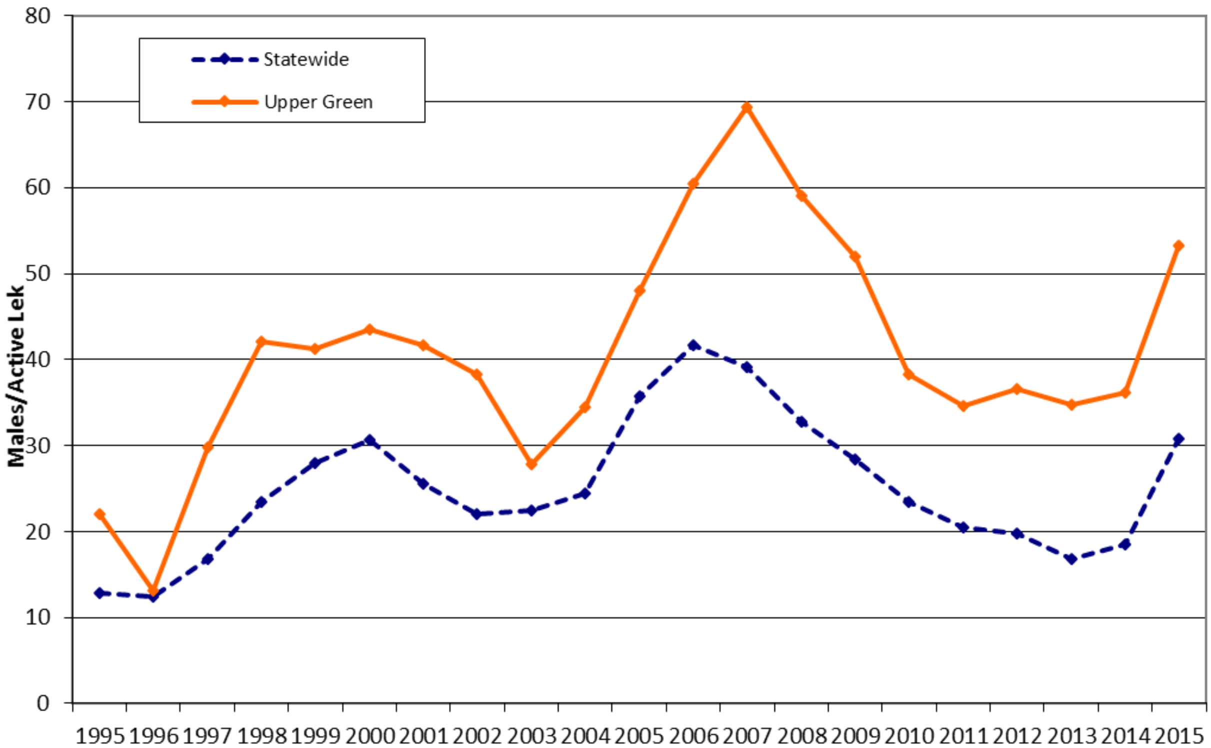
[36] *Average peak male lek attendance refers to the average of the maximum number of individual males that have been observed at a lek during an annual survey of that lek. Average peak male lek attendance is used by the WGFD and other biologists as a primary indicator of Sage-Grouse lek attendance and general population and trends because Sage-Grouse gather on traditional display areas (leks) each spring which allows biologists to use counts of displaying males as an index to track changes in breeding populations (WAFWA 2015).*

Figure 3-24. Wyoming Greater Sage-Grouse Lek Trend Model, Average Peak Male Attendance across Wyoming in Local Working Group Boundaries between 1995 and 2015



Source: WGFD 2015c.

Figure 3-25. Average Peak Male Attendance at Leks in the Upper Green River Basin Compared to the Statewide Average between 1995 and 2015



Source: WGFD 2015c.

Note: Upper Green River Basin averages represent data collected from 152 leks; 132 occupied and 20 unoccupied leks. Statewide averages represent data collected from 2,418 leks throughout the state. Data summarized in both averages were not available for all leks in all given years.

Threats/Reasons for Decline

Sage-Grouse populations have declined across their range and now occupy 56 percent of their historic range and the Sage-Grouse has been extirpated from two states and one Canadian province (USFWS 2013c). Population declines are, in large part, due to loss and fragmentation of sagebrush habitats (Connelly and Braun 1997; Connelly et al. 2004). Largely a result of human activities, primary threats contributing to sagebrush fragmentation include disturbance due to oil and gas development (Walker et al. 2007), conversion of sagebrush habitat for agriculture, and urban development in sagebrush habitats (Knick et al. 2011). Other influences on Sage-Grouse populations include fire and invasive species (Miller and Eddleman 2001), habitat loss from expansion of native conifers predation, weather fluctuations, and diseases including West Nile Virus (Hagen 2011, UGRBLWG 2014, Naugle et al. 2004; Walker 2008). Research has shown that functional habitat loss occurs due to human activities, including noise, which cause Sage-Grouse to avoid areas even when sagebrush remains intact (Blickley et al. 2012), and that ambient sound plays a central role in Sage-Grouse breeding behavior (Dantzker 1999; Braun et al. 2002). Refer to Appendix G (*Noise Technical Report*) for more information on noise effects and Sage-Grouse.

Conservation Status

In March 2010, the USFWS found that listing the Sage-Grouse rangewide was warranted but precluded by other higher priority actions and as a result of current research was made a candidate for listing (75

FR 13910). On May 10, 2011, the USFWS filed a multiyear workplan with a deadline to publish a proposed rule or not warranted finding by September 30, 2015. The USFWS found that listing the Sage-Grouse was not warranted on October 2, 2015 (80 FR 59858).

BLM Management

Sage-Grouse populations and habitats are managed in Wyoming by the BLM and WGFD. The BLM applies protective stipulations during critical periods of the life cycle to ensure that activities do not cause the degradation of habitat or disrupt breeding, nesting, and brood-rearing activities, resulting in a further decline in Sage-Grouse numbers. As a result of the March 2010 USFWS finding of "warranted but precluded", the BLM, in coordination with the USFS, developed a landscape-level management strategy to offer the highest protection for Sage-Grouse in the most important habitat areas. The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) include Sage-Grouse habitat management direction that avoids and minimizes additional disturbance in Sage-Grouse habitat management areas and target restoration of and improvements to the most important areas of habitat. The BLM Wyoming Sage-Grouse RMP Amendments identified land use allocations that would limit or eliminate new surface disturbance in Priority Habitat management Area (PHMA), while minimizing disturbance in General Habitat Management Areas (GHMA) (occupied habitat outside of PHMA). The BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) also identified specific Sagebrush Focal Areas which are a subset of PHMA. Sagebrush Focal Areas were derived from Sage-Grouse "stronghold" areas that were noted in a USFWS memorandum to BLM and USFS (USFWS 2014) and were referenced as having the highest densities of Sage-Grouse and other criteria important for the persistence of the species.

WGFD Management

Wyoming EO 2015-4 was published by the State of Wyoming in July, 2015 and replaces EO 2011-5 and EO 2013-3 and establishes a system of interagency coordination to monitor and track development and conservation activities across PHMA population areas for Sage-Grouse. Wyoming EO 2015-4 further outlines the permitting process and stipulations for development in Sage-Grouse PHMA in the State of Wyoming (State of Wyoming 2015).

Sage-Grouse Habitat in the Project Area

The Project Area supports year-round populations of Sage-Grouse, including approximately 48,036 acres of PHMA in the Project Area (34 percent of the Project Area). There are 430,163 acres of PHMA and 441,638 acres of GHMA in the 11-mile analysis area (Map 40).

There are 1,259 acres of Sagebrush Focal Area in the Project Area and 168,293 acres of Sagebrush Focal Area within the 11-mile analysis area for Sage-Grouse and observations of Sage-Grouse using the Sagebrush Focal Areas in the Project Area have been documented (Map 40).

Sage-Grouse Winter Concentration Areas, as defined in Wyoming EO 2015-4, are places where large numbers of PHMA Sage-Grouse congregate and persistently occupy between December 1 and March 14 (State of Wyoming 2015). Sage-Grouse select sagebrush/grassland habitats in gentle topography during winter months where sagebrush is taller than snow depth (Doherty et al. 2008). The BLM PFO and RSFO monitored Sage-Grouse populations during the winter months of 2010 and 2011 for the Project Area, with incidental winter observations also recorded during baseline surveys conducted by ACC during that period. The NPL Project Area overlaps approximately 27,292 acres of the delineated Sage-Grouse Winter Concentration Areas with approximately 31,532 acres occurring in the analysis area (Map 40). In particular, two areas in the northwest and north near Alkali Creek and Alkali Draw, respectively, comprise greater than 25 square miles of Winter Concentration Area. These areas are currently the only delineated Winter Concentration Area in the State of Wyoming and are larger than other areas being considered by the WGFD for delineation as Winter Concentration Areas.

Results of BLM winter surveys documented individual flocks of Sage-Grouse larger than 50 individuals within the survey area, with nearly 2,000 individual grouse recorded collectively throughout the western portion of the Project Area. These Winter Concentration Areas are outside established Sage-Grouse PHMA; however, they are important to maintaining sustainable Sage-Grouse populations. From 2005 to 2011, 84 individual radio-collared Sage-Grouse were observed during the winter in or near the Project Area (Map 40). Of these Sage-Grouse, 74 percent were from leks or late summering habitats located within PHMA. These findings suggest that Sage-Grouse within PHMA use the Project Area during the winter; however, the travel paths and timing of movements between these areas are not well studied (Millspaugh et al. 2013). BLM surveys have also observed Sage-Grouse during the winter outside of the delineated Winter Concentration Areas; flocks of 50 or more birds have been observed in the eastern portion of the Project Area and northeast of the Project Area boundary (Map 40).

Sage-Grouse Leks

Leks are typically bare areas where male Sage-Grouse perform courtship displays to attract females (USFWS 2013). Lek data, or numbers of males attending a given lek, provide managers the needed information to gauge population trends and to effectively promote the conservation of a species. The WGFD classifies the annual status of a lek based on the following definitions (WGFD 2012f). An active lek is one that is attended by male Sage-Grouse during the strutting season. An inactive lek is one where sufficient data indicates no strutting activity took place throughout a strutting season and requires documentation that no birds were present on the lek during at least two ground surveys separated by at least seven days. An unknown designation is given for which active/inactive status has not been documented during the course of a strutting season and is only applied in rare instances.

The agency's long-term management status of each lek is defined as follows. An *occupied* lek has been active during at least one strutting season in the prior 10 years. An *unoccupied-destroyed* lek is a formerly active lek and surrounding sagebrush habitat that has been destroyed and is no longer suitable for Sage-Grouse breeding. An *unoccupied-abandoned* lek is in otherwise suitable habitat but has not been active during a period of 10 consecutive years. An *undetermined* lek has not been documented as active in the in the last 10 years, but survey information is insufficient to designate the lek as unoccupied. There are 56 Sage-Grouse leks within 11 miles of the Project Area (Map 48). Forty-four of those leks are designated as occupied and 12 are unoccupied. Ten occupied leks and one unoccupied-destroyed lek occur within the Project Area (Map 40).

Density Disturbance Calculation Tool

In accordance with the BLM Wyoming Sage-Grouse RMP Amendments (BLM 2015e) and Wyoming EO 2015-4 (State of Wyoming 2015), the BLM will utilize the DDCT process (Wyoming 2014) during site-specific permitting to assess the maximum allowable disturbance within Sage-Grouse PHMA (i.e., no more than 5 percent total disturbance per 640 acres). As part of this EIS process, the BLM followed DDCT guidance to quantify existing surface disturbance in PHMA in the Project Area (Table 3-66 and Table 3-67). The results of the DDCT existing disturbance assessment will be used for future planning of site-specific development locations, assessing proposed development in PHMA and application of the DDCT process during site-specific permitting. During the site-specific planning and permitting process, the BLM would determine maximum allowable new disturbance in PHMA using the DDCT process.

Existing Surface Disturbance in Sage-Grouse PHMA

As indicated in Table 3-66, there is an estimated 265.4 acres of existing disturbance in Sage-Grouse PHMA (core habitat) in the Project Area (approximately 0.55 percent of PHMA acreage). Table 3-67 identifies acreage of PHMA and estimated existing disturbance in PHMA for each USGS quadrangle section of land that overlaps PHMA in the Project Area.

Table 3-66. Sage-Grouse PHMA Existing Disturbance Summary

	Total PHMA in the NPL Project Area (acres)	Existing Disturbance in PHMA (acres)	Percentage of PHMA in the NPL Project Area with Existing Surface Disturbance (acres)
Acreage	48,036	265.4	0.55%

Note: See Table 2-1 for sources of existing disturbance data.

Table 3-67. Existing Disturbance in Sage-Grouse PHMA Sections of Land in the NPL Project Area

Township/Range/Section	Acreage of PHMA in Section (acres)	Existing Disturbance in PHMA (acres)	Percentage of PHMA Acreage of Section Currently Disturbed (Existing Disturbance Acres/Acreage of PHMA in Section)	Percent of 640-Acre Section Currently Disturbed (Existing Disturbance Acres/640-acres in Section)
T27N R107W Section 06	621.16	5.17	0.83%	0.81%
T27N R107W Section 07	621.41	1.85	0.30%	0.29%
T27N R107W Section 18	622.34	0.00	0.00%	0.00%
T27N R107W Section 19	622.85	0.00	0.00%	0.00%
T27N R107W Section 30	624.24	0.00	0.00%	0.00%
T27N R107W Section 31	626.70	0.00	0.00%	0.00%
T27N R108W Section 01	638.92	1.94	0.30%	0.30%
T27N R108W Section 02	635.27	0.00	0.00%	0.00%
T27N R108W Section 03	637.13	0.00	0.00%	0.00%
T27N R108W Section 04	638.67	0.00	0.00%	0.00%
T27N R108W Section 05	543.58	0.00	0.00%	0.00%
T27N R108W Section 07	194.57	2.12	1.09%	0.33%
T27N R108W Section 08	643.36	0.00	0.00%	0.00%
T27N R108W Section 09	640.80	0.00	0.00%	0.00%
T27N R108W Section 10	640.95	0.00	0.00%	0.00%
T27N R108W Section 11	639.51	0.00	0.00%	0.00%
T27N R108W Section 12	641.31	0.00	0.00%	0.00%
T27N R108W Section 13	639.44	0.00	0.00%	0.00%
T27N R108W Section 14	639.04	0.00	0.00%	0.00%
T27N R108W Section 15	640.26	0.00	0.00%	0.00%

Table 3-67. Existing Disturbance in Sage-Grouse PHMA Sections of Land in the NPL Project Area

Township/Range/Section	Acreage of PHMA in Section (acres)	Existing Disturbance in PHMA (acres)	Percentage of PHMA Acreage of Section Currently Disturbed (Existing Disturbance Acres/Acreage of PHMA in Section)	Percent of 640-Acre Section Currently Disturbed (Existing Disturbance Acres/640-acres in Section)
T27N R108W Section 16	640.12	5.14	0.80%	0.80%
T27N R108W Section 17	641.47	6.11	0.95%	0.95%
T27N R108W Section 18	608.34	18.09	2.97%	2.83%
T27N R108W Section 19	625.02	14.13	2.26%	2.21%
T27N R108W Section 20	639.62	0.00	0.00%	0.00%
T27N R108W Section 21	638.88	27.00	4.23%	4.22%
T27N R108W Section 22	640.74	3.62	0.56%	0.57%
T27N R108W Section 23	639.48	0.00	0.00%	0.00%
T27N R108W Section 24	639.15	0.00	0.00%	0.00%
T27N R108W Section 25	641.62	0.00	0.00%	0.00%
T27N R108W Section 26	639.12	0.00	0.00%	0.00%
T27N R108W Section 27	642.26	11.42	1.78%	1.78%
T27N R108W Section 28	641.03	0.17	0.03%	0.03%
T27N R108W Section 29	638.35	4.47	0.70%	0.70%
T27N R108W Section 30	626.71	9.45	1.51%	1.48%
T27N R108W Section 31	626.68	5.22	0.83%	0.81%
T27N R108W Section 32	634.50	0.00	0.00%	0.00%
T27N R108W Section 33	636.67	0.00	0.00%	0.00%
T27N R108W Section 34	636.42	0.00	0.00%	0.00%
T27N R108W Section 35	636.03	0.00	0.00%	0.00%
T27N R108W Section 36	641.24	1.53	0.24%	0.24%
T27N R109W Section 13	380.80	4.28	1.12%	0.67%
T27N R109W Section 14	336.56	5.15	1.53%	0.81%
T27N R109W Section 15	318.90	5.92	1.86%	0.92%
T27N R109W Section 16	299.19	0.00	0.00%	0.00%
T27N R109W Section 22	633.86	1.24	0.20%	0.19%
T27N R109W Section 23	638.90	10.41	1.63%	1.63%
T27N R109W Section 24	638.51	30.28	4.74%	4.73%
T27N R109W Section 25	637.92	7.32	1.15%	1.14%
T27N R109W Section 26	640.21	0.00	0.00%	0.00%
T27N R109W Section 27	632.54	0.00	0.00%	0.00%
T27N R109W Section 34	638.89	18.02	2.82%	2.82%
T27N R109W Section 35	640.78	11.58	1.81%	1.81%
T27N R109W Section 36	639.18	31.22	4.88%	4.88%
T28N R107W Section 05	343.33	0.00	0.00%	0.00%

Table 3-67. Existing Disturbance in Sage-Grouse PHMA Sections of Land in the NPL Project Area

Township/Range/Section	Acreage of PHMA in Section (acres)	Existing Disturbance in PHMA (acres)	Percentage of PHMA Acreage of Section Currently Disturbed (Existing Disturbance Acres/Acreage of PHMA in Section)	Percent of 640-Acre Section Currently Disturbed (Existing Disturbance Acres/640-acres in Section)
T28N R107W Section 06	134.20	0.00	0.00%	0.00%
T28N R107W Section 07	646.93	0.00	0.00%	0.00%
T28N R107W Section 08	640.87	5.45	0.85%	0.85%
T28N R107W Section 17	637.39	0.36	0.06%	0.06%
T28N R107W Section 18	640.15	0.00	0.00%	0.00%
T28N R107W Section 19	635.55	0.00	0.00%	0.00%
T28N R107W Section 30	631.90	0.00	0.00%	0.00%
T28N R107W Section 31	626.66	0.00	0.00%	0.00%
T28N R108W Section 01	0.49	0.00	0.00%	0.00%
T28N R108W Section 11	75.66	0.00	0.00%	0.00%
T28N R108W Section 12	512.47	0.00	0.00%	0.00%
T28N R108W Section 13	639.58	0.00	0.00%	0.00%
T28N R108W Section 14	613.16	0.02	0.00%	0.00%
T28N R108W Section 15	311.41	0.00	0.00%	0.00%
T28N R108W Section 16	19.41	0.00	0.00%	0.00%
T28N R108W Section 20	24.65	0.00	0.00%	0.00%
T28N R108W Section 21	536.33	6.37	1.19%	1.00%
T28N R108W Section 22	639.71	0.00	0.00%	0.00%
T28N R108W Section 23	638.84	0.00	0.00%	0.00%
T28N R108W Section 24	639.13	0.00	0.00%	0.00%
T28N R108W Section 25	639.21	0.02	0.00%	0.00%
T28N R108W Section 26	638.80	0.00	0.00%	0.00%
T28N R108W Section 27	638.40	0.00	0.00%	0.00%
T28N R108W Section 28	637.81	0.00	0.00%	0.00%
T28N R108W Section 29	263.34	0.00	0.00%	0.00%
T28N R108W Section 32	406.06	0.00	0.00%	0.00%
T28N R108W Section 33	637.82	0.00	0.00%	0.00%
T28N R108W Section 34	637.96	0.00	0.00%	0.00%
T28N R108W Section 35	638.76	0.00	0.00%	0.00%
T28N R108W Section 36	639.06	10.33	1.62%	1.61%
T29N R107W Section 33	80.21	0.00	0.00%	0.00%

Note: See Table 2-1 for sources of existing disturbance data.