BLM

# Environmental Assessment

## Jonah Year-Round Development Project

**WY-100-EA16-36**

**March 2016**

High Desert District

## Table of Contents

## List of Figures



## List of Maps



## List of Tables

## List of Attachments



## List of Abbreviations and Acronyms

| | |
|---|---|
| ΔANC | change in acid neutralizing capacity |
| µeq/L | microequivalents per liter |
| µg/m$^3$ | micrograms per cubic meter |
| ACEC | Area of Critical Environmental Concern |
| ANC | acid neutralizing capacity |
| AO | Authorized Officer |
| APDs | Applications for Permit to Drill |
| AQD | Air Quality Division |
| AQRVs | air quality related values |
| AQTSD | Air Quality Technical Support Document |
| AR5 | fifth assessment report |
| ARMPA | Approved Resource Management Plan Amendment |
| AUM | animal unit month |

| | |
|---|---|
| BACT | Best Available Control Technology |
| BBS | Breeding Bird Survey |
| BCC | Birds of Conservation Concern |
| BCR | Bird Conservation Regions |
| BGEPA | Bald and Golden Eagle Protection Act |
| BLM | Bureau of Land Management |
| BMPs | Best Management Practices |
| bp | before present |
| BTEX | benzene, ethyl benzene, toluene, and xylene |
| CAA | Clean Air Act |
| Cab | Cabrito |
| CAMx | Comprehensive Air quality Model with Extensions |
| CASTNET | Clean Air Status and Trends Network |
| CDA | Concentrated Development Area |
| CD-C | Continental Divide-Creston |
| CEQ | Council on Environmental Quality |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CFR | Code of Federal Regulations |
| $CH_4$ | methane |
| CHU | critical habitat unit |
| CIAA | cumulative impact analysis area |
| CM | compensatory mitigation |
| CMAs | Cultural Management Areas |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| COAs | conditions of approval |
| DATs | Deposition Analysis Thresholds |
| dB | decibel |
| dBA | A-weighted decibels |
| DR | Decision Record |
| dv | deciview |
| DVC | base case or current year |
| DVF | future year |
| E | Eligible |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| EPA | U.S. Environmental Protection Agency |
| ESD | Ecological Site Descriptions |
| $^oF$ | degrees Fahrenheit |
| FDOP | first date of production |
| FEIS | Final Environmental Impact Statement |
| FIP | Federal Implementation Plan |
| FLAG | Federal Land Managers' Air Quality Related Values Work Group |
| FLMs | Federal Land Managers |
| FLPMA | Federal Land Policy and Management Act |
| FONSI | Finding of No Significant Impacts |
| ft | feet |
| FWS | U.S. Fish and Wildlife Service |
| GGRB | Greater Green River Basin |
| GHGs | greenhouse gases |
| GHMA | General Habitat Management Area |
| GWP | global warming potential |
| HAPs | hazardous air pollutants |
| ICE | internal combustion engines |

| | |
|---|---|
| ID Team | interdisciplinary team |
| IDLH | Immediately Dangerous to Life or Health |
| IMPROVE | Interagency Monitoring of Protected Visual Environments |
| IPCC | Intergovernmental Panel on Climate Change |
| JIDP | Jonah Infill Drilling Project |
| JIDPA | Jonah Infill Drilling Project Area |
| JPADA | Jonah and Pinedale Anticline Development Area |
| kg/ha-yr | kilograms per hectare per year |
| km | kilometers |
| $L_{50}$ | median measured noise level in dBs |
| LDAR | Leak Detection and Repair |
| LOP | life of the project |
| m | meter |
| $m^3$ | cubic meters |
| MATS | Modeled Attainment Test Software |
| MBTA | Migratory Bird Treaty Act |
| MEI | maximally-exposed-individual |
| MLA | Mineral Leasing Act |
| MLE | most-likely-exposure |
| MLRA | Major Land Resource Area |
| MMBtu | million British thermal units |
| MMT | million metric tons |
| MOU | Memorandum of Understanding |
| mph | miles per hour |
| N | nitrogen |
| $N_2O$ | nitrous oxide |
| N/ha-yr | nitrogen per hectare per year |
| NAAQS | National Ambient Air Quality Standards |
| NADP | National Acid Deposition Program |
| NASA | National Aeronautics and Space Administration |
| NC | Non-Contributing |
| NCA | U.S. National Climate Assessment |
| Ncore | North Cheyenne Soccer Complex |
| NE | Not Eligible |
| NEPA | National Environmental Policy Act |
| NESHAPS | National Emission Standards for Hazardous Air Pollutants |
| NI | not impacted |
| $NO_2$ | nitrogen dioxide |
| NOx | nitrogen oxides |
| NOAA | National Oceanic and Atmospheric Administration |
| NP | not present |
| NPS | National Park Service |
| NRCS | Natural Resources Conservation Service |
| NRHP | National Register of Historic Places |
| NSPS | New Source Performance Standards |
| NSR | New Source Review |
| NTN | National Trends Network |
| $O_3$ | ozone |
| OHV | off-highway vehicle |
| Operators | Jonah Energy LLC and LINN Operating, Inc. |
| P-BACT | Presumptive BACT |
| PA | Programmatic Agreement |
| PAPA | Pinedale Anticline Project Area |
| PFO | Pinedale Field Office |
| PFYC | Potential Fossil Yield Classification |
| PGM | photochemical grid model |

| | |
|---|---|
| PHMA | Priority Habitat Management Area |
| PI | potentially impacted |
| PM | particulate matter |
| $PM_{2.5}$ | particulate matter greater than 2.5 microns in effective diameter |
| $PM_{10}$ | particulate matter greater than 10 microns in effective diameter |
| PND | Pinedale station |
| ppb | parts per billion |
| ppm | parts per million |
| Project | Jonah YRD Project |
| PRPA | Paleontological Resources Preservation Act |
| PSD | Prevention of Significant Deterioration |
| RCRA | Resource Conservation and Recovery Act |
| REA | Rapid Ecoregional Assessment |
| RELs | Reference Exposure Levels |
| RfCs | Reference Concentrations for Chronic Inhalation |
| RFD | reasonably foreseeable development |
| RHR | Regional Haze Rule |
| RMP | Resource Management Plan |
| ROD | Record of Decision |
| S | sulfur |
| SCR | Selective Catalytic Reduction |
| SDF | Sand Draw Federal |
| SFAs | Sagebrush Focal Areas |
| SHB | Stud Horse Butte |
| SI | spark ignition |
| Simops | simultaneous operations |
| SIP | State Implementation Plan |
| $SO_2$ | sulfur dioxide |
| $SO_4$ | sulfate |
| SPCC | Spill Prevention Control and Countermeasure |
| TCP | Traditional Cultural Properties |
| TIP | Tribal Implementation Plan |
| tpy | tons per year |
| UGRB | Upper Green River Basin |
| Uneval | unevaluated |
| USC | United States Code |
| USDA | United States Department of Agriculture |
| USGS | U.S. Geological Survey |
| VIEWS | Visibility Information Exchange Web System |
| VOCs | volatile organic compounds |
| VRM | visual resource management |
| WAAQS | Wyoming Ambient Air Quality Standards |
| WAQSR | Wyoming Air Quality Standards and Regulations |
| WDEQ | Wyoming Department of Environmental Quality |
| WGFD | Wyoming Game and Fish Department |
| WLCI | Wyoming Landscape Conservation Initiative |
| WMMM | Wildlife Monitoring and Mitigation Matrix |
| WRCC | Western Regional Climate Center |
| WYCRO | Wyoming Cultural Records Office |
| WYNDD | Wyoming Natural Diversity Database |
| YRD | Year-Round Development |

# 1.0 INTRODUCTION

**Applicant:** Jonah Energy LLC

Leases: WYW-118154, WYW-107040, WYW-144998, WYW 126677, WYW 128703, WYW-160395
Natural Gas Wells: Stud Horse Butte (SHB) 18-14 well pad: 84-14, 91-14, 83-14, 18-14
SHB 214-9 well pad: 214-09, 215-09B, 215-09C, 216-09, 213-09A
Cabrito (Cab) 71-19 well pad: 122-19, 126-19, 125-19X, 71-19
SHB 208-13 well pad: 209-13A, 209-13B, 209-13C
SHB 34-14 well pad: 207-14B, 94-14, 34-14
SHB 77-04 well pad: 61-04, 67-04, 78-04, 202-09
SHB 36-14 well pad: 90X-14, 204-14, 208-14, 207-14A, 36-14
SHB 18-09 well pad: 204-09, 95-09, 90X-09, 19-09, 91-09, 91X-09, 92-09, 18-09
SHB 218-11 well pad: 219-11C, 218-11, 223-11
SHB 14-04 well pad: 114-04, 60-04, 69-04
SHB 73-04 well pad: 74-04, 125-04, 203-09B, 122-04
SHB 17-08 well pad: 206-08, 205-08, 17-08, 81-08
SHB 20-10 well pad: 20-10, 201-10B
SHB 203-15B well pad: 203-15B, 203-15C, 222-10, 220-10, 216-10
SHB 33-10 well pad: 206-10
SHB 17-10 well pad: 83-10, 18-10, 201-10C, 91-10, 91X-10, 30-10, 31-10
SHB 57-11 well pad: 57-11, 218-10, 71-11, 72-11, 221-11A

**Applicant:** LINN Operating, Inc.

Leases: WYW 12677, WYW 128703, WYW 118154, WYW 130317
Natural Gas Wells: Cabrito 15-13 well pad: Cab 13n1, Cab 13o2, Cab13o3, Cab 13p2
Cabrito 13-13 well pad: SHB13k4, SHB13k6, Cab13L1, Cab13L2, Cab13L3, Cab13L4, Cab13L5, Cab13L6, Cab13m2, Cab13m3, Cab13m4, Cab13m5, Cab13n2, Cab13n3, Cab13n4
SHB10o well pad: SHB10o2, SHB10o3, SHB10o4, SHB10o5, SHB10p1, SHB10p2, SHB10p3, SHB10p4, SHB10p5, SHB10p6
Cabrito 46-13 well pad: Cabrito Federal 35-13, Cabrito Federal 36-13, Cabrito Federal 45-13, Cabrito Federal 46-13, SHB 13b1, SHB 13b2, SHB13g5, SHB 13g6, SHB13h1, SHB13h2, SHB13h3, SHB13h4, SHB13h5, SHB13h6.
Cabrito 23-13 well pad: Cabrito Federal 23-13, Cabrito Federal 24-13, Cabrito Federal 25-13, Cabrito Federal 26-13, SHB13b3, SHB13c1, SHB13c2, SHB13c3, SHB13c4, SHB13c5, SHB13c6, SHB13d5, SHB13d6.
SHB9c well pad: SHB9c1, SHB 9c2, SHB 9c3, SHB9c5, SHB 9c6, SHB9f1, SHB9f2, SHB 9f4, SHB 9f5, SHB 9f6.
Sand Draw Federal (SDF) 61-11 well pad: SDF52-11, SDF61-11, SDF62-11, SDF11i2, SDF11i3, SFD11i4, SDF11i5, SDF11i6, SDF11j5, SDF11j6.

**Location:** Jonah Gas Field, 6th Principal Meridian, Sublette County, Wyoming (see Map 1.0-1).

| | |
|---|---|
| T. 29 N., R 107 W. | Sec. 17, 18, 19, 20, all |
| | Sec. 29 $N^1/_2N^1/_2$, $N^1/_2S^1/_2N^1/_2$ |
| | Sec. 30 $N^1/_2N^1/_2$, $N^1/_2S^1/_2N^1/_2$ |
| T. 29 N., R 108 W. | Sec. 2, 4, 9, 10, 11, 12, 13, 15, 16, all |
| | Sec. 3 $S^1/_2$, $S^1/_2N^1/_2$ |
| | Sec. 5 $E^1/_2$, $SE^1/_4$ $NW^1/_4$, $E^1/_2$ $SW^1/_4$ |
| | Sec. 8 $NE^1/_4$, $E^1/_2SE^1/_4$ |
| | Sec. 14 $N^1/_2$, $SE^1/_4$, $N^1/_2SW^1/_4$ |
| | Sec. 22 $N^1/_2$, $N^1/_2S^1/_2$, $N^1/_2S^1/_2SE^1/_4$ |
| | Sec. 25 $NE^1/_4NE^1/_4$ |

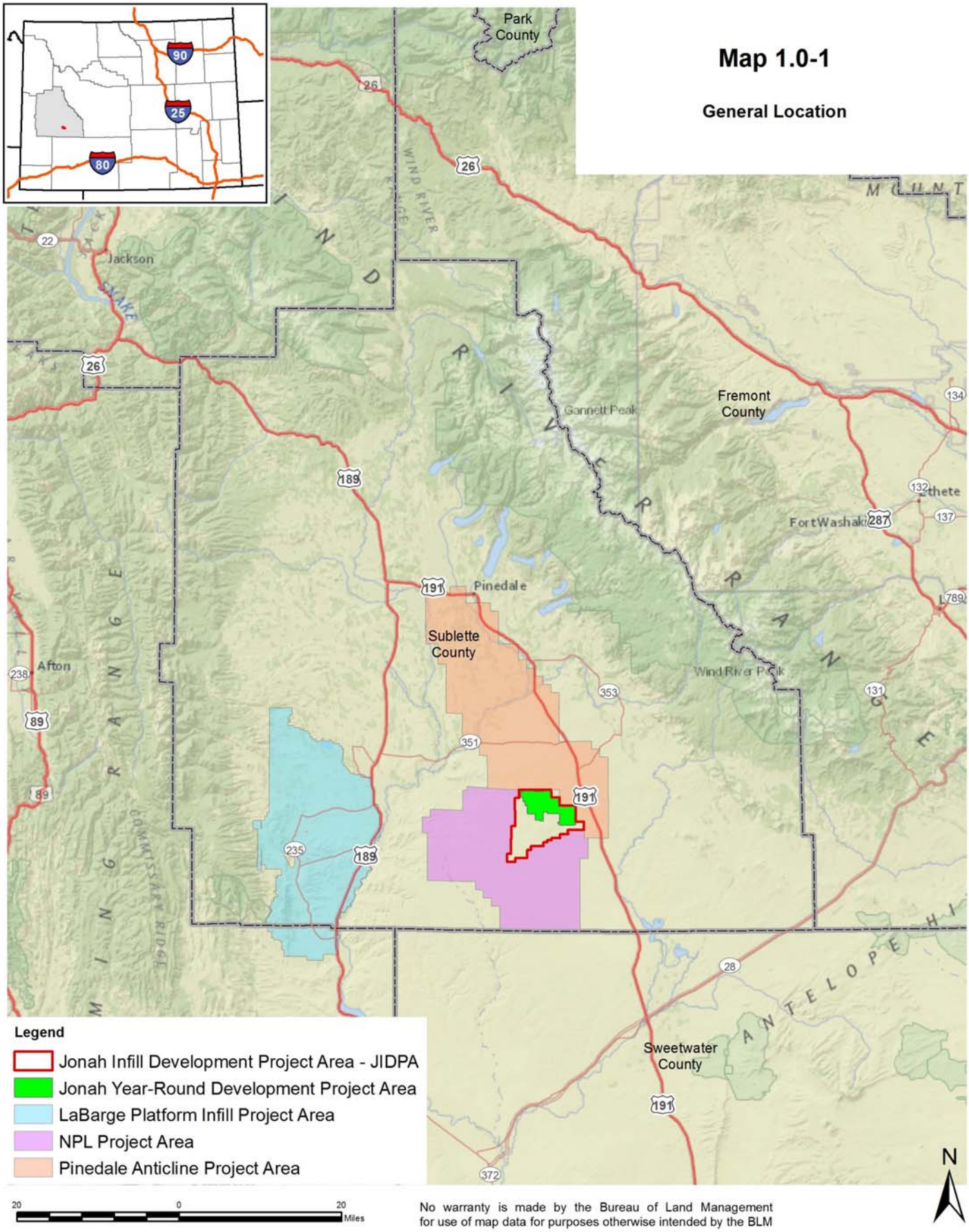
**EA Number:** WY-100-EA16-36

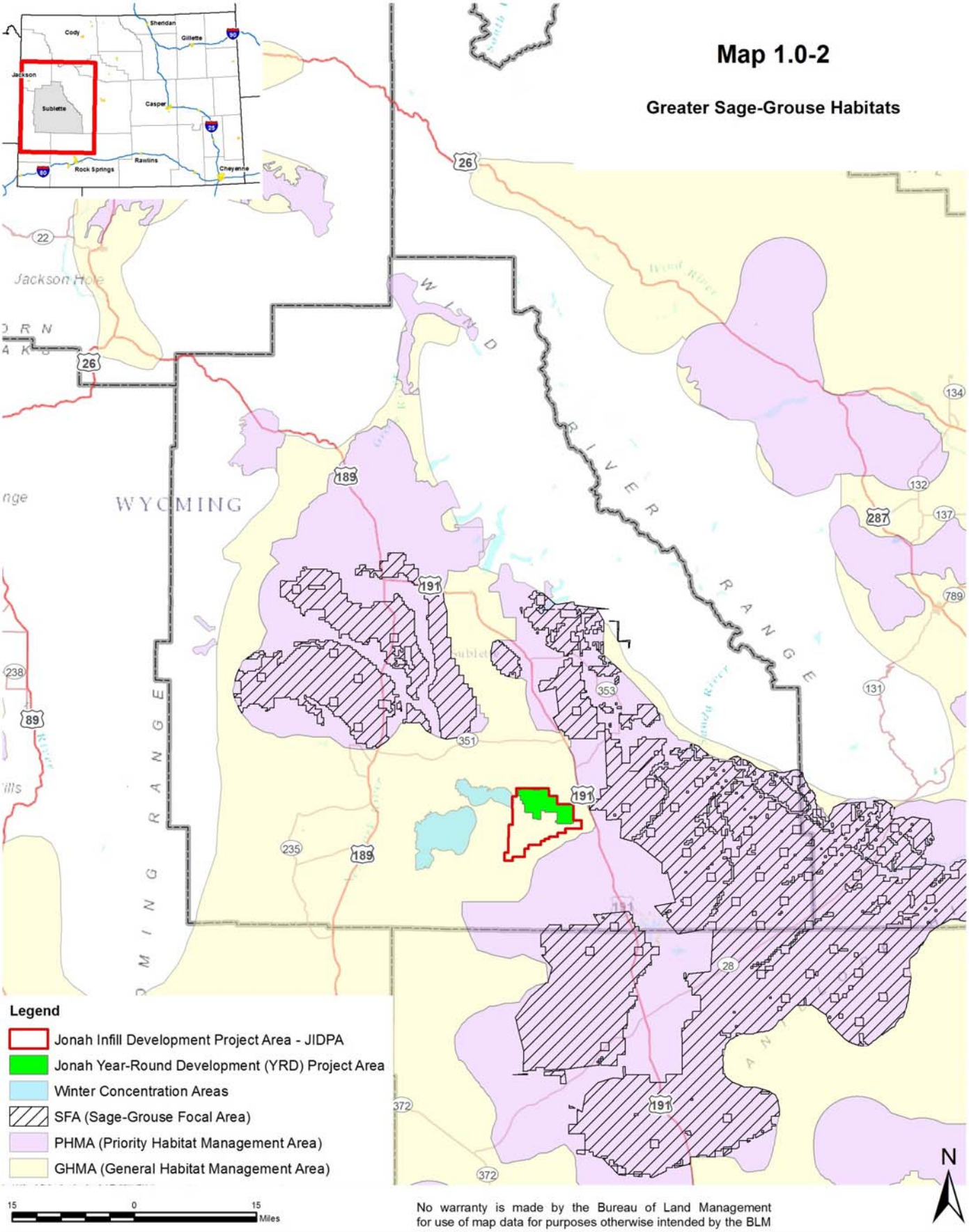
**Prepared by:** BLM Pinedale Field Office, Pinedale, Wyoming

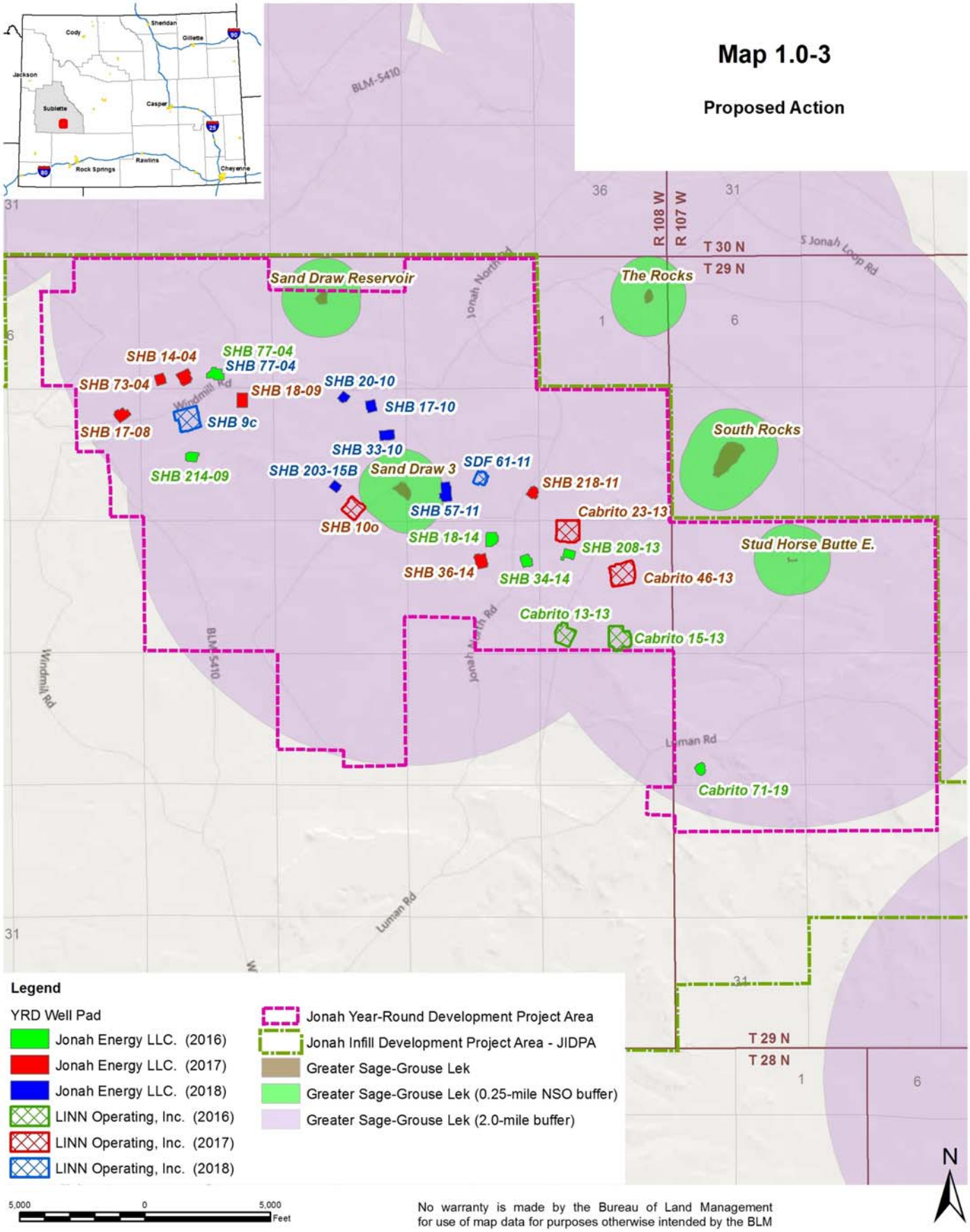
**Background:** In January 2016, Jonah Energy LLC (Jonah Energy) and LINN Operating, Inc. (LINN Operating), collectively referred to as "Operators", submitted a Plan of Development to the Bureau of Land Management (BLM) Pinedale Field Office (PFO) for year-round development. The Year-Round Development (YRD) Project Area is approximately the northern third of the Jonah Infill Drilling Project Area (JIDPA). The Plan of Development includes development of 245 wells on 24 multi-well pads (YRD Pads) and associated access roads and natural gas gathering lines over a 3 year period; although year-round development may occur over 5 years. All wells and disturbance for YRD Pads, access roads, and natural gas gathering lines are previously authorized under the Jonah Infill Drilling Project (JIDP) Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) (BLM, 2006a and BLM, 2006b).

The JIDP ROD, the Pinedale Resource Management Plan (RMP) (BLM, 2008a) as amended by the Approved RMP Amendment (ARMPA) for Greater Sage-Grouse (BLM, 2015a), and the oil and gas leases include timing limitations which would not allow development within 2 miles of a greater sage-grouse lek. Specifically, Management Decision - MD SSS 9 in the ARMPA (p. 36) prohibits surface disturbing and/or disruptive activities from March 15 to 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 of Priority Habitat Management Area (PHMA). The YRD Project Area is located outside of PHMA and is located in General Habitat Management Area (GHMA); however, the majority of the YRD Project Area is within the 2-mile buffer of occupied leks and nesting/early brood-rearing habitat (see Maps 1.0-2 and 1.0-3).

In addition, the Pinedale RMP (BLM, 2008a) includes seasonal wildlife timing limitations for all surface disturbing activity (Appendix 12, Table A12-1) for big game crucial winter ranges between November 15 and April 30. A large portion of the YRD Project Area is within Wyoming Game & Fish Department (WGFD) designated pronghorn crucial winter range (Map 3.2-1). Although some of the area has been block cleared by the BLM (2015b), some of the proposed disturbance is in an area that has not been block cleared.


Map 1.0-1
General Location
Park County
Jackson
Fremont County
Gannett Peak
Pinedale
Sublette County
Afton
Wind River Peak
Fort Washakie
Sweetwater County
Legend
Jonah Infill Development Project Area - JIDPA
Jonah Year-Round Development Project Area
LaBarge Platform Infill Project Area
NPL Project Area
Pinedale Anticline Project Area
20 0 20 Miles
N
No warranty is made by the Bureau of Land Management for use of map data for purposes otherwise intended by the BLM


Map 1.0-2
Greater Sage-Grouse Habitats
Cody
Sheridan
Gillette
Jackson
Sublette
Casper
Rawlins
Rock Springs
Cheyenne
WYOMING
Jackson Hole
WIND RIVER RANGE
WYOMING RANGE
Legend
Jonah Infill Development Project Area - JIDPA
Jonah Year-Round Development (YRD) Project Area
Winter Concentration Areas
SFA (Sage-Grouse Focal Area)
PHMA (Priority Habitat Management Area)
GHMA (General Habitat Management Area)
15 0 15 Miles
No warranty is made by the Bureau of Land Management for use of map data for purposes otherwise intended by the BLM
N


Map 1.0-3
Proposed Action
Cody
Sheridan
Gillette
Jackson
Sublette
Casper
Rawlins
Rock Springs
Cheyenne
BLM-5410
R 108 W
R 107 W
T 30 N
T 29 N
T 28 N
Sand Draw Reservoir
The Rocks
South Rocks
Stud Horse Butte E.
Jonah North Rd
S Jonah Loop Rd
Windmill Rd
Jonah Access Rd
Luman Rd
SHB 14-04
SHB 77-04
SHB 77-04
SHB 73-04
SHB 18-09
SHB 20-10
SHB 17-10
SHB 9c
SHB 17-08
SHB 33-10
SHB 214-09
SHB 203-15B
Sand Draw 3
SDF 61-11
SHB 218-11
SHB 57-11
SHB 10o
Cabrito 23-13
SHB 18-14
SHB 208-13
SHB 36-14
SHB 34-14
Cabrito 46-13
Cabrito 13-13
Cabrito 15-13
Cabrito 71-19
Legend
YRD Well Pad
Jonah Energy LLC. (2016)
Jonah Energy LLC. (2017)
Jonah Energy LLC. (2018)
LINN Operating, Inc. (2016)
LINN Operating, Inc. (2017)
LINN Operating, Inc. (2018)
Jonah Year-Round Development Project Area
Jonah Infill Development Project Area - JIDPA
Greater Sage-Grouse Lek
Greater Sage-Grouse Lek (0.25-mile NSO buffer)
Greater Sage-Grouse Lek (2.0-mile buffer)
5,000 0 5,000 Feet
N
No warranty is made by the Bureau of Land Management for use of map data for purposes otherwise intended by the BLM

Although the JIDP ROD addressed vertical wells on single-well pads, the Operators have been conducting directional drilling in the Jonah Infill Drilling Project Area (JIDPA) from multi-well pads, resulting in reduced overall surface disturbance (less acres to reclaim), reduced human presence, and reduced vehicle traffic. As development of the JIDP progresses, the potential well pad locations outside of the area where the greater sage-grouse and pronghorn timing limitation apply are being drilled out. To be able to utilize the new drilling technologies economically, the Operators are requesting to develop their leases year-round within the greater sage-grouse timing limitation period (March 15 to June 30) and within the big game crucial winter range timing limitation for pronghorn (November 15 to April 30). Adhering to the greater sage-grouse and pronghorn timing limitations would render directional drilling on multi-well pads economically infeasible because of the expenses associated with additional rig mobilizations and demobilizations that would be required on a seasonal basis. In this case, multi-well pads would take longer to reclaim.

This Environmental Assessment (EA) provides site-specific analyses of potential environmental impacts that could result from the implementation of the Proposed Action, the BLM Mitigation Alternative, and the No Action Alternative. The EA assists the BLM in the decision-making process, ensuring compliance with the National Environmental Policy Act (NEPA), and in making a determination whether any "significant" impacts could result from the analyzed actions. "Significance" as defined by NEPA is found in regulation 40 Code of Federal Regulations (CFR) 1508.27 and on page 70 of the BLM's NEPA Handbook H-1790-1 (BLM, 2008b). Significance is defined as "effects of sufficient context and intensity that an environmental impact statement is required."

An EA provides evidence for determining whether to prepare an Environmental Impact Statement (EIS) or "Finding of No Significant Impact" (FONSI). An EIS would be prepared for the Project if the decision-maker determines that this YRD Project Area has "significant" impacts following the analysis in the EA. A Decision Record (DR) could be signed for the EA approving the selected alternative if impacts would not be significant.

## 1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

**Purpose for the Proposed Action:** The purpose of the Proposed Action is to provide Jonah Energy LLC and LINN Operating, Inc., lease holders, the opportunity to develop oil and gas leases on federal mineral estate within the YRD Project Area as required in 43 CFR 3160, Onshore Orders (1-5, and 7) and the Mineral Leasing Act of 1920 (MLA), as amended and supplemented, (30 USC §181 et seq.).

Need for the Proposed Action: The need for the Proposed Action is established by the BLM's responsibility under Onshore Order No. 1 pursuant to the authority of the MLA as amended and supplemented, (30 USC §181 et seq.) and prescribed in 43 CFR Part 3160 and the Federal Land Policy Management Act (FLPMA) to respond to the Plan of Development submitted by Jonah Energy LLC and LINN Operating, Inc., to develop the proposed natural gas wells in their valid oil and gas leases.

**Decision to Be Made:** The BLM will decide, based on the analysis contained in this EA, whether to authorize the Proposed Action. If authorized, the DR associated with this EA would not constitute the final approval for all actions, such as approval for individual applications for permit to drill (APDs), rights-of-way, and Sundry Notices associated with the Proposed Action. The EA analysis would, however, provide the BLM's Authorized Officer (AO) with information that could be used to inform final approvals for individual YRD Project components such as APDs and Sundry Notices. Conditions of approval (COAs), other restrictions and required mitigation would be administered after APDs are approved.

## 1.2 PLAN CONFORMANCE

The Proposed Action is subject to and conforms to the land use plans and NEPA documents in Table 1.2-1.

**Table 1.2-1**
**Applicable Land Use Plans and NEPA Documents**

| Land Use Plan/NEPA Document | Approval Date |
|---|---|
| Record of Decision (ROD) and Approved Resource Management Plan Amendment (ARMPA) for the Rocky Mountain Region, Including Greater Sage-Grouse Sub-Regions of Lewiston North Dakota, Northwest Colorado, Wyoming, Bureau of Land Management | 9/21/15 |
| Pinedale Resource Management Plan (RMP)/Environmental Impact Statement (EIS) and ROD | 11/26/08 |
| Jonah Infill Drilling Project FEIS ROD | 3/14/06 |
| Jonah II EIS ROD | 4/27/98 |
| Modified Jonah II EA WY-100-EA00-171 | 6/9/00 |
| Continental Divide-Creston Draft EIS (CD-C) | 7/14 |

The RMP for the BLM PFO has been amended by the ARMPA. This EA is tiered to the Pinedale RMP ROD (as amended by the ARMPA) and NEPA documents listed above in Table 1.2-1. Effects similar to those analyzed in previous NEPA documents are referenced in Chapter 3.

The Pinedale RMP ROD (as amended) was reviewed and the Proposed Action, as mitigated, conforms to the Pinedale RMP ROD's terms and conditions as required by 43 CFR 1610.5-3. The Pinedale RMP ROD states, "Existing oil and gas or other mineral lease rights will be honored. When an oil and gas lease is issued, it constitutes a valid existing right; BLM cannot unilaterally change the terms and conditions of the lease. Existing leases will not be affected by new closures and/or areas administratively unavailable for lease, and restrictions cannot be added to existing leases. Surface use and timing restrictions resulting from this RMP cannot be applied to existing leases. Existing leases will not be terminated until the lease expires. However, based on site- or project-specific environmental analysis, COAs could be applied at the APD and Sundry Notice stages and subsequent development stages to mitigate potential impacts from oil and gas operations within existing lease areas, provided the leaseholder's right to develop the lease remains intact."

The Proposed Action is within the valid and existing oil and gas leases. The MLA conveyed unto the federal government the authority to issue leases for oil and gas, as well as other mineral resources. The leases were issued under this authority. The lessee has the right to explore for and extract the oil and gas resources contained on and under the surface of the lease area via federal regulations promulgated from the MLA. Specifically, 43 CFR 3101.1-2 states, "A lessee shall have the right to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all of the leased resource in a leasehold…" Consistent with these rights, the lessee has submitted a Plan of Development and will submit APDs, to develop the proposed natural gas wells. Any hydrocarbon product derived from this action would help meet the American public's demand for the product.

The Jonah Field is identified in the Pinedale RMP as an "Intensively Developed Field"; thus, the objective for these areas is to: Make federal lands and minerals within existing oil and gas fields (175,040 acres) available for intensive oil and gas leasing, exploration, development, and production (Map 2-9, BLM, 2008a). The Pinedale RMP also allows the BLM to grant exceptions to wildlife timing limitations in Intensively Developed Fields under certain circumstances.

Under the exception process set forth in the Pinedale RMP, if an exception to lease stipulation, COA, or operating standard is requested and before an exception may be granted, the lessee/permittee shall demonstrate to the satisfaction of the BLM AO that implementation of the lease stipulation, COA, or operating standard: (1) is not technically feasible, (2) is economically prohibitive, or (3) an environmentally preferred alternative is available. The lessee/permittee must also show that the proposed alternative fully satisfies the objective/outcome of the lease stipulation, COA, or operating standard (Pinedale RMP ROD, Appendix 3, page 3-3).

Exceptions to the following wildlife timing limitations would be required for the Proposed Action and the BLM Mitigation Alternative described in Sections 2.1 and 2.2, respectively:

- MD SSS 9 in the ARMPA prohibits surface disturbing and/or disruptive activities from March 15 to 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 of PHMA (ARMPA, p. 36).
- Activities or surface use are not allowed from November 15 through April 30 for the protection of big game crucial winter habitat (Pinedale RMP Appendix 12, Table A12-1).

Best Management Practices (BMPs), COAs, and other measures would be applied to activities associated with the Proposed Action where necessary to mitigate impacts on sensitive habitats and other resources (Appendices 3 and 5, BLM, 2008a) to the extent possible and practicable in coordination with cooperating agencies and in consideration of resource objectives.

## 1.3 PROPOSED PROJECT CONFORMANCE WITH THE JIDP ROD FOR COMPLETE FIELD DEVELOPMENT

Prior to the JIDP ROD (March 2006), 726 wells were drilled in the JIDPA. Since the JIDP ROD, a total of 1,388 wells have been drilled in the JIDPA. Approximately 7,000 acres have been disturbed in the JIDPA of which 5,070 are in reclamation status. The Proposed Action would not cause field-wide totals to exceed the maximum number of authorized wells (3,600) and would not exceed the maximum limit of 14,030 acres, at any given time, set forth in the JIDP ROD (Appendix A, page A-1).

The U.S. Fish and Wildlife Service (FWS) Final Biological Opinion (Appendix D to the JIDP ROD) included an average annual depletion of 1,006.7 acre-feet per year with a total depletion of 12,483 acre-feet over the 12.4-year life of the project. To date (through 2015), total depletion is about 6,000 acre-feet. Estimated average annual depletion for the YRD Project is 734 acre-feet per year. The estimated average annual depletion of 734 acre-feet per year (3,670 acre-feet for 5 years) added to the total depletion through 2015 (6,000 acre-feet) would not exceed the 12,483 acre-feet total included in the FWS Final Biological Opinion.

## 1.4 SCOPING AND ISSUES

The BLM completed extensive external scoping for the JIDP FEIS. The Proposed Action does not entirely fall within the scope of that analysis, and therefore, additional public scoping was conducted. The EA was made available for the public to comment for 15 days beginning on February 8, 2016 and ending February 22, 2016. A total of 25 comments were received. Seventeen of the comments noted general support for the Project including the Wyoming Governor Mead, Wyoming Legislators, WGFD, National Wildlife Federation and Wyoming Wildlife Federation, Coalition of Local Governments, Sublette County and several from businesses and industry. The Wyoming Department of Agriculture and Eastfork Livestock

Company asked that the BLM coordinate with livestock grazing permittees and questioned fencing requirements. Two comments were neutral but were concerned with the level of protection that would be applied for the greater sage-grouse. Six comments opposed approval of the Project with concerns focused on potential impacts from exceptions to timing limitations for greater sage-grouse and wintering pronghorn as well as for air quality. The BLM reviewed the comments and, where appropriate, provided responses (Attachment A to this EA) and incorporated responses into the EA.

Internally, the BLM interdisciplinary team (ID team) reviewed the Plan of Development and YRD Pad locations to identify potentially affected resources and land uses. Chapter 3 of this EA identifies those resources and land uses present and affected by the Proposed Action. Those resources and land uses that are either not present, not affected, or were adequately covered by the Pinedale RMP, the ARMPA, and the NEPA documents listed in Table 1.2-1 are not discussed in this EA.

The ID team identified issues for the affected resources to further focus the analysis. This EA addresses those site-specific impacts that were not disclosed within the Pinedale RMP, the ARMPA, and the NEPA documents listed in Table 1.2-1 that would help in making a reasonable decision or may be related to a potentially significant effect. Issues for this project include:

- Air Quality and Climate: the Operators propose multi-well pad drilling and operation which was not considered in the JIDP FEIS analysis. In addition, there are new ambient air quality standards (e.g., 1-hour $NO_2$ and $SO_2$ National Ambient Air Quality Standards - NAAQS/Wyoming Ambient Air Quality Standards - WAAQS) and revised NAAQS and WAAQS (e.g., for ozone and $PM_{2.5}$) since the JIPD ROD was issued. The YRD Project Area is located within the Upper Green River Basin (UGRB) nonattainment area, and, therefore, the BLM must complete a conformity determination before authorizing any action.
- Light: effects from 24-7 bright lighting of drilling rigs and accessory pad lighting during drilling and completion was noted, however, there is no official guidance in the Pinedale RMP and ARMPA to address this issue.
- Paleontological: Fossils could exist within the YRD Project Area.
- Cultural: Eligible and unknown discoveries could exist within the YRD Project Area.
- Native American Religious Concerns: Native American sensitive sites could be affected.
- Livestock: Acreage temporarily lost for grazing. Mortality could occur due to vehicular collisions and exposure to oil and gas contaminants. Benefits to livestock in increase quality and quantity of available forage could occur.
- Soils and Vegetation: The proposed development could affect site-stability and reclamation potential. Undesirable, invasive and noxious weed species may appear after surface disturbance has occurred.
- Wildlife: General wildlife habitat loss and displacement from preferred habitat would occur. Wildlife mortality could occur due to vehicular collisions, exposure to oil and gas contaminants and artificial perches (oil and gas facilities). Potential impacts to greater sage-grouse could occur as a result of project development during the timing limitation period specified in the ARMPA (March 15 to July 15) and specifically from noise during the nesting season (March 1 to May 15). Potential impacts to pronghorn in crucial winter range could occur in areas that are not currently block cleared (3,937 acres in the YRD Project Area are block cleared and 2,337 acres are not block cleared).

# 2.0 PROPOSED ACTION AND ALTERNATIVES

## 2.1 PROPOSED ACTION

Under the Proposed Action, development would occur as authorized under the JIDP ROD (BLM, 2006b) with the exception that development would occur during seasonal timing limitations for greater sage-grouse in nesting and early brood-rearing habitats and pronghorn crucial winter range. Development procedures under the Proposed Action are described in the following documents:

- Operator-Committed Practices (Appendix B of the JIDP ROD - Attachment B to this EA); and
- JIDP Development Procedures Technical Support Document (Appendix B to the JIDP FEIS, Volume 2) including the Transportation Plan (Subappendix DP-A), Reclamation Plan (Subappendix DP-B), and Hazardous Materials Management Summary (Subappendix DP-C).

With the exception of seasonal timing limitations for greater sage-grouse and pronghorn crucial winter range, the following administrative requirements, COAs, and mitigation would apply under this alternative:

- JIDP Administrative Requirements, Conditions of Approval, and Mitigation (Appendix A to the JIDP ROD - Attachment C to this EA);
- Adaptive Management in the JIDPA (Appendix C to the JIDP ROD - Attachment D to this EA);
- Mitigation Guidelines and Operating Standards Applied to Surface Disturbing and Disruptive Activities (Appendix 3 to the Pinedale RMP - Attachment E to this EA);
- Seasonal Wildlife Stipulations for All Surface Disturbing Activities (Appendix 12 to the Pinedale RMP – Attachment F to this EA); and
- Management Decisions in the ARMPA.

The Operators propose to conduct year-round development for about 5 years in the northern portion of the JIDPA within the YRD Project Area (see Map 1.0-3) within the area where timing limitations for greater sage-grouse nesting and early brood-rearing habitats (March 15 to June 30) and pronghorn crucial winter range (November 15 to April 30) would normally apply. The Operators have identified 24 YRD Pads from which year-round development would occur. A total of 245 wells would be drilled and completed year-round (both within the timing limitation period and outside of the timing limitation period). The Operators estimate that 146 wells would be drilled within the greater sage-grouse timing limitation period and 99 wells would be drilled outside of the greater sage-grouse timing limitation period on the identified YRD Pads during the first 3 years of YRD development. Surface disturbance for YRD Pads, access roads, and natural gas gathering lines and the proposed wells is authorized under the JIDP ROD (BLM, 2006b). Disturbance would mostly occur outside of the timing limitation period for greater sage-grouse (before March 15 or after June 30).

Table 2.1-1 provides a comparison of development as authorized under the JIDP ROD to development under the YRD Project.

**Table 2.1-1**
**Disturbance Estimates for Year-Round Development**
**Compared to Authorization under the JIDP ROD**

| Project Component | As Authorized Under the JIDP ROD | Year-Round Development Project |
|---|---|---|
| Wells | 245 | 245 |
| Well Pads | 245 | 24 |
| Average Disturbance per Well on Well Pad (approximate acres) | 4.0 | 0.79 |
| Temporary Disturbance (approximate acres) | 1,314 | 228 |
| Long-Term Disturbance ( approximate acres) | 323 | 49 |
| Duration of Development (months) | 49.5 | 36 |
| Worker Days Rig Mobilization/Demobilization | 18,375 | 1,800 |
| Worker Days Reclamation | 12,250 | 1,200 |

### 2.1.1 SURFACE DISTURBANCE BY WELLFIELD COMPONENT

Surface disturbance for YRD Pads, access roads, and natural gas gathering lines is presented in Table 2.1-2; however, surface disturbance for YRD Pads, access roads, and the majority of the natural gas gathering lines would occur outside of the greater sage-grouse timing limitation period. Other than a minimal amount of natural gas gathering line installation, all construction would occur between July 1 and March 14. Estimates of surface disturbance are presented so that they can be compared to surface disturbance for the same wells as authorized under the JIDP ROD (BLM, 2006b).

### 2.1.2 CONSTRUCTION TECHNIQUES

The Operators have committed to follow the JIDP ROD, Onshore Order No. 1, the Gold Book (BLM and Forest Service, 2007) and the Wyoming BLM Reclamation Policy for the construction, maintenance and reclamation of the YRD Project Area. Typical surface use plans describing construction, drilling, completion, production and reclamation are included as Attachment G to this EA.

Well Pads

Each YRD Pad would be designed to prevent safety hazards during development while minimizing surface disturbance. The topsoil (along with vegetation) would be removed using belly scrapers and stockpiled about 10 feet high, outside the border of the YRD Pads. The depth of topsoil stripped (about 6 inches) would be determined by the Operator's reclamation specialist. Each YRD Pad would include unlined cuttings pits, used for water based drill cuttings and excess cement.

Access Roads

Topsoil would be stripped for building the access roads (about 45 feet wide and crowned and ditched, about 50 feet wide where ROWs would apply). Culverts and wing ditches could be installed to divert water off and away from the access roads. Access roads would be converted into a two-track while wells are producing and they would be fully reclaimed once the wells have been plugged and abandoned.

**Table 2.1-2**
**Proposed Well Pad Locations and Surface Disturbances**

| Proposed YRD Pad | Location | Disturbance | | |
|---|---|---|---|---|
| | | Well Pad (approximate acres) | Access Road Length (ft) Area (approximate acres)[1] | Gathering Line Length (ft) Area (approximate acres)[2] |
| **Jonah Energy Proposed YRD Pads** | | | | |
| SHB 214-09 | NE¼SW¼ Section 9, T29N, R108W | 4.54 | 159<br>0.16 | 2,654<br>1.83 |
| SHB 208-13 | SW¼NW¼ Section 13, T29N, R108W | 4.22 | 1,816<br>1.88 | 0<br>0 |
| Cab 71-19 | SW¼SW¼ Section 19, T29N, R107W | 4.05 | 170<br>0.18 | 116<br>0.08 |
| SHB 18-14 | NW¼NE¼ Section 14, T29N, R108W | 6.18 | 479<br>0.49 | 2,358<br>1.62 |
| SHB 77-04 | SW¼SE¼ Section 4, T29N, R108W | 6.47 | 675<br>0.7 | 831<br>0.57 |
| SHB 34-14 | SE¼NE¼ Section 14, T29N, R108W | 4.77 | 419<br>0.43 | 244<br>0.17 |
| SHB 36-14 | SW¼NE¼ Section 14, T29N, R108W | 6.63 | 125<br>0.13 | 53<br>0.04 |
| SHB 218-11 | SE¼SE¼ Section 11, T29N, R108W | 4.39 | 445<br>0.46 | 818<br>0.56 |
| SHB 14-04 | SE¼SW¼ Section 4, T29N, R108W | 6.78 | 1,423<br>1.47 | 683<br>0.47 |
| SHB 73-04 | SE¼SW¼ Section 4, T29N, R108W | 4.05 | 505<br>0.52 | 462<br>0.32 |
| SHB 17-08 | NE¼NE¼ Section 8, T29N, R108W | 6.13 | 410<br>0.42 | 2,061<br>1.42 |
| SHB 18-09 | NE¼NE¼ Section 9, T29N, R108W | 6.31 | 576<br>0.60 | 539<br>0.37 |
| SHB 203-15B | NW¼SW¼ Section 10, T29N, R108W | 3.49 | 419<br>0.43 | 1,944<br>1.34 |
| SHB 33-10 | SE¼NE¼ Section 10, T29N, R108W | 5.86 | 341<br>0.35 | 782<br>0.54 |
| SHB 17-10 | NW¼NE¼ Section 10, T29N, R108W | 4.61 | 374<br>0.39 | 1,089<br>0.75 |
| SHB 20-10 | NW¼NE¼ Section 10, T29N, R108W | 3.38 | 394<br>0.41 | 344<br>0.24 |
| SHB 57-11 | NW¼NE¼ Section 10, T29N, R108W | 8.12 | 157<br>0.16 | 556<br>0.38 |
| **LINN Operating Proposed YRD Pads** | | | | |
| Cabrito 15-13 | SW¼SE¼ Section 13, T29N, R108W | 10.70 | 1,502<br>1.55 | 1,487<br>1.71 |
| Cabrito 13-13 | SW¼SW¼ Section 13, T29N, R108W | 11.50 | 2,654<br>2.74 | 2,655<br>3.05 |
| SHB 10o | SW¼SE¼ Section 10, T29N, R108W | 10.70 | 905<br>0.93 | 885<br>1.02 |
| Cabrito 46-13 | SE¼NE¼ Section 13, T29N, R108W | 18.60 | 677<br>0.70 | 545<br>0.63 |
| Cabrito 23-13 | NW¼NW¼ Section 13, T29N, R108W | 17.80 | 1,070<br>1.11 | 1,080<br>1.24 |
| SHB 9c | NE¼NW¼ Section 9, T29N, R108W | 17.30 | 144<br>0.15 | 144<br>0.17 |
| SDF 61-11 | NW¼SE¼ Section 11, T29N, R108W | 18.00 | 956<br>0.99 | 951<br>1.10 |
| | **Total (approximate acres)** | 194.60 (195) | 17.35 (18) | 19.62 (20) |

[1] Based on approximate 45 foot disturbance width for road.
[2] Based on approximate 30 foot disturbance width for Jonah Energy natural gas gathering lines and approximate 50 foot disturbance width for LINN Operating natural gas gathering lines.

Natural Gas Gathering Lines

All natural gas gathering lines would be trenched, installed, and buried underground. Trenches would be about 4 feet wide by 6 feet deep and would be dug to install a 1-inch diameter fuel supply line and 4-inch diameter flow lines for each well. YRD Pads with greater than three wells would tie into an 8-inch diameter flow line at the edge of the YRD Pad. Disturbance width for the natural gas gathering lines would be about 30 to 50 feet wide. Topsoil would be handled the same as for access roads. Natural gas gathering lines would be buried as soon as possible after construction and disturbance would be reclaimed during the first appropriate growing season after installation.

Surface Fuel Lines

Jonah Energy would use drilling rigs powered by natural gas. Temporary 4-inch surface fuel lines would be used and would follow existing roads and/or approved natural gas gathering lines and hydraulic fracturing line routes as established.

### 2.1.3 DRILLING AND COMPLETION

Natural gas wells would be drilled directionally (see JIDP Development Procedures Technical Support Document – Appendix B to the JIDP FEIS, Volume 2). Drilling fluids would be water-based through the initial depths and mud-based as the well goes deeper. Drill cuttings that meet Wyoming Oil and Gas Conservation Commission's hydrocarbon standards and excess cement would be buried in the cuttings pit with at least 2 feet of clean fill material covering the pits below the bottom of the topsoil. A closed-loop drilling system would be used.

The wells would be completed through hydraulic fracturing, which forces gelled, water-based fracturing fluid(s) into the gas-bearing formation surrounding the wellbore perforations. Hydraulic fracturing equipment for the proposed natural gas wells would be located on the same well pad as the natural gas wells or on an existing nearby location. Temporary hydraulic fracturing lines (used for well completions) would be installed on the surface with no additional surface disturbance and would follow existing roads, two-tracks, and natural gas gathering lines.

The components of the water based-hydraulic fracturing fluids used may vary by Operator and may include small amounts of acid, polymers, sand or mineral grains or fibers, solvents and salts. The composition of the hydraulic fracturing fluids may be considered "proprietary." This process opens small fractures in the rock and props them open, providing pathways through which gas can move to the well perforations and up the well bore to ground surface. Hydraulic fracturing would occur at depths of roughly 8,000 feet or more. Nearly all of the hydraulic fracturing fluids injected into each well would be recovered for reuse during the flowback part of the well completion process or during early stages of well production. As the fluids flow back to the surface, the recovered hydraulic fracturing fluid(s) would be contained in tanks and when possible, its components would be cleaned and recycled for reuse on other YRD Pads. Flowback to pits is not proposed, nor would it be allowed except in emergency cases.

### 2.1.4 WATER SUPPLY

Water for drilling, completions, and operations would be obtained from existing water supply wells in the Jonah Field. It may be necessary for LINN Operating to drill an additional water supply well. Water would either be pumped through a temporary surface line (surface disturbance not required) following existing roads, two-tracks, or natural gas gathering lines or trucked to the location.

### 2.1.5 WASTE DISPOSAL AND WATER TREATMENT

Disposal of fluids used or produced from natural gas development would either injected (deep wells), treated at the Jonah Water Treatment Facility, or sent to another approved facility for

disposal. Reserve pits would not be used for produced water and other wastes. Cuttings pits would be used for water-based cuttings and excess cement.

### 2.1.6 PRODUCTION

After the wells begin producing natural gas, cathodic protection would be installed within the existing surface disturbance and would consist of an anode bed, underground cable, and solar panel. Fuel cells would replace solar panels for cathodic protection for YRD Pads with more than five wells. Each well would have a wellhead hut and a solar panel. All other production equipment would be located at centralized facilities and not on the YRD Pads. Production equipment at centralized facilities would include separators, water condensate tanks, dehydrators, and associated heaters and solar panels. LINN Operating YRD Pads would include all the production equipment discussed above for centralized facilities on each YRD Pad. The facilities left on the YRD Pad for more than 90 days would be painted using a BLM-approved color to blend with the surrounding landscape.

### 2.1.7 WEED CONTROL

The Operators would follow the Jonah Interagency Office/Pinedale Anticline Project Office's *Noxious and Invasive Weed Management Plan for Oil and Gas Development Areas*. Jonah Energy and LINN Operating would comply with the reclamation plan in the surface use plan of the submitted APDs and would follow the 2006 JIDP FEIS ROD, Gold Book (BLM and Forest Service, 2007), and the Wyoming BLM Reclamation Policy.

### 2.1.8 RECLAMATION

If reclamation is not successful, irrigation or fencing (intended to restrict or prohibit grazing) may be required. However, if reclamation continues to be unsuccessful after two or three re-establishment attempts, non-native species may be necessary to supplement the missing vegetation components. Non-native species would fill the same ecological niche and not out-compete the native species.

### 2.1.9 SCHEDULE

The Operators propose to begin year-round development in the Spring of 2016, once all approvals are obtained. It is estimated that the YRD Project would continue for 5 years.

## 2.2 BLM MITIGATION ALTERNATIVE

The BLM Mitigation Alternative was developed in order to potentially reduce the environmental impacts of the YRD Project. This alternative is similar to the Proposed Action, in that 24 YRD Pads would be developed within seasonal timing limitations for greater sage-grouse and pronghorn crucial winter range. Development procedures would be similar to those described above for the Proposed Action (Attachment B to this EA) and administrative requirements, COAs, and mitigation described under the Proposed Action would also apply (see Attachments C through F to this EA).

The number of wells developed in Year 3 of the proposed Project would be reduced from 91 under the Proposed Action to 84 under the BLM Mitigation Alternative to demonstrate that the proposed Project would conform to nonattainment requirements and would not be subject to a conformity determination. Prior to Year 3, the Operators may submit a revised emissions inventory to the BLM for evaluation and approval if they can demonstrate that the proposed Project (with 91 wells) would conform to nonattainment requirements.

To mitigate potential impacts to greater sage-grouse and wintering pronghorn, the BLM assessed locations of known greater sage-grouse strikes and known pronghorn crossing

locations and existing gates in the YRD Project Area. Based on this assessment, the BLM has identified and would require approximately 3 miles of fence to be converted to drop-down fence and installation of approximately 10 gates or crossing locations. Drop-down fences would be put up prior the beginning of the livestock season each year and would be dropped down by November 1 of each year in coordination with the livestock permittees.

To further mitigate potential impacts to greater sage-grouse, if drilling is proposed between 6 pm and 8 am from March 1 to May 15, noise mitigation would be applied to reduce noise levels to 40 dBA or below (measured at the perimeter of the Sand Draw Reservoir and South Rocks leks) at the following YRD Pads: SHB 14-04, SHB 18-09, SHB 33-10, SHB 17-10, SHB 20-10, and Cabrito 46-13. Operators may conduct additional modeling and/or noise measurement to show that noise levels do not exceed 40.0 dBA at the Sand Draw Reservoir and South Rocks greater sage-grouse leks.

If hydraulic fracturing or simultaneous operations (Simops) are proposed between 6 pm and 8 am from March 1 to May 15, noise mitigation would be applied to reduce noise levels to 40 dBA or below (measured at the perimeter of the Sand Draw Reservoir and South Rocks leks) at the following YRD Pads: SHB 214-09, SHB 208-13, SHB 18-14, SHB 77-04, SHB 34-14, SHB 218-11, SHB 14-04, SHB 73-04, SHB 17-08, SHB 18-09, SHB 203-15B, SHB 33-10, SHB 20-10, SHB 57-11, Cabrito 15-13, Cabrito 13-13, SHB 10o, Cabrito 46-13, Cabrito 23-13, SHB 9c, and SDF 61-11. Operators may conduct additional modeling and/or noise measurement to show that noise levels do not exceed 40.0 dBA at the Sand Draw Reservoir and South Rocks greater sage-grouse leks.

In addition, the BLM would require Jonah Energy and LINN Operating to work with the Pinedale Anticline operators to develop a conservation strategy for the Yellow Point Lek Complex acceptable to the BLM within 1 year.

## 2.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, development would occur as authorized under the JIDP ROD (BLM, 2006b).

Development procedures under the No Action Alternative are described in the following documents:

- Operator-Committed Practices (Appendix B of the JIDP ROD - Attachment B to this EA); and
- JIDP Development Procedures Technical Support Document (Appendix B to the JIDP FEIS, Volume 2) including the Transportation Plan (Subappendix DP-A), Reclamation Plan (Subappendix DP-B), and Hazardous Materials Management Summary (Subappendix DP-C).

The following administrative requirements, COAs, and mitigation would apply under this alternative:

- JIDP Administrative Requirements, Conditions of Approval, and Mitigation (Appendix A to the JIDP ROD - Attachment C to this EA);
- Adaptive Management in the JIDPA (Appendix C to the JIDP ROD - Attachment D to this EA);
- Mitigation Guidelines and Operating Standards Applied to Surface Disturbing and Disruptive Activities (Appendix 3 to the Pinedale RMP - Attachment E to this EA);

- Seasonal Wildlife Stipulations for All Surface Disturbing Activities (Appendix 12 to the Pinedale RMP – Attachment F to this EA); and
- Management Decisions in the ARMPA.

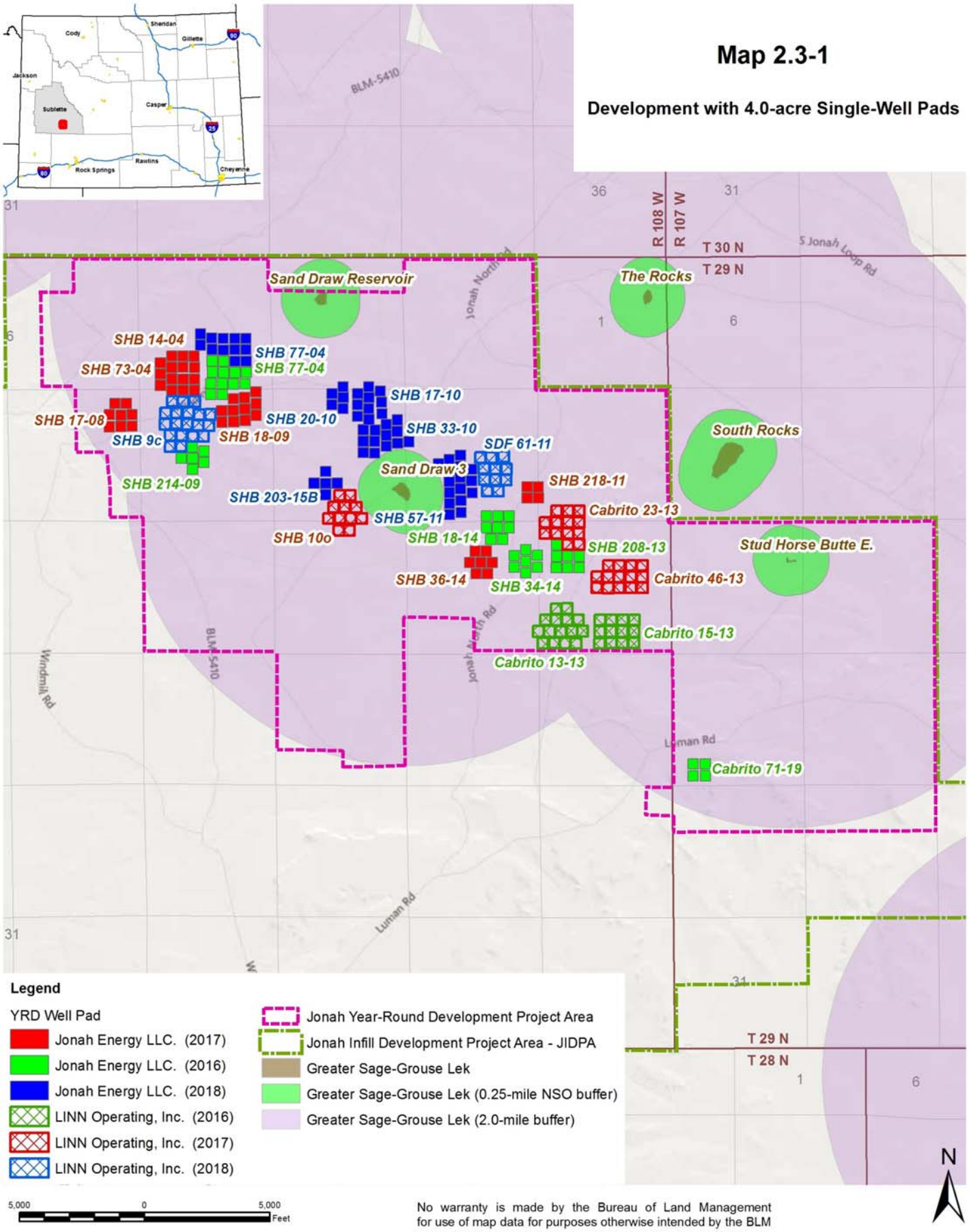
For the first 3 years, 245 wells would be developed on 245 single well pads requiring 1,314 acres of overall surface disturbance; 1,082 acres more than under the Proposed Action. Map 2.3-1 provides a depiction of the extent of single well pads required for development under this alternative. No development would occur during timing limitations for greater sage-grouse (March 15 to June 30) and for pronghorn crucial winter range in areas that are not block cleared (November 15 to April 30). For development identified for the first 3 years, the period of development would increase from 36 months to 49.5 months if seasonal timing limitations for greater-sage grouse and pronghorn apply.

For the first 3 years, construction of 245 well pads would require approximately 980 acres of temporary surface disturbance (based on 4-acre well pads analyzed in the JIDP FEIS); approximately 785 acres more than the 195 acres required for the YRD pads under the Proposed Action. Long-term disturbance for 245 single well pads would be approximately 123 acres (assuming each well pad reclaimed to 0.5 acre); well pads would be approximately 91 acres more than the approximate 32 acres of long-term disturbance required for the YRD Pads identified in the Proposed Action.

Surface disturbance required for access roads (approximately 200 acres) and natural gas gathering lines (approximately 134 acres) is approximately 297 acres more than the approximate 38 acres required for access roads (18 acres) and natural gas gathering lines (20 acres) under the Proposed Action.

Under this alternative, 75 worker days are estimated per well pad for rig mobilization/demobilization (Appendix B JIDP Development Procedures Technical Support Document) totaling to 18,375 worker days for 245 single well pads. This is 16,575 worker days more than the 1,800 worker days estimated for rig mobilization/demobilization for 24 YRD Pads under the Proposed Action.

Fifty worker days are estimated per well pad for reclamation (Appendix B JIDP Development Procedures Technical Support Document) totaling 12,250 worker days for 245 single well pads. This is 11,050 worker days more than the 1,200 worker days estimated for rig mobilization/demobilization for 24 YRD Pads under the Proposed Action.


Map 2.3-1
Development with 4.0-acre Single-Well Pads
Sheridan
Cody
Gillette
Jackson
Sublette
Casper
Rock Springs
Rawlins
Cheyenne
BLM-5410
R 108 W
R 107 W
T 30 N
T 29 N
T 29 N
T 28 N
Sand Draw Reservoir
The Rocks
South Rocks
Stud Horse Butte E.
Sand Draw 3
SHB 14-04
SHB 73-04
SHB 77-04
SHB 77-04
SHB 17-08
SHB 9c
SHB 20-10
SHB 18-09
SHB 17-10
SHB 33-10
SDF 61-11
SHB 214-09
SHB 203-15B
SHB 57-11
SHB 10o
SHB 218-11
Cabrito 23-13
SHB 18-14
SHB 208-13
SHB 36-14
SHB 34-14
Cabrito 46-13
Cabrito 15-13
Cabrito 13-13
Cabrito 71-19
Windmill Rd
Luman Rd
Legend
YRD Well Pad
Jonah Energy LLC. (2017)
Jonah Energy LLC. (2016)
Jonah Energy LLC. (2018)
LINN Operating, Inc. (2016)
LINN Operating, Inc. (2017)
LINN Operating, Inc. (2018)
Jonah Year-Round Development Project Area
Jonah Infill Development Project Area - JIDPA
Greater Sage-Grouse Lek
Greater Sage-Grouse Lek (0.25-mile NSO buffer)
Greater Sage-Grouse Lek (2.0-mile buffer)
5,000
0
5,000
Feet
N
No warranty is made by the Bureau of Land Management
for use of map data for purposes otherwise intended by the BLM

# 3.0 AFFECTED ENVIRONMENT AND EFFECTS

Refer to the affected environment chapter of the JIDP FEIS for a thorough description of the affected environment associated with the Jonah Field, which encompasses the YRD Pads. BLM Resource Specialists, experts in their respective fields, determined which resources would be brought forward for analysis by evaluating whether the resources were present within the YRD Project Area and whether the Proposed Action would impact those resources. Resources that could potentially be impacted are analyzed in this EA. Table 3.0-1 presents that resource evaluation.

**Table 3.0-1**
**Resources Considered**

| Determination | Resource | Rationale for Determination |
|---|---|---|
| **Physical Resources** | | |
| PI | Air Quality and Climate (includes Greenhouse Gases) | See Section 3.1.1 |
| PI | Soil Resources | See Section 3.1.2 |
| PI | Paleontological Resources | See Section 3.1.3 |
| PI | Water Resources | See Section 3.1.4 |
| PI | Noise and Odor | See Section 3.1.5 |
| **Biological Resources** | | |
| NP | Forests | No forests are present in the YRD Project Area. |
| NP | Floodplains | No floodplains are present in the YRD Project Area. |
| NI | Wetland and Riparian Zones | National Wetland Inventory data does not coincide with disturbance for the YRD Project. |
| PI | Invasive Non-native Species and Noxious Weeds | See Section 3.2.1 |
| PI | Vegetation | See Section 3.2.2 |
| PI | Special Status Plant Species | See Section 3.2.3 |
| PI | Special Status Animal Species | See Section 3.2.4 |
| PI | Migratory Birds | See Section 3.2.5 |
| PI | Wildlife and Fisheries | See Section 3.2.6 |
| **Heritage Resources and Human Environment** | | |
| NI | Environmental Justice | The action alternatives were reviewed in accordance with Executive Order 12898 and no impacts to minority and low-income populations are expected. |
| PI | Native American Religious Concerns | See Section 3.3.1 |
| PI | Cultural and Historical Resources | See Section 3.3.2 |
| PI | Visual Resources | See Section 3.3.3 |
| PI | Socioeconomics | See Section 3.3.4 |
| PI | Transportation and Access | See Section 3.3.5 |
| PI | Hazardous Materials | See Section 3.3.6 |
| **Land Resources** | | |
| NP | Fire and Fuels | No fuels projects are planned or proposed within the YRD Project Area. All wild land fires and fire management will be managed according to BLM protocol. |
| NP | Areas of Critical Environmental Concern (ACEC) | No ACECs are present in the YRD Project Area. |

| Determination | Resource | Rationale for Determination |
|---|---|---|
| NP | Wilderness Areas | No Wilderness Areas are present in the YRD Project Area. |
| NP | Lands with Wilderness Characteristics | Lands with Wilderness Characteristics are not present in the YRD Project Area – See Attachment H. |
| NP | Prime or Unique Farmlands | No Prime or Unique Farmlands are present in the YRD Project Area. |
| NP | Wild and Scenic Rivers | No Wild and Scenic Rivers are present in the YRD Project Area. |
| PI | Recreation | See Section 3.4.1 |
| PI | Livestock Grazing | See Section 3.4.2 |
| PI=potentially impacted, NI=not impacted, NP=not present | | |

## 3.1 PHYSICAL RESOURCES

### 3.1.1 AIR RESOURCES AND CLIMATE

#### 3.1.1.1 Current Conditions

Regional air quality is influenced by a combination of factors including climate, meteorology, the magnitude and spatial distribution of local and regional air pollution sources, and the chemical properties of emitted pollutants. Within the lower atmosphere, regional and local scale air masses interact with regional topography to influence atmospheric dispersion and transport of pollutants. The following sections summarize the climatic conditions and existing air quality within the YRD Project Area and surrounding region.

##### 3.1.1.1.1 Regional Climate

The YRD Project Area is located in a semiarid (dry and cold), mid-continental climate regime. The area is typified by dry, windy conditions with limited rainfall and long, cold winters. The nearest precipitation and temperature measurements are collected at LaBarge, Wyoming (1958–2012), approximately 20 miles southwest of the YRD Project Area at an elevation of 6,858 feet above mean sea level (WRCC - Western Regional Climate Center, 2016).

The annual average total precipitation at LaBarge is 7.9 inches, with annual totals from 3.4 inches (1975) to 17.8 inches (1995). Precipitation is greatest from spring to summer, tapering off during the fall and winter months. Annual average snow fall is 31.8 inches (annual high 49.0 inches in 2010), with the majority of the snow between October and April.

The region has cool temperatures, with an average monthly range (in degrees Fahrenheit - ˚F) between -2.4˚F and 30.1˚F in January to between 44.4˚F and 83.6˚F in July. Extreme daily temperatures have ranged from -52˚F (12/23/1990) to 96˚F (07/13/2002). The frost-free period generally occurs from May to September. Table 3.1-1 shows the mean monthly temperature ranges and total precipitation amounts.

**Table 3.1-1**
**Mean Monthly Temperature Ranges and Total Precipitation Amounts [1]**

| Month | Average Temperature Range (°F) | Total Precipitation (inches) |
|---|---|---|
| January | -2.4 – 30.1 | 0.31 |
| February | 0.2 – 33.8 | 0.36 |
| March | 13.8 – 43.2 | 0.40 |
| April | 23.5 – 53.9 | 0.78 |
| May | 31.9 – 64.3 | 1.28 |
| June | 39.1 – 73.4 | 1.03 |
| July | 44.4 – 83.6 | 0.62 |
| August | 42.5 – 81.5 | 0.89 |
| September | 33.1 – 71.0 | 0.75 |
| October | 22.8 – 59.0 | 0.63 |
| November | 10.5 – 41.5 | 0.42 |
| December | -0.9 – 30.8 | 0.47 |
| ANNUAL | 38.5 (mean) | 7.94 (mean) |

[1] WRCC, 2016.

The YRD Project Area is subject to strong and gusty winds, reflecting channeling and mountain valley flows due to complex terrain. During winter months, strong winds are often accompanied by snow, producing blizzard conditions. The closest comprehensive wind measurements are collected at the Juel Spring station, which is located approximately 18 miles north-northwest of Farson, Wyoming. The Wyoming Department of Environmental Quality (WDEQ) – Air Quality Division (AQD) has operated this station since 2009. To describe the wind flow pattern for the region, a wind rose for the Juel Spring site for years 2012 through 2014 is presented in Figure 3.1-1.

Tables 3.1-2 and 3.1-3 list the wind speed and wind direction distributions in tabular format. From this information, it is evident that the winds originate from the west to northwest over 38 percent of the time. The frequency and strength of winds greatly affect the transport and dispersion of air pollutants. The annual mean wind speed is nearly 11 miles per hour (mph), and the relatively high average wind speed indicates good dispersion and mixing of any potential pollutant emissions.

**Table 3.1-2**
**Wind Speed Distribution, Juel Spring, Wyoming, 2012–2014[1]**

| Wind Speed (mph) | Frequency (%) |
|---|---|
| 0 – 4.0 | 10.1 |
| 4.0 – 7.5 | 28.6 |
| 7.5 – 12.1 | 28.5 |
| 12.1 – 19.0 | 20.4 |
| 19.0 – 24.7 | 7.3 |
| Greater than 24.7 | 5.1 |

[1] WDEQ-AQD, 2015a.

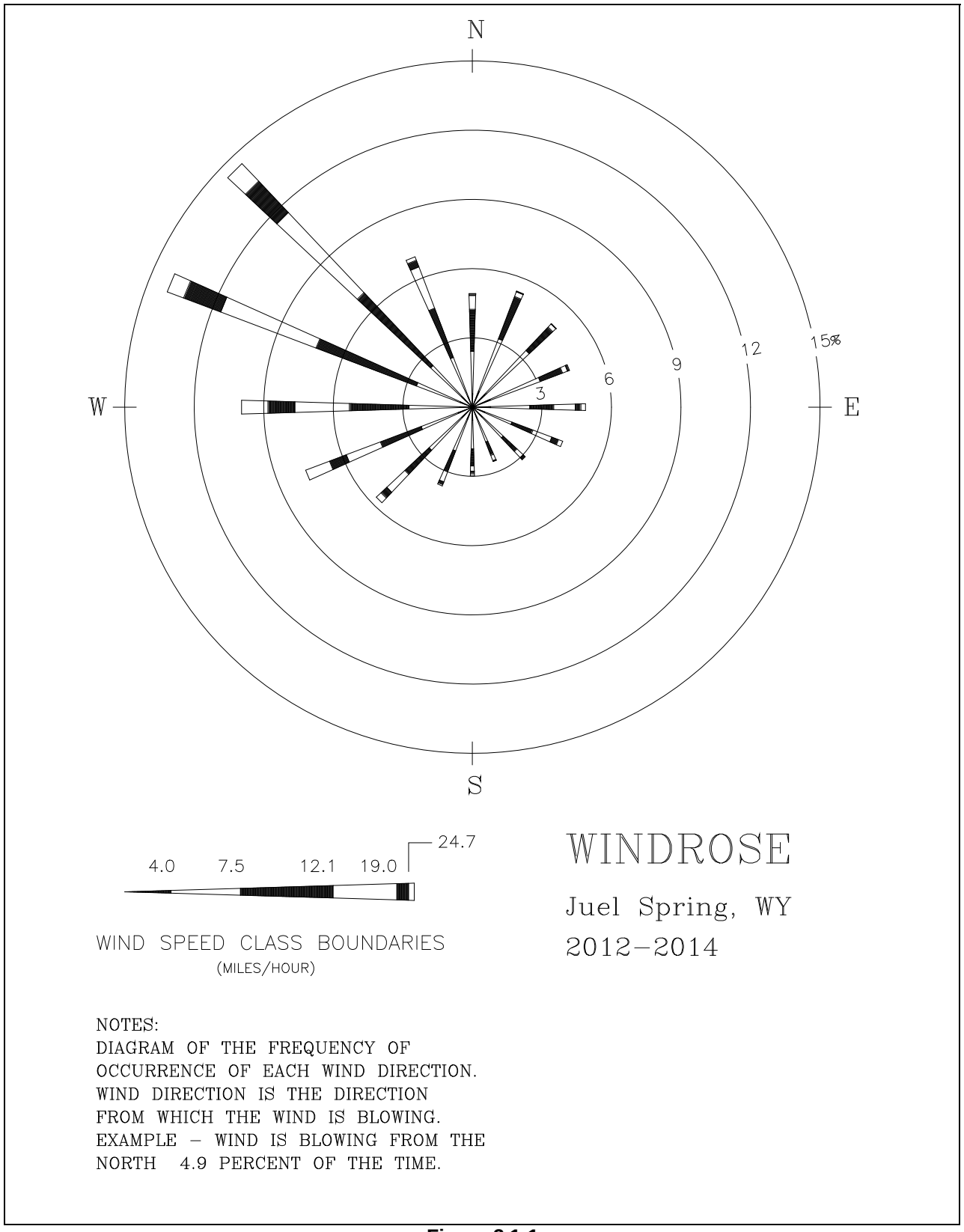



**Figure 3.1-1**
**Juel Spring, Wyoming Meteorological Data Wind Rose**

**Table 3.1-3**
**Wind Direction Frequency Distribution,**
**Juel Spring, Wyoming, 2012–2014[1]**

| Wind Direction | Frequency (%) |
|---|---|
| N | 4.9 |
| NNE | 5.4 |
| NE | 5.0 |
| ENE | 4.5 |
| E | 4.9 |
| ESE | 4.2 |
| SE | 3.1 |
| SSE | 2.5 |
| S | 3.0 |
| SSW | 3.6 |
| SW | 5.7 |
| WSW | 7.7 |
| W | 10.0 |
| WNW | 14.0 |
| NW | 14.5 |
| NNW | 7.0 |

[1] WDEQ-AQD, 2015a

#### 3.1.1.1.2 Overview of Regulatory Environment

The WDEQ–AQD is the primary air quality regulatory agency responsible for estimating impacts once detailed industrial development plans have been made. Those development plans are subject to applicable air quality laws, regulations, standards, control measures, and management practices. Unlike the conceptual 'reasonable, but conservative' engineering designs used in NEPA analyses, any WDEQ-AQD air quality preconstruction permitting demonstrations required would be based on very site-specific, detailed engineering values, which would be assessed in the permit application review. Any proposed facility which meets the requirements set forth under Wyoming Air Quality Standards and Regulations (WAQSR) Chapter 6 (WDEQ-AQD 2015b) is subject to the WDEQ-AQD permitting and compliance processes.

Federal air quality regulations adopted and enforced by WDEQ-AQD limit incremental emission increases to specific levels defined by the classification of air quality in an area. The Prevention of Significant Deterioration (PSD) Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. Incremental increases in PSD Class I areas are strictly limited, while increases allowed in Class II areas are less strict. Under the PSD program, Class I areas are protected by Federal Land Managers (FLMs) through management of air quality related values (AQRVs) such as visibility, aquatic ecosystems, flora, fauna, and others.

The 1977 Clean Air Act amendments established visibility as an AQRV for Federal Land Managers to consider. The 1990 Clean Air Act amendments contain a goal of improving visibility within PSD Class I areas. The Regional Haze Rule, finalized in 1999, requires states, in coordination with federal agencies and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment.

The JIDP ROD (BLM, 2006b), and analyses performed as part of that NEPA effort were based on regulations, standards, and guidance in place at that time. Changes in the regulatory environment have occurred since 2006 which affect Jonah Field air emissions, permit requirements, and future ambient air quality demonstrations. Some of these important changes are summarized below and each is discussed in greater detail later in this section:

- Ozone nonattainment designation of the UGRB in 2012. The designation has effected change in air pollutant emission rates in the Jonah Field through the development by WDEQ-AQD of presumptive Best Available Control Technology (BACT) and expanded permitting guidance in the UGRB, as well as prompting conformity analysis requirements;

- Ozone NAAQS change from 0.75 ppm to 0.70 parts per million (ppm) in 2015;

- Addition of 1-hour nitrogen dioxide ($NO_2$) and sulfur dioxide ($SO_2$) NAAQS in 2010;

- Revisions to Wyoming Oil and Gas Production Facilities Chapter 6, Section 2 Permitting Guidance, through 2013; and

- Finalization of New Source Performance Standards (NSPS) Subpart OOOO, Standards of Performance for Crude Oil and Natural Gas Production Sources in 2012 (and the recently 2015 Proposed NSPS Subpart OOOOa) place additional requirements on oil and gas emissions sources.

Regulations, standards, and permitting and analysis guidance relevant to the project are discussed in the remainder of this section, and include:

- NAAQS (40 CFR Part 50) and WAAQS (WAQSR Chapter 2);

- Conformity Analysis (Clean Air Act Section 176(c) and WAQSR Chapter 8);

- HAPs Analysis Requirements;

- PSD (40 CFR Part 51.166);

- NSPS (40 CFR Part 60);

- National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 63);

- Non-Road Engine Tier Standards (40 CFR Part 89);

- Permitted BACT for diesel-fired drill rig engines (WDEQ-AQD Permit CT-8122A3); and

- Wyoming Oil and Gas Permitting Guidance (supplement to WAQSR Chapter 6, Section 2).

Each of these regulations is further described in the following sections.

## Ambient Air Quality Standards

The Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set NAAQS for pollutants considered to endanger public health and the environment. The NAAQS prescribe limits on ambient levels of these pollutants in order to protect public health, including the health of sensitive groups. The EPA has developed NAAQS for six criteria pollutants: $NO_2$, carbon monoxide (CO), $SO_2$, particulate matter (PM), ozone ($O_3$), and lead. Lead emissions from project sources are negligible and therefore the lead NAAQS is not addressed in this analysis. States typically adopt the NAAQS but may also develop state-specific ambient air quality standards for certain pollutants. The NAAQS and the WAAQS are summarized in Table 3.1-4. The ambient air quality standards are shown in units of ppm, parts per billion (ppb), and micrograms per cubic meter ($\mu g/m^3$) for purposes of providing the standards as written in the corresponding regulation, and for comparison with the pollutant concentration units as provided by the air quality models used for impact analysis (Section 4.1, below).

**Table 3.1-4**
**Ambient Air Quality Standards**

| Pollutant | Averaging Time | NAAQS | | | WAAQS | | |
|---|---|---|---|---|---|---|---|
| | | (ppm) | (ppb) | ($\mu g/m^3$) | (ppm) | (ppb) | ($\mu g/m^3$) |
| Carbon monoxide | 1-hour[1] | 35 | 35,000 | 40,000 | 35 | 35,000 | 40 ($mg/m^3$) |
| | 8-hour[1] | 9 | 9,000 | 10,000 | 9 | 9,000 | 10 ($mg/m^3$) |
| Nitrogen dioxide | 1-hour[2] | 0.1 | 100 | 188 | 0.1 | 100 | 188 |
| | Annual[3] | 0.053 | 53 | 100 | 0.053 | 53 | 100 |
| Ozone | 8-hour[4] | 0.070[5] | 70 | 137 | 0.075 | 75 | 147 |
| $PM_{10}$ | 24-hour[1] | NA | NA | 150 | NA | NA | 150 |
| | Annual[3] | NA | NA | --[6] | NA | NA | 50 |
| $PM_{2.5}$ | 24-hour[7] | NA | NA | 35 | NA | NA | 35 |
| | Annual[3] | NA | NA | 12 | NA | NA | 12 |
| Sulfur dioxide | 1-hour[8] | 0.075 | 75 | 196 | 0.075 | 75 | 196 |
| | 3-hour[1] | 0.5 | 500 | 1,300 | 0.5 | 500 | 1,300 |

Note: **Bold** indicates the standard as written in the corresponding regulation. Other values are conversions.

[1] Not to be exceeded more than once per year.

[2] An area is in compliance with the standard if the 98th percentile of daily maximum 1-hour nitrogen dioxide concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.

[3] Annual arithmetic mean.

[4] An area is in compliance with the standard if the fourth-highest daily maximum 8-hour ozone concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.

[5] On October 1, 2015 the EPA revised the NAAQS for 8-hour ozone concentrations from 75 ppb to 70 ppb. The effective date of the revised NAAQS is December 28, 2015 (EPA, 2015a).

[6] The NAAQS for this averaging time for this pollutant has been revoked by EPA.

[7] An area is in compliance with the standard if the highest 24-hour $PM_{2.5}$ concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.

[8] An area is in compliance with the standard if the 99th percentile of daily maximum 1-hour sulfur dioxide concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.

An area that is shown to exceed the NAAQS for a given pollutant may be designated as a nonattainment area for that pollutant. In May 2012, the UGRB, encompassing Sublette County and parts of Lincoln and Sweetwater counties, was designated by the EPA as “marginal” non-attainment areas under the 2008 ozone standard given there were monitored ozone concentrations above the 75 ppb ozone NAAQS. The effective date of the nonattainment designation was July 20, 2012 (WDEQ-AQD, 2012). The EPA has recently proposed to determine that these areas attained the 2008 NAAQS by the applicable attainment date of July

20, 2015, based on complete, quality-assured and certified ozone monitoring data for 2012 to 2014 (EPA, 2015b).

On October 1, 2015, the EPA lowered the primary ozone NAAQS from 75 ppb to a more stringent value of 70 ppb. The EPA expects to issue detailed guidance on the designation process in early 2016, but has indicated that attainment designations for the 2015 NAAQS will be based on 2014 to 2016 data. State recommendations for designations of attainment and non-attainment areas are due to EPA by October 1, 2016 and EPA will finalize designations by October 1, 2017.

The YRD Project Area is located within the UGRB nonattainment area. Consequently, under Section 176(c) of the Clean Air Act (CAA) and WAQSR Chapter 8, a conformity analysis must be completed to determine conformity to any applicable state, tribal, or federal implementation plans (SIP, TIP, or FIP) for attaining and maintaining the NAAQS. Where actions are not specifically exempted, the BLM must complete a conformity determination before authorizing any action in a nonattainment area. Activities permitted under New Source Review (NSR) are exempt from conformity review. WAQSR Chapter 8 Section 3 establishes thresholds under which a project is presumed to conform; any conformity analysis would be conducted pursuant to BLM guidance (BLM, 2012a).

**Hazardous Air Pollutant Analysis**

Toxic air pollutants, also known as 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. No ambient air quality standards exist for HAPs; instead, emissions of these pollutants are controlled by a variety of regulations that target the specific source class and industrial sectors for stationary, mobile, and product use/formulations. Sources of HAPs from project operations include well-site production emissions (benzene, toluene, ethyl benzene, xylene, n-hexane, and formaldehyde), and drill rig engines (formaldehyde).

For the project analysis, short-term (1-hour) HAP concentrations are compared to acute Reference Exposure Levels (RELs) (EPA, 2014a) shown in Table 3.1-5. RELs are defined as concentrations at or below which no adverse health effects are expected. No RELs are available for ethyl benzene and n-hexane; instead, the available “Immediately Dangerous to Life or Health” (IDLH) values divided by 10 (IDLH/10) are used. These IDLH values were determined by the National Institute for Occupational Safety and Health and were obtained from EPA’s Air Toxics Database (EPA, 2014a). These values are approximately comparable to mild effects levels for 1-hour exposures.

Long-term exposure to HAPs is compared to Reference Concentrations for Chronic Inhalation (RfCs). An RfC is defined by the EPA as the daily inhalation concentration at which no long-term adverse health effects are expected. RfCs exist for both non-carcinogenic and carcinogenic effects on human health (EPA, 2014b). Annual modeled HAP concentrations for all HAPs emitted were compared directly to the non-carcinogenic RfCs shown in Table 3.1-6.

Long-term exposures to emissions of suspected carcinogens (benzene, ethyl benzene, and formaldehyde) are also evaluated based on estimates of the increased latent cancer risk over a 70-year lifetime.

**Table 3.1-5**
**Acute RELs (1-hour exposure)**

| HAP | REL (µg/m$^3$) |
|---|---|
| Benzene | 1,300[1] |
| Toluene | 37,000[1] |
| Ethyl Benzene | 350,000[2] |
| Xylene | 22,000[1] |
| n-Hexane | 390,000[2] |
| Formaldehyde | 55[1] |

[1] EPA Air Toxics Database, Table 2 (EPA, 2014a).
[2] No REL available for these HAPs. Values shown are IDLH (IDLH/10), EPA Air Toxics Database, Table 2 (EPA, 2014a).

**Table 3.1-6**
**Non-Carcinogenic HAP RfCs (annual average)[1]**

| HAP | Non-Carcinogenic RfC[1] (µg/m$^3$) |
|---|---|
| Benzene | 30 |
| Toluene | 5,000 |
| Ethyl Benzene | 1,000 |
| Xylenes | 100 |
| n-Hexane | 700 |
| Formaldehyde | 9.8 |

[1] EPA Air Toxics Database, Table 1 (EPA, 2014b).

## Prevention of Significant Deterioration (PSD)

The PSD Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. All areas of the country are assigned a classification which describes the degree of degradation to the existing air quality that is allowed to occur within the area under the PSD permitting rules. PSD Class I areas are areas of special national or regional natural, scenic, recreational, or historic value, and very little degradation in air quality is allowed by strictly limiting industrial growth. PSD Class II areas allow for reasonable industrial/economic expansion. Certain national parks and wilderness areas are designated as PSD Class I, and air quality in these areas is protected by allowing only slight incremental increases in pollutant concentrations. The PSD Class I area nearest to the YRD Project Area is the Bridger Wilderness Area In a PSD increment analysis, impacts from proposed emissions sources are compared with the allowable limits on increases in pollutant concentrations, which are called Class I PSD increments; these increments are shown in Table 3.1-7. The YRD Project Area is classified as PSD Class II, where less stringent limits on increases in pollutant concentrations apply.

**Table 3.1-7**
**PSD increments (µg/m$^3$)**

| Pollutant | Averaging Time | PSD Class I Increment | PSD Class II Increment |
|---|---|---|---|
| Nitrogen dioxide | 1-hour | None | None |
| | Annual | 2.5 | 25 |
| $PM_{10}$ | 24-hour | 8 | 30 |
| | Annual | 4 | 17 |
| $PM_{2.5}$ | 24-hour | 2 | 9 |
| | Annual | 1 | 4 |
| Sulfur dioxide | 1-hour | None | None |
| | 3-hour | 25 | 512 |
| | 24-hour | 5 | 91 |
| | Annual | 2 | 20 |
| Note: The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD increment consumption analysis. | | | |

Comparisons of project impacts to the PSD Class I and II increments are for informational purposes only and are intended to evaluate a threshold of concern. They do not represent a regulatory PSD Increment Consumption Analysis, which would be completed as necessary during the NSR permitting process by the State of Wyoming.

In addition to the PSD increments, Class I areas are protected by FLMs through management of AQRVs such as visibility, aquatic ecosystems, flora, and fauna. Evaluations of impacts to AQRVs would also be performed during the NSR permitting process under the direction of the WDEQ-AQD in consultation with the FLMs.

AQRVs that were identified as a concern for the YRD Project Area include visibility, atmospheric deposition, and potential sensitive lake acid neutralizing capacity. A discussion of the analysis thresholds and applicable background data is provided below.

**Visibility Thresholds**

Change in atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in The Federal Land Managers' Air Quality Related Values Work Group (FLAG) Report (FLAG, 2010), with the results reported in percent change in light extinction and change in deciviews (dv). A 5-percent change in light extinction (approximately equal to 0.5 dv) is the threshold recommended in FLAG (2010) and is considered to contribute to regional haze visibility impairment. A 10-percent change in light extinction (approximately equal to 1.0 dv) is considered to represent a noticeable change in visibility when compared to background conditions.

**Atmospheric Deposition and Lake Chemistry Thresholds**

The effects of atmospheric deposition of nitrogen and sulfur compounds on terrestrial and aquatic ecosystems are well-documented and have shown to cause leaching of nutrients from soils, acidification of surface waters, injury to high-elevation vegetation, and changes in nutrient cycling and species composition. FLAG (2010) recommends that applicable sources assess impacts of nitrogen and sulfur deposition in Class I areas.

This guidance recognizes the importance of establishing critical deposition loading values ("critical loads") for each specific Class I area as these critical loads are completely dependent on local atmospheric, aquatic, and terrestrial conditions and chemistry. Critical load thresholds are essentially a level of atmospheric pollutant deposition below which negative ecosystem effects are not likely to occur. FLAG (2010) does not include any critical load levels for specific Class I areas and refers to site-specific critical load information on FLM websites for each area of concern. This guidance does, however, recommend the use of deposition analysis thresholds (DATs) developed by the National Park Service (NPS) and the FWS. The DATs represent screening level values for nitrogen and sulfur deposition from project-alone emission sources below which estimated impacts are considered negligible. The DAT established for both nitrogen and sulfur in western Class I areas is 0.005 kilograms per hectare per year (kg/ha-yr).

In addition to the project-specific analysis, results from cumulative emission sources are compared to critical load thresholds established for the Rocky Mountain region to assess total deposition impacts. The NPS has provided recent information on nitrogen critical load values applicable for Wyoming Class I (NPS, 2014). For Class I areas in Wyoming, a critical load value of 2.2 kg/ha-yr for nitrogen deposition (estimated from a wet deposition critical load value of 1.4 kg N/ha-yr) is applicable, based on research conducted by Saros et. al. (2010) in the eastern Sierra Nevada and Greater Yellowstone ecosystems. This is a critical load value that is protective of high elevation surface waters.

For sulfur deposition, the critical load threshold published by Fox et al. (1989) for total sulfur of 5 kg/ha-yr, for the Bob Marshall Wilderness Area in Montana and Bridger Wilderness Area in Wyoming, is used as a critical load threshold from cumulative sources.

**New Source Performance Standards**

Under Section 111 of the Clean Air Act, the EPA has promulgated technology-based emissions standards which apply to specific categories of stationary sources. These standards are referred to as New Source Performance Standards (NSPS; 40 CFR Part 60). The NSPS potentially applicable to the project include the following subparts of 40 CFR Part 60:

- Subpart A – General Provisions;
- Subpart Kb – Standards of Performance for Volatile Organic Storage Vessels;
- Subpart JJJJ – Standards of Performance for Stationary Spark-Ignition Internal Combustion Engines;
- Subpart KKKK – Standards of Performance for Stationary Combustion Turbines;
- Subpart OOOO – Standards for Crude Oil and Natural Gas Production Sources; and
- Proposed Subpart OOOOa – Standards for Crude Oil and Natural Gas Production Sources.

Subpart A – General Provisions

Provisions of Subpart A apply to the owner or operator of any stationary source which contains an affected facility. The provisions apply to facilities that commenced construction or modification after the date of publication of any proposed standard. Provisions of Subpart A apply to proposed sources that are affected by NSPS.

Subpart Kb – Volatile Organic Liquid Storage Vessels

Subpart Kb applies to storage vessels with a capacity greater than or equal to 75 cubic meters ($m^3$) that are used to store volatile organic liquids for which construction, reconstruction, or

modification is commenced after July 23, 1984. This subpart is applicable to storage tanks for natural gas liquids.

Subpart JJJ – Spark Ignition Internal Combustion Engines

Subpart JJJJ establishes emission standards and compliance schedules for the control of emissions from spark ignition (SI) internal combustion engines (ICE). The rule requires new engines of various horsepower classes to meet increasingly stringent nitrogen oxides (NOx) and volatile organic compound (VOC) emission standards over the phase-in period of the regulation. Owners and operators of stationary SI ICE that commenced construction, modification, or reconstruction after June 12, 2006 are subject to this rule; standards will depend on the engine horsepower and manufacture date. This regulation applies to central compressor engines, wellhead and lateral compressor engines, and artificial lift engines as well as any other miscellaneous engines that are stationary, spark-ignited natural gas-powered engines. Therefore, provisions of Subpart JJJJ apply to proposed SI ICE sources in the YRD Project Area.

Subpart KKK – Stationary Combustion Turbines

Subpart KKKK establishes emission standards and compliance schedules for the control of emissions from stationary combustion turbines that commenced construction, modification, or reconstruction after February 18, 2005. Stationary combustion turbines with a heat input at peak load equal to or greater than 10.7 gigajoules (10 million British thermal units - MMBtu) per hour are subject to this rule. Based on the engine characteristics, any stationary combustion turbines in the YRD Project Area are affected by Subpart KKKK.

Subpart OOOO – Crude Oil and Natural Gas Production Sources

Effective October 15, 2012 with related amendments through July 31, 2015, the NSPS Subpart OOOO regulates VOC emissions from common sources in oil and gas upstream and midstream facilities that include well sites and natural gas processing plants. It also regulates sulfur dioxide emissions from sweetening units at onshore natural gas processing plants. The emission sources affected by Subpart OOOO include well completions, pneumatic controllers, equipment leaks from natural gas processing plants, sweetening units at natural gas processing plants, reciprocating compressors, centrifugal compressors and storage vessels at facilities which are constructed, modified or reconstructed after August 23, 2011. Well completions subject to Subpart OOOO are limited to hydraulic fracturing or re-fracturing completion operations at natural gas wells.

Proposed Subpart OOOOa – Crude Oil and Natural Gas Production Sources

Proposed NSPS Subpart OOOOa (EPA, 2015c) would regulate VOC and methane emissions from oil and gas upstream and midstream facilities constructed, modified, or reconstructed after the date of publication of the final rule in the Federal Register. Newly regulated emission sources would include 1) fugitive emissions from well sites and compressor stations, 2) hydraulically fractured or re-fractured oil well completions, 3) pneumatic pumps, and 4) compressors and pneumatic controllers at natural gas transmission compressor stations and gas storage facilities.

**Non-Road Engine Tier Standards**

The EPA sets emissions standards for non-road diesel engines for hydrocarbons, nitrogen dioxide, carbon monoxide, and particulate matter. The emissions standards are implemented in tiers by year, with different standards and start years for various engine power ratings. The new

standards do not apply to existing non-road equipment. Only equipment built after the start date for an engine category (1999 to 2006, depending on the category) is affected by the rule. Over the life of the project, the fleet of non-road equipment would turn over and higher-emitting engines would be replaced with lower-emitting engines. This fleet turnover is accounted for in the project emissions inventory.

**Wyoming Oil and Gas Permitting Guidance**

The YRD Project Area lies entirely within Sublette County in Wyoming and is part of the Jonah and Pinedale Anticline Development Area (JPADA), as well as within the State of Wyoming's Concentrated Development Area (CDA) and the UGRB. The YRD Project Area is subject to restrictions on emissions set forth in the WDEQ-AQD's September 2013 Oil and Gas Production Facilities Chapter 6, Section 2 Permitting Guidance (WDEQ-AQD, 2013). The Guidance states, "Presumptive BACT permitting requirements…apply to facilities with associated wells with the first date of production (FDOP) on/after November 1, 2013 and to facilities with a modification occurring on/after November 1, 2013. Startup or modification of a facility may occur prior to obtaining an Air Quality Permit or Waiver only when the Presumptive BACT permitting requirements under this Guidance are met. Otherwise, an Air Quality Permit or Waiver shall be obtained prior to start up or modification of a facility." The guidance establishes presumptive BACT requirements for emissions from the following source categories:

- Tank Flashing. VOC and HAP flashing emissions shall be controlled by at least 98%. Tanks for emergency or upset condition use are not subject to these requirements, and control devices may be removed with approval after one year if VOC flashing emissions will be less than 4 tons per year (tpy).

- Dehydration Units. All VOC and HAP emissions from dehydration unit process vents must be controlled by at least 98%. Controls may not be removed.

- Pneumatic Pumps. VOC and HAP emissions from discharge streams of all natural gas-operated pneumatic pumps shall be controlled by at least 98% or the pump discharge streams shall be routed into a closed loop system. For removable combustion units, the control method for pump emissions will be evaluated upon request for approval to remove the combustion unit.

- Pneumatic Controllers. New or modified facilities must be equipped with low- or no-bleed controllers, or controller discharge stream shall be routed to a closed loop system.

- Produced Water Tanks. VOC and HAP emissions from all active produced water tanks must be controlled by at least 98%. This does not apply to tanks used for emergency or upset conditions. Water tank emissions controls may be allowed upon approval.

- Fugitives. New and modified facilities where fugitive emissions are greater than or equal to 4 tpy of VOCs shall submit a Leak Detection and Repair (LDAR) Protocol that must be approved by the Division.

- Well Drilling/Completions. WDEQ-AQD will issue one air quality permit to each company that drills and completes wells. WDEQ-AQD air quality permit CT-8122A3 issued to Jonah Energy LLC on August 18, 2014 establishes BACT as the installation of Selective Catalytic Reduction (SCR) with 90% control efficiency and a 10 tpy NOx emission limit per drill rig (all engines).

- Blowdown/Venting. BMP and information gathering requirements will be incorporated into permits for new and modified facilities.

- Emission Sources without Presumptive BACT requirements. For uncontrolled sources emitting greater than or equal to 4 tpy VOC that do not have Presumptive-BACT (P-BACT) requirements, a BACT analysis shall be filed with the permit application for the associated facility.

**National Emission Standards for Hazardous Air Pollutants**

Under Section 112 of the Clean Air Act, the EPA has promulgated emissions standards for HAPs which apply to specific source categories. These standards are referred to as National Emission Standards for Hazardous Air Pollutants (NESHAPS) and are codified in 40 CFR 63. Applicable to this project is 40 CFR 63 Subpart HH, National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities. Subpart HH sets standards for benzene, ethyl benzene, toluene, and xylene (BTEX) at gas well facilities and natural gas processing plants. Sources regulated include existing and new, small and large glycol dehydrators at major and area sources, certain storage vessels at major sources, and compressors and ancillary equipment in VOC/HAP service at major sources.

**Greenhouse Gases and Climate Change**

Climate change is a statistically-significant and long-term change in climate patterns. The terms climate change and "global warming" are often used interchangeably, although they are not the same thing. Climate change is any deviation from the average climate, whether warming or cooling, and can result from both natural and human (anthropogenic) sources. Natural contributors to climate change include fluctuations in solar radiation, volcanic eruptions, and plate tectonics. Global warming refers to the apparent warming of climate observed since the early 20th century and is primarily attributed to human activities such as fossil fuel combustion, industrial processes, and land use changes.

The natural greenhouse effect is critical to the discussion of climate change. The greenhouse effect refers to the process by which greenhouse gases (GHGs) in the atmosphere absorb heat energy radiated by Earth's surface and re-radiate some of that heat back toward Earth, causing temperatures in the lower atmosphere and on the surface of Earth to be higher than they would be without atmospheric GHGs. These GHGs trap heat that would otherwise be radiated into space, causing Earth's atmosphere to warm and making temperatures suitable for life on Earth. Without the natural greenhouse effect, the average surface temperature of Earth would be about 0˚F. Higher concentrations of GHGs amplify the heat-trapping effect resulting in higher surface temperatures. Water vapor is the most abundant GHG, followed by carbon dioxide, methane, nitrous oxide, and several trace gases. Water vapor, which occurs naturally in the atmosphere, is often excluded from the discussion of GHGs and climate change since its atmospheric concentration is largely dependent upon temperature rather than being emitted by specific sources. Other GHGs, such as carbon dioxide and methane, occur naturally in the atmosphere and are also emitted into the atmosphere by human activities.

Atmospheric concentrations of naturally-emitted GHGs have varied for millennia and Earth's climate has fluctuated accordingly. However, since the beginning of the industrial revolution around 1750, human activities have significantly increased GHG concentrations and introduced man-made compounds that act as GHGs in the atmosphere. The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. From pre-industrial times until today, the global average concentrations of carbon dioxide, methane, and nitrous oxide in the atmosphere have increased by around 40

percent, 150 percent, and 20 percent, respectively (IPCC - Intergovernmental Panel on Climate Change, 2013).

Human activities emit billions of tons of carbon dioxide every year. Carbon dioxide is primarily emitted from fossil fuel combustion, but has a variety of other industrial sources. Methane is emitted from oil and natural gas systems, landfills, mining, agricultural activities, and waste and other industrial processes. Nitrous oxide is emitted from anthropogenic activities in the agricultural, energy-related, waste and industrial sectors. The manufacture of refrigerants and semiconductors, electrical transmission, and metal production emit a variety of trace GHGs including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These trace gases have no natural sources and come entirely from human activities. Carbon dioxide, methane, nitrous oxide, and the trace gases are considered well-mixed and long-lived GHGs.

Several gases have no direct effect on climate change, but indirectly affect the absorption of radiation by impacting the formation or destruction of GHGs. These gases include carbon monoxide, oxides of nitrogen, and non-methane VOCs. Fossil fuel combustion and industrial processes account for the majority of emissions of these indirect GHGs. Unlike other GHGs, which have atmospheric lifetimes on the order of decades, these gases are short-lived in the atmosphere.

Atmospheric aerosols, or particulate matter (PM), also contribute to climate change. Aerosols directly affect climate by scattering and absorbing radiation (aerosol-radiation interactions) and indirectly affect climate by altering cloud properties (aerosol-cloud interactions). Particles less than 10 micrometers in diameter ($PM_{10}$) typically originate from natural sources and settle out of the atmosphere in hours or days. Particles smaller than 2.5 micrometers in diameter ($PM_{2.5}$), often originate from human activities such as fossil fuel combustion. These so-called “fine” particles can exist in the atmosphere for several weeks and have local, short-term impacts on climate. Aerosols can also act as cloud condensation nuclei, the particles upon which cloud droplets form.

Light-colored particles such as sulfate aerosols, reflect and scatter incoming solar radiation, having a mild cooling effect, while dark-colored particles (often referred to as “soot” or “black carbon”) absorb radiation and have a warming effect. There is also the potential for black carbon to deposit on snow and ice, altering the surface albedo (or reflectivity), and enhancing melting. There is high confidence that aerosol effects are partially offsetting the warming effects of GHGs, but the magnitude of their effects contributes the largest uncertainly to our understanding of climate change (IPCC, 2013).

Our current understanding of the climate system comes from the cumulative results of observations, experimental research, theoretical studies, and model simulations. The IPCC Fifth Assessment Report (AR5) (IPCC, 2013) uses terms to indicate the assessed likelihood of an outcome ranging from *exceptionally unlikely* (0–1 percent probability) to *virtually certain* (99 to 100 percent probability) and level of confidence ranging from *very low* to *very high*. The findings presented in AR5 indicate that warming of the climate system is unequivocal and many of the observed changes are unprecedented over decades to millennia. It is *certain* that Global Mean Surface Temperature has increased since the late 19th century and *virtually certain* (99 to 100 percent probability) that maximum and minimum temperatures over land have increased on a global scale since 1950. The globally averaged combined land and ocean surface temperature data show a warming of 1.5°F. Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea-level rise, and in changes in some climate extremes. It is *extremely likely* (95 to 100 percent probability) that human influence has been the dominant cause of the observed warming since the mid-20th century (IPCC, 2013). Findings from AR5 and reported by

other organizations, such as the National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies (National Oceanic and Atmospheric Administration - NOAA, 2013), also indicate that changes in the climate system are not uniform and regional differences are apparent.

**National Assessment of Climate Change**

The U.S. Global Change Research Program released the third U.S. National Climate Assessment (NCA) in May 2014. The NCA summarizes the current state of knowledge on climate change and its impacts throughout the U.S. It was written by climate scientists and draws from a large body of peer-reviewed scientific research, technical reports, and other publicly available sources. The NCA documents climate change impacts that are currently occurring and those that are anticipated to occur throughout this century. It also provides region-specific impact assessments for key sectors such as energy, water, and human health.

The NCA summarizes their conclusions in a number of Key Messages (NCA, 2014a), several of which are excerpted here:

- *Global climate is changing and this change is apparent across a wide range of observations. The global warming of the past 50 years is primarily due to human activities.*
- *Global climate is projected to continue to change over this century and beyond. The magnitude of climate change beyond the next few decades depends primarily on the amount of heat-trapping gases emitted globally, and how sensitive the Earth's climate is to those emissions.*
- *U.S. average temperature has increased by 1.3°F to 1.9°F since record keeping began in 1895; most of this increase has occurred since about 1970. The most recent decade was the nation's warmest on record. Temperatures in the United States are expected to continue to rise. Because human-induced warming is superimposed on a naturally varying climate, the temperature rise has not been, and will not be, uniform or smooth across the country or over time.*
- *Average U.S. precipitation has increased since 1900, but some areas have had increases greater than the national average, and some areas have had decreases. More winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.*
- *Global sea level has risen by about 8 inches since reliable record keeping began in 1880. It is projected to rise another 1 to 4 feet by 2100.*
- *The oceans are currently absorbing about a quarter of the carbon dioxide emitted to the atmosphere annually and are becoming more acidic as a result, leading to concerns about intensifying impacts on marine ecosystems.*

The NCA provided analysis of projected climate change by region, and the YRD Project Area is part of the Great Plains Region. The Key Messages for this region (NCA, 2014b) are as follows:

- *Rising temperatures are leading to increased demand for water and energy. In parts of the region, this will constrain development, stress natural resources, and increase competition for water among communities, agriculture, energy production, and ecological needs.*

- *Changes to crop growth cycles due to warming winters and alterations in the timing and magnitude of rainfall events have already been observed; as these trends continue, they will require new agriculture and livestock management practices.*
- *Landscape fragmentation is increasing, for example, in the context of energy development activities in the northern Great Plains. A highly fragmented landscape will hinder adaptation of species when climate change alters habitat composition and timing of plant development cycles.*
- *Communities that are already the most vulnerable to weather and climate extremes will be stressed even further by more frequent extreme events occurring within an already highly variable climate system.*
- *The magnitude of expected changes will exceed those experienced in the last century. Existing adaptation and planning efforts are inadequate to respond to these projected impacts.*

**Project Greenhouse Gas Emissions and Climate Change**

GHGs projected to be emitted by project sources are carbon dioxide, methane, and nitrous oxide. In 2007, the U.S. Supreme Court ruled in *Massachusetts v. EPA* that the EPA has the authority to regulate GHGs such as methane and carbon dioxide as air pollutants under the Clean Air Act. The ruling did not, however, require the EPA to create any emission control standards or ambient air quality standards for GHGs. At present there are no ambient air quality standards for GHGs. However, NSPS currently proposed by EPA (2015b) would limit methane emissions from oil and gas emission sources and, once final, these methane emission limits would apply to the sources developed under the project. In addition there are applicable reporting requirements under the EPA's Greenhouse Gas Reporting Program. These GHG emission reporting requirements, finalized in 2010 under 40 CFR Part 98, require operators to develop and report annual methane and carbon dioxide emissions from equipment leaks and venting, and emissions of carbon dioxide, methane, and nitrous oxide from flaring, onshore production stationary and portable combustion emissions, and combustion emissions from stationary equipment.

The Council on Environmental Quality (CEQ) has developed draft guidance for federal agencies on consideration of GHGs and the effects of climate change in NEPA documents (CEQ, 2014). While the guidance provides federal agencies with significant discretion on how to consider the effects of GHG emissions and climate change in their evaluation of proposals for federal actions, it also provides an expectation of what should be considered and disclosed. Agencies are directed to consider two separate issues when addressing climate change: (1) the effects of a proposed action on climate change as indicated by its GHG emissions; and (2) the implications of climate change for the environmental effect of a proposed action. Agencies should consider the climate change effects of a proposal by comparing the GHG emissions of the proposed action and the reasonable alternatives. The effects of climate change on the proposed action and alternatives should be considered during the analysis of the affected environment. Land managers should consult the CEQ guidance for information on direct, indirect, and cumulative impact analyses, among other topics.

Renewable and nonrenewable resource management actions have the potential to impact climate change due to GHG emissions and other anthropogenic effects. However, the assessment of GHG emissions and climate change is extremely complex because of the inherent interrelationships among its sources, causation, mechanisms of action, and impacts. Emitted GHGs become well-mixed throughout the atmosphere and contribute to the global atmospheric burden of GHGs. Given the global and complex nature of climate change, it is not

possible to attribute a particular climate impact in any given region to GHG emissions from a particular source. The uncertainty in applying results from Global Climate Models to the regional or local scale (a process known as downscaling) limits our ability to quantify potential future impacts from GHGs emissions at this scale. When further information on the impacts of local emissions to climate change is known, such information would be incorporated into the BLM's planning and NEPA documents as appropriate.

The environmental impacts of GHG emissions from oil and gas refining and from consumption, such as from vehicle operations, are not effects of BLM actions related to oil and gas development as defined by the CEQ because they do not occur at the same time and place as the action. Thus, GHG emissions from refining and consumption of oil and gas do not constitute a direct effect that is analyzed under NEPA. Nor are refining and consumption an indirect effect of oil and gas production because production is not a proximate cause of GHG emissions resulting from refining and consumption. However, emissions from refining and consumption and other activities are accounted for in the cumulative effects analysis (BLM, 2014a).

#### 3.1.1.1.3 Monitored Air Pollutant Concentrations

Monitoring of air pollutant concentrations has been conducted within the project area and the study area. These monitoring sites are part of several monitoring networks overseen by state and federal agencies, including: WDEQ (State of Wyoming), Clean Air Status and Trends Network (CASTNET), Interagency Monitoring of Protected Visual Environments (IMPROVE), and the National Acid Deposition Program (NADP) National Trends Network.

Air pollutants monitored at these sites include carbon monoxide, nitrogen dioxide, ozone, $PM_{10}$, $PM_{2.5}$, and sulfur dioxide. Background concentrations of these pollutants define ambient air concentrations in the region and establish existing compliance with ambient air quality standards. The most representative monitored regional background concentrations available for criteria pollutants as identified by WDEQ–AQD, 2015c) are shown in Table 3.1-8.

#### 3.1.1.1.4 Monitored Visibility

Visibility conditions can be measured as standard visual range, the farthest distance at which an observer can just see a black object viewed against the horizon sky; the larger the standard visual range, the cleaner the air. Visibility for the region is considered to be very good. Continuous visibility-related optical background data have been collected in the PSD Class I Bridger Wilderness Area (the closest Class I area to the project area), as part of the IMPROVE program. The average standard visual range at Bridger Wilderness Areas is over 200 kilometers (Visibility Information Exchange Web System – VIEWS, 2016).

#### 3.1.1.1.5 Monitored Atmospheric Deposition

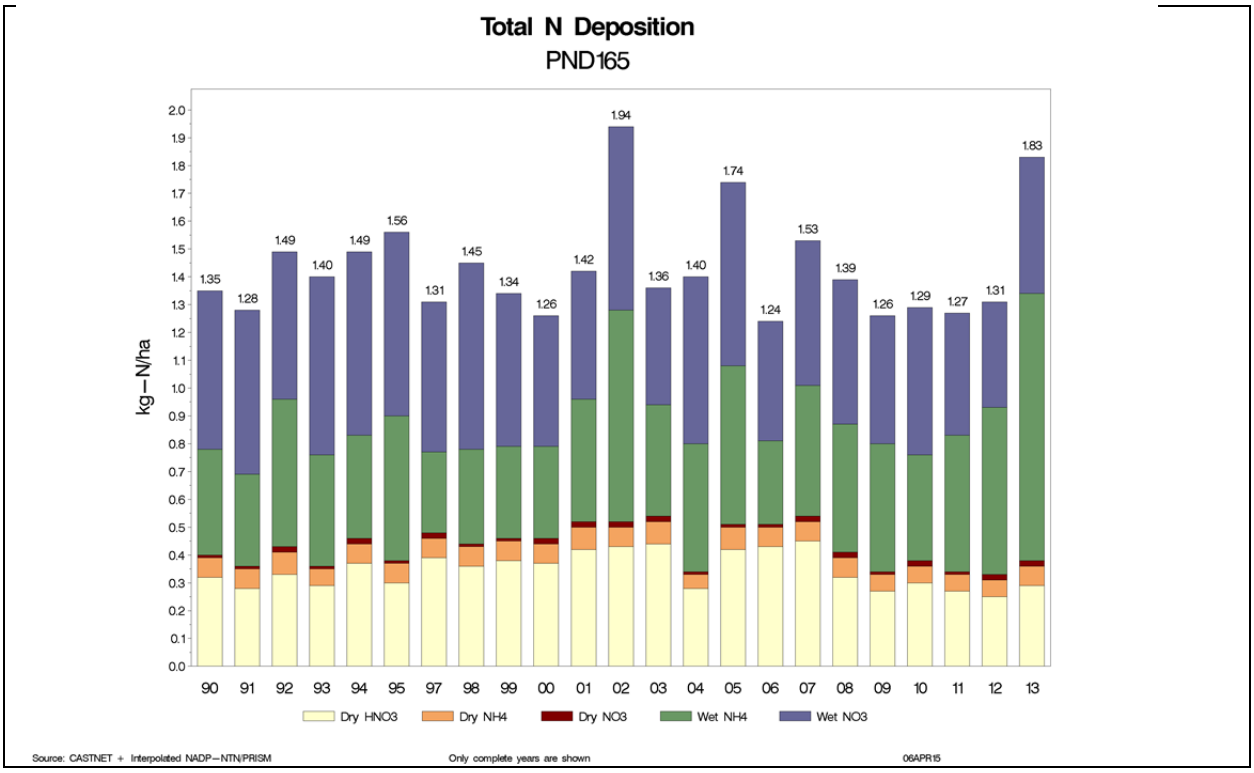
Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and it is reported as the mass of material deposited on an area per year (kg/ha-yr). Air pollutants are deposited by wet deposition (precipitation) and dry deposition (gravitational settling of pollutants). The chemical components of wet deposition include sulfate ($SO_4$), nitrate, and ammonium; the chemical components of dry deposition include sulfate, sulfur dioxide, nitrate, ammonium, and nitric acid.

The NADP and the National Trends Network (NTN) station monitors wet atmospheric deposition and the CASTNET station monitors dry atmospheric deposition at a site near Pinedale (station PND165). The total annual nitrogen and sulfur deposition (wet and dry) derived from CASTNET and NADP/NTN measurements for the monitoring period of record (1990 through 2013) are shown in Figures 3.1-2 and 3.1-3.

**Table 3.1-8**
**Background Ambient Air Quality Concentrations (µg/m$^3$)**

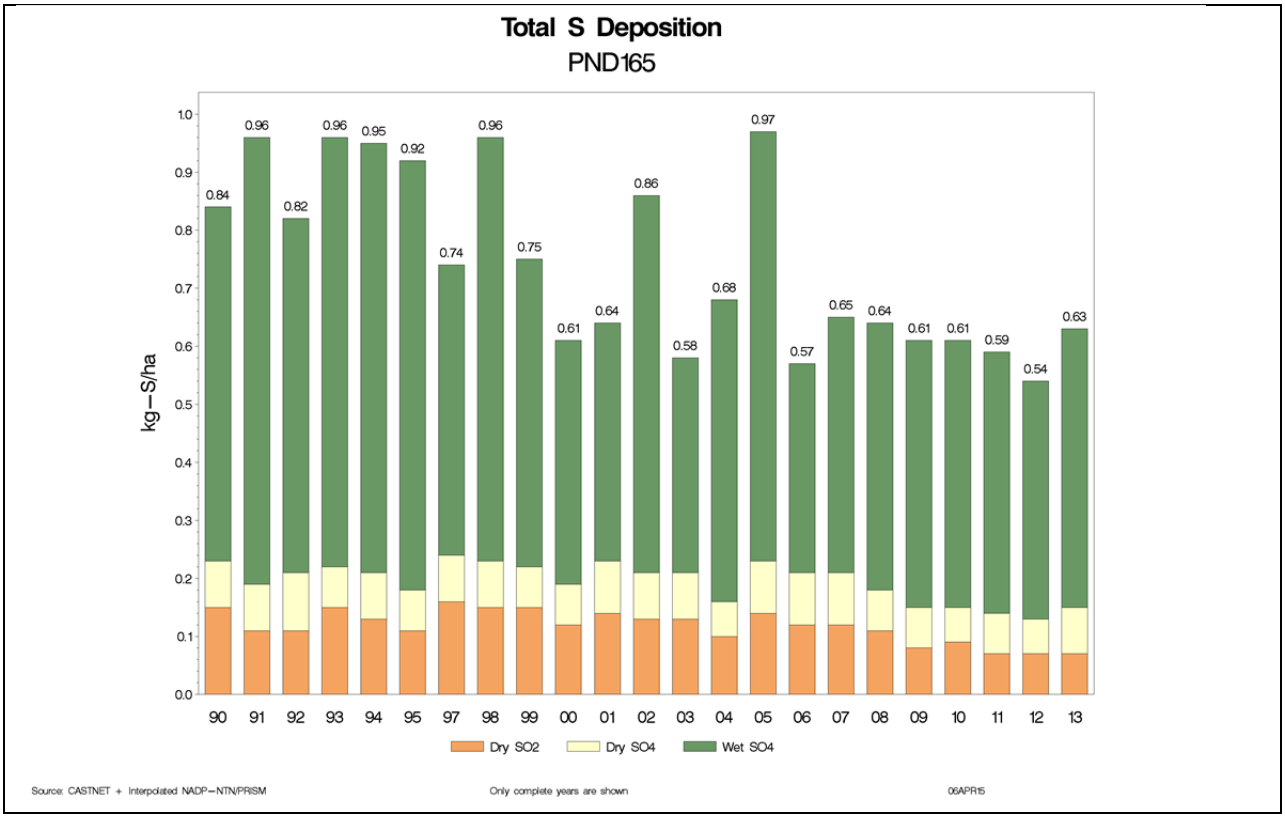
| Pollutant | Averaging Period | Measured Background Concentration |
|---|---|---|
| Carbon monoxide[1] | 1-hour<br>8-hour | 572<br>343 |
| Nitrogen dioxide[2] | 1-hour<br>Annual | 20.7<br>1.4 |
| Ozone[3] | 8-hour | 125.6 |
| $PM_{10}$[4] | 24-hour<br>Annual | 31<br>7.9 |
| $PM_{2.5}$[5] | 24-hour<br>Annual | 17.2<br>5.9 |
| Sulfur dioxide[6] | 1-hour<br>3-hour<br>24-hour<br>Annual | 15.7<br>11.4<br>2.9<br>0.8 |

[1] Data collected during 2014 at North Cheyenne Soccer Complex (Ncore), Cheyenne Wyoming; concentrations are maximum values.
[2] Data collected at Juel Spring, Wyoming: 1-hour concentration is the three year average (2012-2014) of daily maximum 98th percentile 1-hour concentrations, annual value is for 2014.
[3] Data collected at Juel Spring, Wyoming: 8-hour concentration is the three year average (2012-2014) of the fourth-highest daily maximum 8-hour concentrations.
[4] Data collected at Boulder, Wyoming during 2014, 24-hour value is maximum concentration.
[5] Data collected at Pinedale, Wyoming: 24-hour value is the three year average (2012-2014) of daily maximum 98$^{th}$ percentile 24-hour concentrations, annual value is three year average of annual means (2012-2014).
[6] Data collected at Ncore, Cheyenne Wyoming; 1-hour value is the three year average (2012-2014) of daily maximum 98th percentile 1-hour concentrations, 3-hour, 24-hour and annual concentrations were collected during 2014, 3-hour and 24-hour data are second-highest maximum values.




*Source: EPA,2016.*

**Figure 3.1-2**
**Annual Nitrogen Deposition (kg/ha-yr) at Pinedale, PND165 (1990–2013)**




*Source: EPA 2016.*

**Figure 3.1-3**
**Annual Sulfur Deposition (kg/ha-yr) at Pinedale, PND165 (1990–2013)**

### 3.1.1.2 Environmental Consequences

**Proposed Action**

An air quality modeling analysis was performed to assess the impacts on ambient air quality and AQRVs from potential air emissions due to the proposed YRD Project. All wells proposed as part of the YRD Project were analyzed as part the JIDP FEIS (BLM 2006a) and authorized under the JIDP ROD (BLM, 2006b). However, whereas analyses performed for the JIDP FEIS considered single well pad drilling and production, the Operators are currently proposing multi-well pad drilling and operation. In addition, there are new ambient air quality standards (e.g., 1-hour $NO_2$ and $SO_2$ NAAQS/WAAQS) and revised NAAQS and WAAQS (e.g., for ozone and $PM_{2.5}$) since the JIPD ROD was issued. Therefore, this air quality analysis was performed to demonstrate compliance with the new and revised NAAQS and WAAQS for operations proposed as part of the YRD Project.

Emissions inventories were developed to quantify emissions resulting from YRD Project construction and production. Air quality modeling analyses were performed to quantify potential ambient air quality impacts, within and near-by the YRD Project Area, for comparison to applicable state and federal ambient air quality standards and PSD increments. HAP concentrations were calculated for assessing impacts both in the immediate vicinity of YRD Project Area emission sources for short-term (acute) exposure assessment and for calculation of long-term risk. Pollutant impacts and AQRV impacts (impacts on visibility, atmospheric deposition and potential increases in acidification to acid-sensitive lakes) at nearby Class I and sensitive Class II areas were evaluated and compared to applicable air quality modeling assessment results that were prepared in support of the JIDP FEIS (BLM, 2006a).

**Impact Significance Criteria.** Air quality impacts from pollutant emissions are limited by regulations, standards, and implementation plans established under the federal Clean Air Act, as administered by the WDEQ-AQD under authorization of the EPA. Under FLPMA and the Clean Air Act, the BLM cannot conduct or authorize any activity which does not conform to all applicable local, state, tribal, or federal air quality laws, statutes, regulations, standards or implementation plans. As such, significant impacts to air quality from the proposed project-related activities would result if it is demonstrated that:

- NAAQS or WAAQS would be exceeded; or
- Class I or Class II PSD Increments would be exceeded; or
- AQRVs would be impacted beyond acceptable levels.

All NEPA analysis comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern, and do not represent a regulatory PSD Increment Consumption Analysis. The determination of PSD increment consumption is an air quality regulatory agency responsibility. Such an analysis would be conducted to determine minor source increment consumption or, for major sources, as part of the NSR process. The NSR process would also include an evaluation of potential impacts to AQRVs such as visibility, aquatic ecosystems, flora, fauna, etc. performed under the direction of FLMs.

**Emissions Inventory Development.** Maximum annual field-wide criteria pollutant (CO, NOx, $SO_2$, $PM_{10}$ and $PM_{2.5}$), VOC, and HAP (benzene, toluene, ethyl benzene, xylene, n-hexane, and formaldehyde) emissions were calculated for the first four years of the life of the project (LOP). The maximum field-wide emissions are expected to occur during Project Year 3, the last year with drilling occurring at a rate of 91 wells per year with 43 drilled during the greater sage-grouse timing limitation period (March 15 – June 30) and 48 drilled outside of the timing limitation period. The criteria pollutant and HAP emissions for well development and production activities in Project Year 3 are shown in Table 3.1-9, for wells developed and operated during the greater sage-grouse timing limitation period, and in Table 3.1-10 for all wells developed and operated on 24 multi-well pads. The HAP emissions include benzene, toluene, ethyl benzene, xylene, n-hexane, and formaldehyde emissions, which are; and 2.3, 4.6, 0.3, 3.3, 3.1, and 3.6 tpy, respectively for the "Wells Developed and Operated During the Greater Sage-Grouse Timing Limitation Period" scenario, and 3.9, 7.8, 0.4, 5.6, 5.3, and 8.1 tpy, respectively for the "Total Wells Developed and Operated on 24 Multi-well Pads" scenario.

**Table 3.1-9**
**Year 3 Emissions (tpy) for Wells Developed and Operated during the Greater Sage-Grouse Timing Limitation Period**

| Activity | CO | NOx | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | VOC | HAPs |
|---|---|---|---|---|---|---|---|
| **Well Pad Construction** | 21.3 | 4.4 | 1.1 | 0.3 | 0.1 | 0.3 | 0.0 |
| **Drilling** | 15.6 | 26.8 | 6.8 | 4.2 | 0.1 | 6.4 | 0.9 |
| **Completion** | 9.3 | 39.2 | 2.1 | 1.0 | 0.7 | 1.7 | 2.8 |
| **Production** | 143.9 | 72.2 | 19.8 | 6.4 | 0.1 | 186.0 | 13.5 |
| **Total** | **190.1** | **142.6** | **29.8** | **11.9** | **1.0** | **194.4** | **17.2** |

**Table 3.1-10**
**Year 3 Emissions (tpy) for Total Wells Developed and Operated on 24 Multi-Well Pads**

| Activity | CO | NOx | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | VOC | HAPs |
|---|---|---|---|---|---|---|---|
| **Well Pad Construction** | 21.3 | 4.4 | 1.1 | 0.3 | 0.1 | 0.3 | 0.0 |
| **Drilling** | 34.2 | 67.6 | 13.9 | 7.5 | 0.2 | 16.6 | 2.6 |
| **Completion** | 18.0 | 83.9 | 4.1 | 2.0 | 1.4 | 3.2 | 5.8 |
| **Production** | 241.5 | 120.8 | 33.2 | 10.8 | 0.3 | 317.1 | 22.7 |
| **Total** | **315.0** | **276.7** | **52.3** | **20.6** | **2.0** | **337.2** | **31.1** |

Greenhouse Gases. As part of the development of the project emission inventory, an inventory of carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$) emissions from field development and production was prepared. GHGs were not modeled in the impact analyses, but the GHG inventory is presented here for informational purposes and is compared to other U.S. GHG emission inventories in order to provide context for the project GHG emissions.

Emissions of the greenhouse gases $CO_2$, $CH_4$, and $N_2O$ are quantified in terms of $CO_2$ equivalents ($CO_2e$). Measuring emissions in terms of $CO_2e$ allows for the comparison of emissions from different greenhouse gases based on their Global Warming Potential (GWP). GWP is defined as the cumulative radiative forcing of a gas over a specified time horizon relative to a reference gas resulting from the emission of a unit mass of gas. The reference gas is taken to be $CO_2$. The $CO_2e$ emissions for a greenhouse gas are derived by multiplying the emissions of the gas by the associated GWP. The GWPs for the inventoried greenhouse gases are $CO_2$:1, $CH_4$:21, $N_2O$:310 (EPA, 2011). Maximum GHG emissions are expected to occur in Project Year 3. Greenhouse gas emissions for construction and production activities for project year 3 are shown in Table 3.1-11.

**Table 3.1-11**
**Jonah YRD Project Year 3 GHG ($CO_2e$) Emissions (metric tons per year)**

| Scenario | Construction | Production | Total |
|---|---|---|---|
| Wells Developed and Produced during Greater Sage-Grouse Timing Limitation Period | 21,337 | 44,738 | 66,075 |
| Total Wells Developed and Produced on 24 Multi-Well Pads | 44,203 | 75,074 | 119,277 |

**Conformity Analysis.** Because the YRD Project Area is located within a federal air quality nonattainment area and the BLM must approve development of the YRD Project Area, a conformity evaluation must be completed in accordance with the Clean Air Act Section 176(c) and WAQSR Chapter 8 Section 3. Air emissions from the Jonah YRD Project have been evaluated to determine if they conform to the State Implementation Plan for the Upper Green River Basin Ozone Nonattainment Designation Area.

WAQSR Chapter 8 Section 3(c) establishes proposed project air emission thresholds below which a proposed project would be presumed to conform to nonattainment area requirements and would not be required to prepare a formal conformity determination. For the UGRB Ozone Nonattainment Designation Area, the conformity de minimis thresholds are 100 tpy of nitrogen oxides (NOx) or volatile organic compounds (VOCs).

An applicability analysis was performed to evaluate maximum annual project emissions for comparison to the de minimis thresholds. Emission sources permitted under NSR are excluded from the evaluation as specified in WAQSR Chapter 8 Section 3(c)(iv)(A). Maximum annual NOx and VOC emissions that are subject to the conformity analysis were calculated for the first three years of the life of the project (maximum emissions years). For the three year period, the maximum NOx emissions are estimated as 82.8, 94.0, and 106.5 tons per year and the maximum VOC emissions are estimated as 8.0, 11.2, and 11.4 tons per year, respectively. These totals are less than the de minimis threshold of 100 tons per year in Years 1 and 2 of the proposed Project; however, in Year 3 of the proposed Project, when 91 new wells are proposed, the NOx emissions are estimated to exceed the 100 ton per year threshold. Consequently, based on the conformity analysis for Year 3, the Proposed Action would not conform to nonattainment requirements and can not be approved unless Year 3 impacts are mitigated below 100 tons/year or the total number of wells authorized is reduced to demonstrate conformity.

**Near-Field Modeling.** A near-field ambient air quality impact assessment was performed to evaluate maximum pollutant impacts within and adjacent to the YRD Project Area resulting from proposed project-related development and production emissions. The EPA's Guideline (EPA, 2005) model, AERMOD (version 15181), combined with three years (2012-2014) of hourly meteorological data collected at Juel Spring, Wyoming, were used to assess these near-field impacts.

The near-field criteria pollutant assessment was performed to estimate maximum potential impacts of CO, $NO_2$, $SO_2$, $PM_{10}$, and $PM_{2.5}$ from project emissions sources that are likely to operate during the development and production phases of the YRD Project. Production activities evaluated included well production from four, 16-well pads in a land-section (10 acre downhole spacing). Modeled well field development included well pad and access road construction, and well drilling. The modeling scenario for well drilling included two drill rigs, operating at maximum hourly load conditions continuously over the year, in a land section. This scenario, which represents a maximum emissions scenario occurring per well pad from drilling and completion operations, also included up to eight wells in production on the well pads in addition to the drilling operations.

For the criteria pollutant modeling scenarios, model receptor grids were based on proposed well pad sizes and ambient air boundary assumptions. The receptor grids consisted of 25-meter spaced receptors placed along the perimeter of well pads and a 100-meter boundary for the well pad and access road under construction. Additional receptors at 100-meter spacing were used for distances extending outward approximately 1 to 1.5 kilometers (km) from these activities. Background pollutant concentrations were added to modeled impacts and the total impacts compared to applicable NAAQS and WAAQS. The most representative monitored regional background concentrations available for criteria pollutants as identified by WDEQ-AQD and presented earlier in Section 3.1 were used. In addition direct modeled pollutant impacts are compared with applicable PSD Class II increments. The comparisons to the PSD Class II increments are intended to evaluate a threshold of concern for potential impacts and do not represent a regulatory PSD increment comparison.

Near-field HAP assessments were performed to estimate HAP impacts from well production activities and from well drilling. The same production and well drilling scenarios evaluated for criteria pollutant impacts were evaluated for HAPs. Near-field HAP (benzene, toluene, ethyl benzene, xylene, n-hexane and formaldehyde) concentrations were calculated for assessing impacts in the immediate vicinity of well production sources for short-term (acute) exposure assessment and for calculation of long-term risk. In addition short-term formaldehyde concentrations from well drilling activities were evaluated.

Short-term (1-hour) HAP concentrations were modeled and compared to acute RELs. Long-term exposures to HAPs emitted from Project sources were compared to RfCs, and evaluated based on estimates of the increased latent cancer risk over a 70-year lifetime. Two estimates of cancer risk were made: one that corresponds to a most-likely-exposure (MLE) over a national residency average of 9 years with some time spent away from home, and one reflective of the maximally-exposed-individual (MEI) residing at one location for a lifetime with no time spent away from home. The cancer risks for all constituents were then summed to provide an estimate of the total inhalation cancer risk.

Criteria Pollutant Impacts. The maximum modeled criteria pollutant impacts from well production activities are shown in Table 3.1-12. As indicated in Table 3.1-12, impacts from well production sources would be below the NAAQS and WAAQS, and would not exceed the PSD Class II increments.

The maximum modeled criteria pollutant impacts from well development are shown in Table 3.1-13. Maximum CO, $NO_2$, and $SO_2$ impacts would occur from well drilling. Maximum $PM_{10}$ and $PM_{2.5}$ impacts would occur during the construction of a well pad and access road. As indicated in Table 3.1-13, maximum impacts from field development source emissions would be in compliance with the NAAQS and WAAQS for all pollutants. Note that the emissions from field-development activities would be temporary and would not consume PSD increment, and as a result are excluded from increment comparisons.

**Table 3.1-12**
**Maximum Modeled Pollutant Concentration Impacts for 4, 16-Well Pads in Production (µg/m$^3$)**

| Pollutant | Averaging Period | Direct Modeled | PSD Class II Increment [1] | Background | Total Predicted | NAAQS | WAAQS |
|---|---|---|---|---|---|---|---|
| CO | 1-hour | 246.9[2] | -- | 572.0 | 818.9 | 40,000 | 40,000 |
| | 8-hour | 143.2[2] | -- | 343.0 | 486.2 | 10,000 | 10,000 |
| $NO_2$ | 1-hour | 137.5[3] | -- | 20.7 | 158.2 | 188 | 188 |
| | Annual | 14.1 | 25 | 1.4 | 15.5 | 100 | 100 |
| $SO_2$ | 1-hour | 1.5[4] | -- | 15.7 | 17.2 | 196 | 196 |
| | 3-hour | 1.3[2] | 512 | 11.4 | 12.7 | 1,300 | 1,300 |
| | 24-hour | 0.6[2] | 91 | -- | -- | -- | -- |
| | Annual | 0.1[2] | 20 | -- | -- | -- | -- |
| $PM_{10}$ | 24-hour | 8.2[2] | 30 | 31.0 | 39.2 | 150 | 150 |
| | Annual | 1.5 | 17 | 7.9 | 9.4 | -- | 50 |
| $PM_{2.5}$ | 24-hour | 8.2[2] | 9 | -- | -- | -- | -- |
| | Annual | 1.3 | 4 | -- | -- | -- | -- |
| $PM_{2.5}$ | 24-hour | 6.0[5] | ---- | 17.2 | 23.2 | 35 | 35 |
| | Annual | 1.3 | | 5.9 | 7.2 | 12 | 12 |

[1] The PSD demonstration serves informational purposes only and do not constitute a regulatory PSD increment consumption analysis.
[2] Highest-second-high concentration.
[3] The 8th highest daily maximum 1-hour concentrations (maximum over the 3 years).
[4] Maximum 99th percentile daily maximum 1-hour concentration (maximum over the 3 years).
[5] Maximum 98th percentile concentration (maximum over the 3 years).

**Table 3.1-13**
**Field Development Sources, Criteria Pollutant Modeling Results**

| Scenario | Pollutant | Averaging Time | Direct Modeled (µg/m$^3$)[1] | Background (µg/m$^3$) | Total Predicted (µg/m$^3$) | WAAQS (µg/m$^3$) | NAAQS (µg/m$^3$) |
|---|---|---|---|---|---|---|---|
| Well drilling | CO | 1-hour | 133.5 | 572.0 | 705.5 | 40,000 | 40,000 |
| | | 8-hour | 92.0 | 343.0 | 435.0 | 10,000 | 10,000 |
| Well drilling | $NO_2$ | 1-hour | 134.6[2] | 20.7 | 155.3 | 188 | 188 |
| | | Annual | 19.8 | 1.4 | 21.2 | 100 | 100 |
| Well drilling | $SO_2$ | 1-hour | 0.8[3] | 15.7 | 16.5 | 196 | 196 |
| | | 3-hour | 0.7 | 11.4 | 12.1 | 1,300 | 1,300 |
| Well drilling | $PM_{10}$ | 24-hour | 58.7 | 31.0 | 89.7 | 150 | 150 |
| | | Annual | 5.7 | 7.9 | 13.6 | 50 | n/a |
| Well drilling | $PM_{2.5}$ | 24-hour | 4.1 | 17.2 | 21.3 | 150 | 150 |
| | | Annual | 1.3 | 5.9 | 7.2 | 50 | n/a |
| Well pad and access road construction | $PM_{10}$ | 24-hour | 67.4 | 31.0 | 98.4 | 150 | 150 |
| | | Annual | 1.3 | 7.9 | 9.2 | 50 | n/a |
| Well pad and access road construction | $PM_{2.5}$ | 24-hour | 6.1[4] | 17.2 | 23.3 | 35 | 35 |
| | | Annual | 0.5 | 5.9 | 6.4 | 12 | 12 |

[1] Highest second-high values are shown for all short-term averaging times with the exception of 1-hour nitrogen dioxide and sulfur dioxide concentrations, and 24-hour $PM_{2.5}$ concentrations.
[2] Nitrogen dioxide 1-hour concentration is 8th highest daily maximum 1-hour concentration in a year.
[3] Sulfur dioxide 1-hour concentration is 4th highest daily maximum 1-hour concentration in a year.
[4] Highest eighth-high value.

## HAPs Impacts

The maximum predicted acute and chronic (long-term) HAP impacts from well production compared with applicable REL and RfC exposure thresholds are shown in Tables 3.1-14 and 3.1-15. As indicated in these tables, HAP emissions resulting from well production and well drilling would result in impacts that are below the HAP threshold exposure levels.

**Table 3.1-14**
**Maximum Short-Term (1-hour) HAP Modeling Results**

| Modeling Scenario | HAP | Modeled Concentration ($\mu g/m^3$) | REL or IDLH ($\mu g/m^3$) |
|---|---|---|---|
| 16-well pad production | Benzene | 32.4 | 1,300[1] |
| 16-well pad production | Toluene | 48.1 | 37,000[1] |
| 16-well pad production | Ethyl benzene | 1.8 | 350,000[2] |
| 16-well pad production | Xylene | 14.7 | 22,000[1] |
| 16-well pad production | n-Hexane | 80.1 | 390,000[2] |
| 16-well pad production | Formaldehyde | 0.2 | 55[1] |
| Drill rig operation | Formaldehyde | 9.8 | 55[1] |

[1] Reference Exposure Level.
[2] Immediately Dangerous to Life or Health value divided by 10.

**Table 3.1-15**
**Production Sources, Maximum Long-Term (annual) HAP Modeling Results**

| HAP | Modeled Concentration ($\mu g/m^3$) | Non-carcinogenic RfC ($\mu g/m^3$) |
|---|---|---|
| Benzene | 0.5 | 30 |
| Toluene | 0.7 | 5,000 |
| Ethyl benzene | 0.03 | 1,000 |
| Xylene | 0.3 | 100 |
| n-Hexane | 1.4 | 700 |
| Formaldehyde | 0.01 | 9.8 |

Two estimates of cancer risk were made: one that corresponds to most-likely-exposure (MLE) over a national residency average of nine years with some time spent away from home, and one reflective of the maximally-exposed-individual (MEI) residing at one location for a lifetime with no time spent away from home. The cancer risks for all constituents were then summed to provide an estimate of the total inhalation cancer risk. Table 3.1-16 presents the cancer risk estimates for well production, for both the edge of the well pad receptor cases, and at the distance required to be below a one-in-one-million cancer risk level for either the MLE or MEI analysis. The modeling results indicate that for the MLE analysis the cancer risk is above a one-in-one-million cancer risk level along the edge of a well pad and would fall below the one-in-one-million cancer risk level approximately 0.25 miles from a well pad.

**Regional Ozone Formation.** Potential ozone impacts resulting from the Jonah YRD Project and other regional emissions have been predicted as part of the Continental Divide-Creston (CD-C) EIS (BLM, 201b) and are discussed further in Section 4.0.

**Table 3.1-16**
**Long-term Modeled MLE and MEI Cancer Risk Analyses for Well Production**

| Receptor Distance | Analysis | HAP Constituent | Modeled Concentration ($\mu g/m^3$) | Unit Risk Factor $1/(\mu g/m^3)$ | Exposure Adjustment Factor | Cancer Risk |
|---|---|---|---|---|---|---|
| Edge of well pad | MLE | Benzene | 0.47 | $7.8 \times 10^{-6}$ | 0.0949 | $0.3 \times 10^{-6}$ |
| | | Ethyl benzene | 0.03 | $2.5 \times 10^{-6}$ | 0.0949 | $0.007 \times 10^{-6}$ |
| | | Formaldehyde | 0.01 | $1.3 \times 10^{-5}$ | 0.0949 | $0.02 \times 10^{-6}$ |
| | | | | | Total Combined[1] | $0.4 \times 10^{-6}$ |
| Edge of Well pad | MEI | Benzene | 0.47 | $7.8 \times 10^{-6}$ | 0.71 | $2.6 \times 10^{-6}$ |
| | | Ethyl benzene | 0.03 | $2.5 \times 10^{-6}$ | 0.71 | $0.05 \times 10^{-6}$ |
| | | Formaldehyde | 0.01 | $1.3 \times 10^{-5}$ | 0.71 | $0.1 \times 10^{-6}$ |
| | | | | | Total Combined[1] | $2.8 \times 10^{-6}$ |
| 0.25 mile | MLE | Benzene | 0.069 | $7.8 \times 10^{-6}$ | 0.0949 | $0.1 \times 10^{-6}$ |
| | | Ethyl benzene | 0.006 | $2.5 \times 10^{-6}$ | 0.0949 | $0.001 \times 10^{-6}$ |
| | | Formaldehyde | 0.001 | $1.3 \times 10^{-5}$ | 0.0949 | $0.001 \times 10^{-6}$ |
| | | | | | Total Combined[1] | $0.1 \times 10^{-6}$ |
| 0.25 mile | MEI | Benzene | 0.069 | $7.8 \times 10^{-6}$ | 0.71 | $0.4 \times 10^{-6}$ |
| | | Ethyl benzene | 0.006 | $2.5 \times 10^{-6}$ | 0.71 | $0.01 \times 10^{-6}$ |
| | | Formaldehyde | 0.001 | $1.3 \times 10^{-5}$ | 0.71 | $0.01 \times 10^{-6}$ |
| | | | | | Total Combined[1] | $0.4 \times 10^{-6}$ |

[1] Total risk is calculated here; however, the additive effects of multiple chemicals are not fully understood and this should be taken into account when viewing these results.

**Far-Field Modeling.** Far-field pollutant impacts were assessed at PSD Class I areas (Bridger, Fitzpatrick, Teton, and Washakie Wilderness Areas and Grand Teton and Yellowstone National Parks), and at the sensitive Class II Popo Agie Wilderness and Wind River Roadless areas in support of the JIDP FEIS (BLM, 2006a) using the CALPUFF model. The analyses included impact assessments to ambient air concentrations, and AQRVs (visibility, acid deposition, and lake acidity - at sensitive lakes within the Wilderness Areas) from air pollutant emissions of $NO_x$, $SO_2$, $PM_{10}$ and $PM_{2.5}$ expected to result from the JIDP. The modeling results are applicable for estimating the potential impacts from the YRD Project.

PSD Increment Comparison. The maximum direct modeled concentrations of $NO_2$, $SO_2$, $PM_{10}$, and $PM_{2.5}$ at Class I and sensitive Class II areas resulting from the YRD Project emissions would be less than the concentrations analyzed for the JIDP FEIS (BLM, 2006a) for the Preferred Alternative "80 percent emissions reduction" scenario and would be below the applicable PSD Class I and Class II increments.

Visibility Impacts. Visibility impacts, at the nearby PSD Class I and sensitive Class II areas, resulting from the Jonah YRD Project emissions would be less than impacts analyzed for the JIDP FEIS (BLM 2006a) for the Preferred Alternative "80 percent emissions reduction" scenario.

Deposition Impacts. Potential direct atmospheric nitrogen and sulfur deposition impacts within Class I and sensitive Class II areas would be less than impacts analyzed for the JIDP FEIS (BLM, 2006a) for the Preferred Alternative "80 percent emissions reduction" scenario. Impacts at sensitive lakes (Black Joe, Deep, Hobbs, Lazy Boy, and Upper Frozen lakes within the Bridger Wilderness Area, Ross Lake in the Fitzpatrick Wilderness Area, and Lower Saddlebag Lake in the Popo Agie Wilderness Area) would be below threshold values.

**Greenhouse Gas Emissions and Climate Change.** The current scientific consensus is that the global climate is warming due to the influence of anthropogenic emissions of greenhouse gases. Current projections of future climate indicate that this warming trend is likely to continue and that there will be widespread impacts (NCA, 2014a). Specific regional effects of climate change are uncertain (see section 3.1, above) but, in general, for the Great Plains region and Wyoming, "Rising temperatures are leading to increased demand for water and energy. In parts of the region, this will constrain development, stress natural resources, and increase competition for water among communities, agriculture, energy production, and ecological needs" (NCA, 2014b). It is not possible to attribute emissions of GHGs from any particular source to a specific climate impact, globally or regionally, due to the longevity of GHGs in the atmosphere. GHG emissions from all sources contribute to increased incremental concentrations in the Earth's atmosphere and to the global climate response. It is currently not feasible to predict with certainty the net impacts from an individual project on global or regional climate. That is, while BLM actions may contribute to climate change, the specific effects of those actions on global or regional climate are not quantifiable. Therefore, the BLM does not have the ability to associate an action's contribution in a localized area to impacts on global climate change. As climate models improve in their sensitivity and predictive capacity, the BLM will incorporate those tools into NEPA analysis at that time.

The total YRD Project GHG emissions are presented for informational purposes and are compared to other U.S. GHG emission inventories in order to provide context for the YRD Project GHG emissions. The maximum greenhouse gas emissions resulting from the YRD Project GHG emissions are estimated at 0.12 million metric tons (MMT) per year of $CO_2e$ emissions and would occur in Project Year 3. To place the YRD Project's GHG emissions in context, the GHG emissions, during year 2014, from the top five emitting coal-fired power plants in Wyoming range from 3 to 14 MMT of $CO_2e$ (EPA, 2015d).

**BLM Mitigation Alternative**

Impacts to air quality analyzed for the Proposed Action are applicable for estimating the impacts for the BLM Mitigation Alternative. Near-field impacts for the BLM Mitigation Alternative would be comparable to the impacts analyzed for the Proposed Action and would be below the applicable air quality standards and thresholds. Far-field impacts to air quality and AQRVs would be slightly below the Proposed Action impacts given that there would be a reduction in emissions resulting from a reduced number of wells developed during the year or from additional controls determined to reduce emissions below the conformity analysis thresholds.

Under the BLM Mitigation Alternative, the proposed Project would conform to nonattainment requirements and not be subject to a conformity determination (with 84 wells in Year 3 of the proposed Project rather than 91 wells). Maximum annual NOx and VOC emissions that are subject to the conformity analysis are estimated at 82.8, 94.0, and 97.9 tons per year and the maximum VOC emissions are estimated as 8.0, 11.2, and 11.0 tons per year, respectively. All are below the 100 ton per year threshold.

**No Action Alternative**

Effects to air quality were analyzed in the JIDP FEIS (Section 4.2.1, pp. 4-3 to 4-25) and authorized under the JIDP ROD. Operator-Committed Practices (Appendix B of the JIDP ROD) and administrative requirements, COAs, and mitigation implemented through the JIDP ROD and the Pinedale RMP would apply as they relate to air quality and be attached to each APD for site-specific mitigation measures to avoid/minimize impacts to air quality.

Air quality analyses to estimate impacts to ambient air concentrations and AQRVs were performed for the JIDP FEIS. In addition, analyses for impacts to ambient air quality and AQRVs were performed for the Proposed Acton Alternative and are described above in Section 3.1.1.2. For the No Action Alternative, near-field impacts to ambient air concentrations would be similar to those analyzed for the Proposed Action. Far-field impacts to ambient air concentrations and AQRVs (visibility and atmospheric nitrogen and sulfur deposition) would likely be greater than the Proposed Action given that there would be more surface disturbance and vehicle emissions (more rig move, additional traffic) resulting from the development and operation of 245 single well pads compared with the 24 YRD Pads under the Proposed Action.

### 3.1.2 SOIL RESOURCES

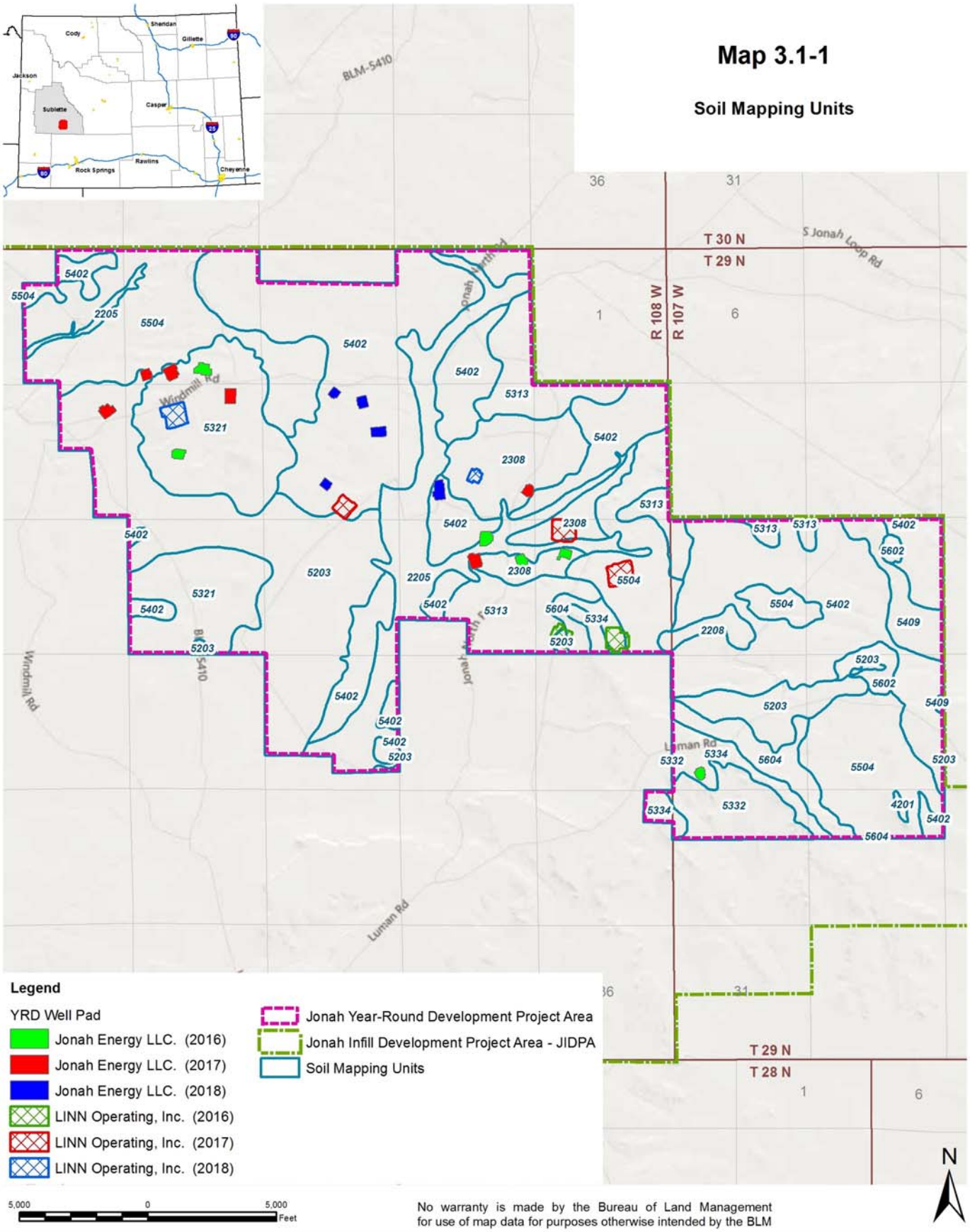
#### 3.1.2.1 Current Conditions

Soils in the YRD Project Area were identified and characterized using the Natural Resources Conservation Service (NRCS) Web Soil Survey spatial and tabular data of Sublette County, Wyoming (NRCS, 2015a). The soil mapping units identified within the YRD Project Area are shown on Map 3.1-1 and listed below with their limiting characteristics (Table 3.1-17). Fourteen soils are within the YRD Project Area boundary, not all of these would be affected by the development. Generally, the soils are deep, well-drained, fine-grained, clay loams and silty clay loams. Erosion potential is classified as slight off-road and off-trail; however, compaction and wind erosion are limiting factors to reclamation. None of the soils are hydric or designated as prime or unique farmlands or farmlands of statewide importance.

**Table 3.1-17**
**Soil Map Units Located in the Year Round Development Project Area**

| Mapping Unit Name & Map Number[1] | Depth[2] (meters) | Slope[3] (percent) | Wind Erodibility Index[4] | T Factor[5] | Hydrologic Group[6] | Rutting Restoration Potential[7] | Compaction Resistance[8] | Off Road and Off Trail Erosion Potential[9] |
|---|---|---|---|---|---|---|---|---|
| Raghigh-Cacklin-Glendive complex MU2205 | 1.5 | 0 - 4 | 86 - 134 | 4-5 | A/ B | Moderate | Moderate | Slight |
| Zagpeed sandy loam MU2208 | 1.5 | 1 - 8 | 86 | 4 | B | Moderate | Low | Slight |
| Forelle-Bluerim-Cotha-Milren complex MU2308 | 1.0 - 1.5 | 1 - 6 | 86 | 3-5 | B/C | Moderate | Low | Slight |
| Cusheet-Roto complex MU4201 | 1.5 | 2 - 6 | 48-86 | 2 | C | Moderate | Low | Slight |
| Golphco-Chickenhill-Bronec complex MU5203 | 1.5 | 1 - 6 | 56-86 | 3-5 | B | Low/ Moderate | Low | Slight |
| Squaretop-Bonhigh-Foreright complex MU5313 | 0.5 -1.5 | 2 - 8 | 56-86 | 2-5 | C/D | Low/ Moderate | Low | Slight |
| Ulric-Lauzer-Cusheet complex MU5321 | 0.5 - 1.5 | 1 - 6 | 48-86 | 3-5 | C/D | Low/ Moderate | Low | Slight |
| Juel-Sandbranch-Ravenhole complex MU5332 | 1.5 | 1 - 8 | 56-86 | 2-4 | B/C | Low/ Moderate | Low | Slight |
| Sweetlette sandy loam MU5334 | 1.5 | 1 - 6 | 56-86 | 4 | B | Moderate | Low | Slight |
| Bluemod-Zagplat-Hoofer complex MU5402 | 1.5 | 1 – 10 | 86 | 2-4 | C/D | Moderate | Low/ Moderate | Slight |
| Yodlow-Forelle-Warfman complex MU5409 | 1.5 | 1 – 10 | 86 | 2-5 | B-D | Moderate | Low | Slight |
| Forelle-Bluerim-Worfman complex MU5504 | 0.25 -1.5 | 2 – 35 | 38-134 | 2-5 | B-D | Moderate | Low/ Moderate | Slight |
| Foreright-Cusheet complex MU5602 | 1.5 | 4 - 25 | 86 | 3-5 | B-D | Moderate | Low | Slight |
| Forelle-Blazon, extremely stony-Cushool complex MU5604 | 0.5 to 1.5 | 4 - 35 | 38-86 | 1-5 | B-D | Moderate | Low | Slight |

[1] Soil group ratings are based on the dominant soil type for the soil map unit. Inclusions of sensitive soil types may be found within soil map units that do not receive sensitive ratings.
[2] NRCS Soil depth classes: Very Shallow, <0.25 m; Shallow, 0.25 m to 0.5 m; Moderately Deep, 0.5 m to 1 m; Deep, 1.0 m to 1.5 m; Very deep >1.5 m.
[3] Steep Slopes – sensitive soils occur in soil map units when slopes are greater than 30 percent.
[4] Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.
[5] Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.
[6] Hydrologic Group - Runoff potential: A = low, B = moderately low, C = moderately high, D = high.
[7] NRCS Web Soil Survey – Selected Soil Interpretations BLM Soil Restoration Potential.
[8] NRCS Web Soil Survey – Selected Soil Interpretations BLM Compaction Resistance.
[9] NRCS Web Soil Survey – Selected Soil Interpretations BLM Forest Service Potential Erosion Hazard.
Source: NRCS, 2015a.


Map 3.1-1
Soil Mapping Units
Cody
Sheridan
Gillette
Jackson
Sublette
Casper
Rawlins
Rock Springs
Cheyenne
BLM-5410
T 30 N
T 29 N
T 28 N
R 108 W
R 107 W
S Jonah Loop Rd
Windmill Rd
Luman Rd
Jonah North Rd
36
31
1
6
Legend
YRD Well Pad
Jonah Energy LLC. (2016)
Jonah Energy LLC. (2017)
Jonah Energy LLC. (2018)
LINN Operating, Inc. (2016)
LINN Operating, Inc. (2017)
LINN Operating, Inc. (2018)
Jonah Year-Round Development Project Area
Jonah Infill Development Project Area - JIDPA
Soil Mapping Units
5,000 0 5,000 Feet
N
No warranty is made by the Bureau of Land Management for use of map data for purposes otherwise intended by the BLM

### 3.1.2.2 Environmental Consequences

**Proposed Action**

Effects to soils were analyzed in the JIDP FEIS (Section 4.1.7, pp. 4-32 to 4-39). The YRD Pads, access roads, and natural gas gathering line disturbances would negatively impact soil, by disturbing 232 acres; however, this would be 1,082 acres less than if the development were to occur as authorized under the JIDP ROD (1,314 acres). Long-term disturbance under the Proposed Action for reclaimed YRD Pads in production and access roads would be about 49 acres; this is 274 acres less than if the development occurred as authorized under the JIDP ROD (323 acres). This long-term disturbance would remain bare for the productive life of the wells, allowing about 53 acres to be reclaimed once the wells are producing. All of the topsoil would be redistributed and reseeded on the YRD Pads, to avoid/minimize soil erosion and soil productivity loss.

Soil horizon mixing could occur during YRD Pad, access road and natural gas gathering line construction, resulting in removal or relocation of organic matter and nutrients to depths where they would be unavailable for vegetative use. Soil horizon mixing could also cause less desirable inorganic compounds such as carbonates, salts or weathered materials to be relocated and negatively impact re-vegetation by reducing soil productivity. Construction could also negatively impact the soil by temporarily altering soil structure, which could reduce infiltration rates and cause compaction and rutting. Operators would reduce the potential of compaction and rutting by avoiding construction in saturated soils.

Soils more susceptible to wind and water erosion could erode, causing subsoil horizons to be exposed on the surface. The YRD Pads would be constructed on areas with less than 15 percent slope; thus, minimal erosion would be expected. The actual amount of erosion that could occur would depend on wind, snow melt, rainfall, soil erodibility, slope length and gradient, plant cover, and erosion control practices. Soil erosion would also negatively impact soil health and productivity.

Each YRD Pad would include a topsoil pile and spoil pile. The topsoil and spoil piles would be stacked about 10 feet high. Stockpiled topsoil's viability could be negatively impacted by reduction of soil microbial activity, which could hinder mineralization and availability of soil nutrients; thus, could negatively impact reclamation goals.

**BLM Mitigation Alternative**

Effects to soils under the BLM Mitigation Alternative would be the same as those described for the Proposed Action.

**No Action Alternative**

Effects to soils would be similar to the effects analyzed in the JIDP FEIS (Section 4.1.7, pp. 4-32 to 4-39) and under the Proposed Action, above, but would occur over an additional 1,082 acres and an additional 221 well pads.

### 3.1.3 PALEONTOLOGICAL RESOURCES

#### 3.1.3.1 Current Conditions

Paleontological resources within the JIDPA are discussed in the JIDP FEIS (Section 3.1.4.3, p. 3-28). Twenty sections of Township 29 North and Ranges 107 and 108 West within five U.S. Geological Survey (USGS) Quadrangles (Olsen Ranch, Gobblers Knob, Stud Horse Butte, Sugar Loaf NE and Bull Draw) occur within the YRD Project Area. Two formal Tertiary geologic units – Wasatch and Green River formations with identifiable members as well as three informal Quaternary units are mapped in this area (Table 3.1-18). Map 3.1-2 is a 1:100,000 scale map showing only the bedrock formations in this area, not the Quaternary cover or developing soils which are abundant. An overview survey of existing paleontological data and a limited field survey of 20 percent of the Jonah Field were done by Bilbey et al. (2007) - Attachment I to this EA. Little paleontological work has been done in the area since that time (Drucker, 2016). Therefore, that review is still pertinent to the YRD Project.

The literature on the Wasatch and Green River formations in Sublette County, Wyoming, is extensive. Dr. Gustaf Winterfeld did the initial paleontological resource assessment for the Jonah Field II Project in 1997, in which he compiled then-current fossil data. In 2002, Dr. Peter Robinson and others prepared an overview survey for the BLM compiling all known vertebrate fossil localities of southwestern Wyoming. Dr. Patricia Holroyd and Dr. Peter Robinson in 2007 updated the faunal and floral lists and localities with recent research by staff from the Museum of Paleontology at the University of California at Berkeley as well as other researchers, and that information was included in Bilbey et al. (2007) – Attachment I to this EA. By unit, the mammalian fossils help differentiate portions of the world-renowned Eocene Wasatchian and Bridgerian Land Mammal Ages (oldest to youngest are identified as Wasatchian – Wa-0 to Wa-7 and Bridgerian Br-1 to Br-3 – Robinson et al., 2004). In the Jonah Field only the Wa-7 and Br-1 are identified (Table 3.1-18).

The terrestrial beds of the Tertiary Wasatch Formation and lacustrine units of the Green River Formation are mapped in the YRD Project Area and are designated as Potential Fossil Yield Classification (PFYC) 5 units (likely to produce significant fossils, particularly vertebrates – see Attachment J). The 2007 fossil faunal and floral lists show that within a 35-mile radius of Jonah these units produce abundant, but at least two distinctive ecosystems (Wa-7 and Br-1 LMA) of Eocene vertebrate fossils (fish, amphibians, reptiles, birds, and mammals) as well as freshwater invertebrates (snails and clams), and plant fossils (impressions in fine-grained sandstone and shale as well as petrified wood) (Bilbey et al., 2007) (Table 3.1-18). The Wasatch and Green River formations inter-tongue in a 30 meter stratigraphic interval in the Jonah Field, the result of expansions and contractions of the Eocene Lake Gosiute system. These inter-tonguing strata are composed mostly of deltaic and marsh deposits and can be very complex, but have proven to be very productive for vertebrate fossils. In particular, a new alligatorid was discovered in this unit during paleontological monitoring in the Jonah Field in 2007. Additional scutes were found during the field survey (Bilbey et al., 2007). It has subsequently been named *Tsoabichi greenriverensis* and was published by Brochu (2010).

Twenty-three fossil occurrences have been identified across approximately 20 percent of the JIDPA; ten were plant or petrified wood, the rest contain vertebrate or multiple types of fossils. Scutes similar to those of the newly described alligatorid, *Tsoabichi greenriverensis* (Brochu, 2010), are found in several locations although the para-type area in the JIDPA is outside the YRD Project Area.

**Table 3.1-18**
**Rock Units Present in the YRD Project Area**

| Rock Unit | Map Symbol | Age | PFYC | Depositional Environment | Brief Description | Fossils Known from GGRB Geologic Unit | Fossils from Jonah[1] |
|---|---|---|---|---|---|---|---|
| Quaternary aeolian deposits | Qe | Pleistocene to Recent | 2 | Wind blown | sands and silts | None | |
| Quaternary alluvial deposits | Qa | Pleistocene to Recent | 2 | Fluvial | stream deposits - sands and gravel | Pleistocene horse? | horse? |
| Quaternary terrace deposits | Qt | Pleistocene | 2 | Glacial outwash to Fluvial | glacial outwash - sand to boulders | None known | |
| Tertiary Green River Formation - Laney Member (LaClede Bed) | Tg | Eocene (Br-1) | 5 | Lacustrine (northern Lake Gosiute) | **Jonah Field** - calcareous, fine-grained sandstone, weathers dark brown to yellowish gray, iron cemented sandstone, and fibrous calcite; **GGRB** - shale, mudstone, limestone, sandstone, evaporites | plants, freshwater clams and snails, insects, arthropods, fish (3 genera), frog and salamander, reptiles (3 turtles, 2 lizards, crocodile and alligators), birds (4 genera), mammals (24 genera) | numerous fish, plant (wood), algal stromatolites |
| Interface interval between the Wasatch and Green River formations | not mapped | Eocene (Br-1) | 5 | Intertonguing lacustrine & fluvial with shoreline deposits | **Jonah Field** - greenish gray mudstone, brownish green paper shale, and mud-clast conglomerates | fish, turtles, crocodiles, gastropods, arthropods, plants | New alligatorid (*Tsoabichi greenriverensis*), fish, egg shell, plant (leaf impressions and petrified wood), ostracods, and planorbid gastropods |
| Tertiary Wasatch Formation - Cathedral Bluffs Member / upper Alkali Creek Member | Twg | Eocene (Br 1, Wa/Br boundary, Wa-7) | 4-5 mostly unknown in Jonah | Terrestrial (fluvial and overbank deposits) to smaller lacustrine | **Jonah Field** - greenish gray mudstone and muddy sandstone bed, minor shale, coarse arkosic cross-bedded sandstone and conglomerates | Sublette County - (La Barge and Alkali Creek Members) - 42 known mammal fossil genera (very small to moderately large), 2 bird orders, reptiles (16 genera), and fish (2 genera) | mammal, turtle, alligator & crocodile, egg shell, plant, freshwater clams & snails |

See [1]Bilbey et al., 2007 Jonah overview report for lists of fossils and their contributors. GGRB - Greater Green River Basin

The area of the Wasatch/Green River interface (a stratigraphic interval of approximately 20 meters on each side of the contact between the units) can be very productive for vertebrate fossils. The Wasatch Formation qualifies as PFYC 5 by the BLM, but surface expression of beds with vertebrate fossils is not common in Jonah except in areas where resistant fluvial sandstone beds are exposed.

The Laney Member is somewhat less productive paleontologically (PFYC 4 or 5), although the first significant discovery in the Jonah Field was of a bed fossil fish exposed in a pipeline ditch.

The Quaternary deposits (eolian, alluvial, and terrace sediments) and developing soils are considered PFYC 1 or 2 and are not likely to produce significant fossils except near long-term water courses. Any bones younger than 10,000 years before present (bp) are generally considered not to be fossiliferous and may fall under the auspices of archaeological studies. However, Quaternary deposits and developing soils obscure much of the Wasatch Formation which weathers easily and is generally flat-lying in the Project Area.

**Resource Assessment Guidelines**

The BLM requests the evaluation of the paleontological sensitivity of all geological formations along proposed access roads, pipelines, well sites, and ancillary facilities pursuant to its authority and obligations, and consistent with its internal policies and procedures, under the following:

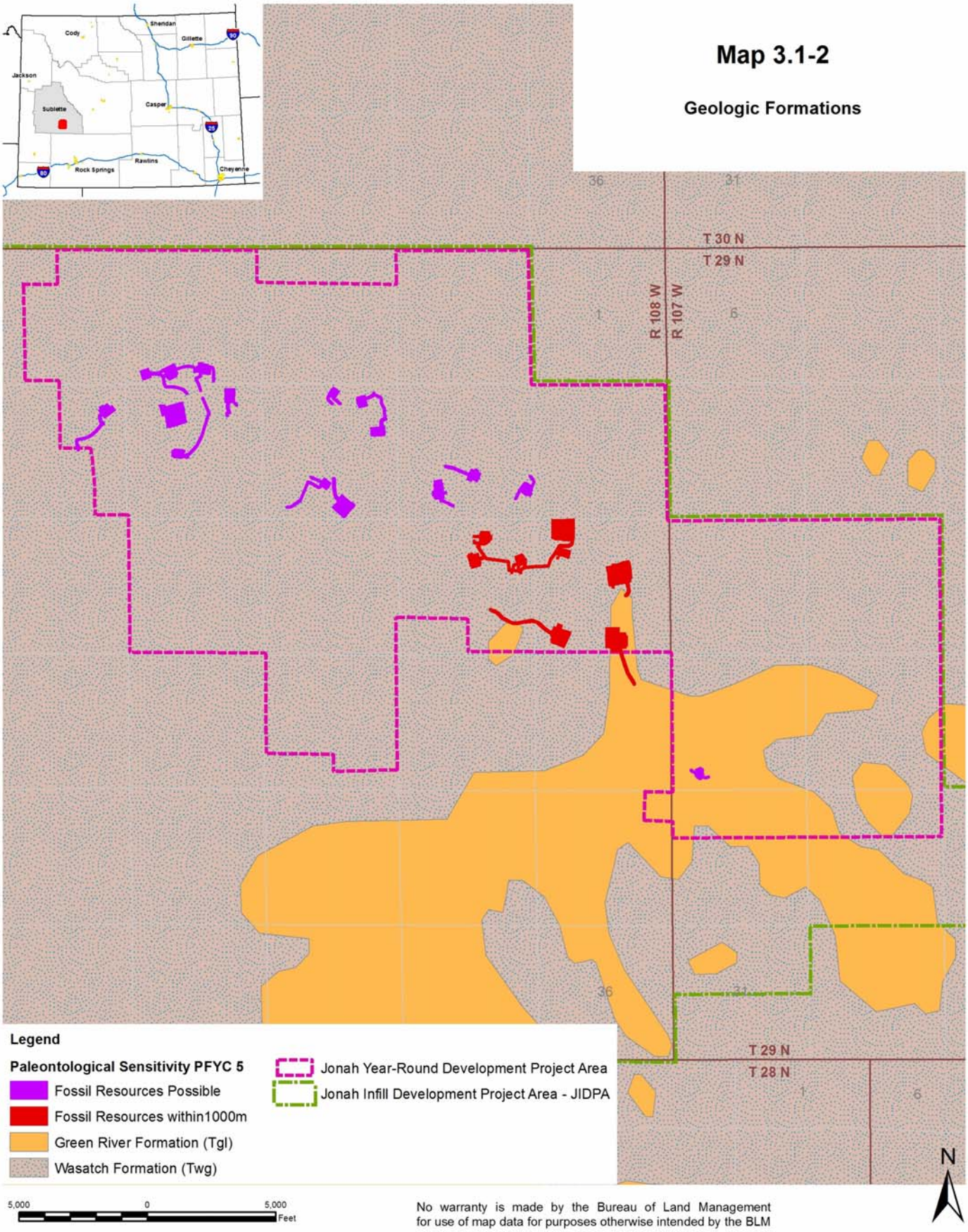
1. Omnibus Public Land Management Act of 2009 – Title VI, Subtitle D, Paleontological Resources Protection Act (PRPA) P.L. 111-11, Sections 6301-6312, Congressional Record – House, p. H3900-H3901.
2. The National Environmental Policy Act of 1969 (NEPA). 42 USC § 4321, et. seq., P.L. 91-190.
3. The Federal Land Policy and Management Act of 1976 (FLPMA). 43 USC § 1701, et. seq., P.L. 94-579.
4. BLM Paleontology Resources Management Manual and Handbook H-8270-1 (revised 1998 & 2008). The PFYC – see Attachment I to this EA.

Similar guidelines also are outlined by Wyoming state laws and regulations regarding paleontological resource protection in Wyoming Title 36-1-114 through 36-1-116 (as of 2003).

### 3.1.3.2 Environmental Consequences

**Proposed Action**

Effects to paleontological resources were analyzed in the JIDP FEIS (Section 4.1.6, p. 4-30 to 4-32). Five of the 23 fossil occurrences described above are within 1,000 meters of the YRD Pads or access roads/natural gas gathering lines (see Maps 3.1-2 and 3.1-3 – red YRD Pads - and Table 3.1-19; Bilbey et al., 2007). As identified in the JIDP FEIS (Appendix C), in areas of paleontological sensitivity, a determination would be made by the BLM as to what measures would be required to ensure that significant paleontological resources are avoided or recovered during construction. Table 3.1-19 serves as BLM's determination indicating locations where full monitoring or spot checking would be required.


Map 3.1-2
Geologic Formations
Cody
Sheridan
Gillette
Jackson
Sublette
Casper
Rawlins
Rock Springs
Cheyenne
T 30 N
T 29 N
T 28 N
R 108 W
R 107 W
36
31
1
6
Legend
Paleontological Sensitivity PFYC 5
Fossil Resources Possible
Fossil Resources within1000m
Green River Formation (Tgl)
Wasatch Formation (Twg)
Jonah Year-Round Development Project Area
Jonah Infill Development Project Area - JIDPA
5,000
0
5,000
Feet
N
No warranty is made by the Bureau of Land Management for use of map data for purposes otherwise intended by the BLM

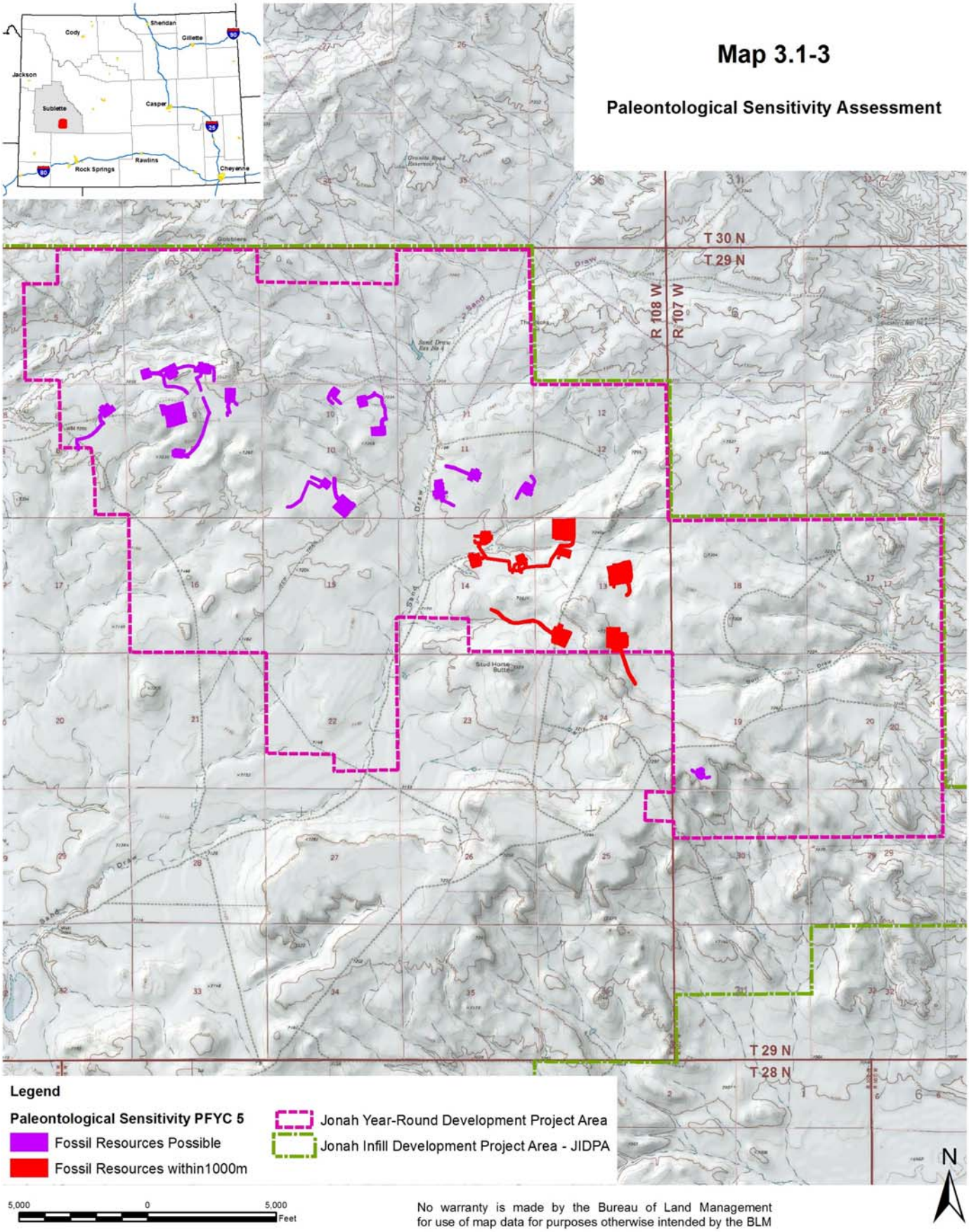

Cody
Sheridan
Gillette
Jackson
Sublette
Casper
Rawlins
Rock Springs
Cheyenne
Map 3.1-3
Paleontological Sensitivity Assessment
T 30 N
T 29 N
R 108 W
R 107 W
T 29 N
T 28 N
Legend
Paleontological Sensitivity PFYC 5
Fossil Resources Possible
Fossil Resources within1000m
Jonah Year-Round Development Project Area
Jonah Infill Development Project Area - JIDPA
5,000
0
5,000
Feet
No warranty is made by the Bureau of Land Management
for use of map data for purposes otherwise intended by the BLM
N

**Table 3.1-19**
**YRD Pads and Roads/Natural Gas Gathering Line Disturbances with Mapped Formations and Monitoring Recommendations (from Bilbey et al., 2007)**

| Name | FeatType | 1/4, ¼ | Location | Formation | PFYC | Known Localities < 1,000m | Recommendations |
|---|---|---|---|---|---|---|---|
| **Jonah Energy YRD Pads** | | | | | | | |
| SHB 73-04 | Pad and linear disturbance | SW, SW | Sec. 4, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 14-04 | Pad and linear disturbance | SE, SW | Sec. 4, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 77-04 | Pad and linear disturbance | SW, SE | Sec. 4, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 17-08 | Pad and linear disturbance | NE, NE | Sec. 8, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 18-09 | Pad and linear disturbance | NE, NE | Sec. 9, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 214-09 | Pad and linear disturbance | NE, SW | Sec. 9, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 20-10 | Pad and linear disturbance | NW, NE | Sec. 10, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 17-10 | Pad and linear disturbance | NE, NE | Sec. 10, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 33-10 | Pad and linear disturbance | SE, NE | Sec. 10, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 218-11 | Pad and linear disturbance | SE, SE | Sec. 11, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 57-11 | Pad and linear disturbance | SE, SW | Sec. 11, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 208-13 | Pad and linear | SE, NW, NW | Sec. 13, T29N, R108W | Tw & Tgl | 5 | Jonah 11, Jonah 12 | Monitor |

| Name | FeatType | 1/4, ¼ | Location | Formation | PFYC | Known Localities < 1,000m | Recommendations |
|---|---|---|---|---|---|---|---|
| | disturbance | | | | | | |
| SHB 36-14 | Pad and linear disturbance | SW, NE | Sec. 14, T29N, R108W | Wasatch | 5 | Jonah 11, Jonah 12 | Monitor |
| SHB 34-14 | Pad and linear disturbance | SE, NE | Sec. 14, T29N, R108W | Wasatch | 5 | Jonah 11, Jonah 12 | Monitor |
| SHB 18-14 | Pad and linear disturbance | NW, NE | Sec. 14, T29N, R108W | Wasatch | 5 | Jonah 11, Jonah 12 | Monitor |
| SHB 203-15B | Pad and linear disturbance | NE, SW | Sec. 15, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| Cabrito 71-19 | Pad and linear disturbance | SW, SW | Sec. 19, T29N, R107W | Green River | 5 | several >1500 m | Spot check w/ potential to upgrade to monitor |
| **Linn Operating YRD Pads** | | | | | | | |
| SHB 9c | Pad and linear disturbance | NE, NW | Sec. 9, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SHB 10o | Pad and linear disturbance | SW, SE | Sec. 10, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| SDF 61-11 | Pad and linear disturbance | NW, SE | Sec. 11, T29N, R108W | Wasatch | 5 | 0 | Spot check w/ potential to upgrade to monitor |
| Cabrito 15-13 | Pad and linear disturbance | SW, SE | Sec. 13, T29N, R108W | Tw & Tgl | 5 | Jonah 11, Jonah 12, Jonah 15 | Monitor |
| Cabrito 13-13 | Pad and linear disturbance | SW, SW | Sec. 13, T29N, R108W | Tw & Tgl | 5 | Jonah 9, Jonah 10, Jonah 11, Jonah 12 | Monitor |
| Cabrito 23-13 | Pad and linear disturbance | NW, NW | Sec. 13, T29N, R108W | Wasatch | 5 | Jonah 11, Jonah 12 | Monitor |
| Cabrito 46-13 | Pad and linear disturbance | SW, NE | Sec. 13, T29N, R108W | Wasatch | 5 | Jonah 11, Jonah 12 | Monitor |

Artificial exposures lead to finding paleontological specimens. Although much of the Wasatch Formation bedrock in the YRD Project Area is covered by Quaternary deposits and developing soils, fossiliferous bedrock is likely to be impacted during excavation work – hillside cuts, pits, cellars, and pipelines. Shallow ground disturbance is not likely to impact fossil resources, so monitoring is only necessary when excavation work is done. When working in the Laney Member of the Green River Formation, the BLM would require spot checking during surface disturbance and full monitoring of deep excavation work.

The BLM would require that a qualified paleontological monitor do the spot checking and/or monitoring as appropriate. Known and unknown fossil resources could be impacted under normal and frozen soil conditions. Any unanticipated vertebrate fossil discovery should halt work in the immediate area. The project paleontologist, the company agent, and the BLM representative should be notified immediately to come to the site to evaluate the discovery and make arrangements for mitigation. Mitigation involves recovery, stabilization, identification, and curation of the fossil specimens at a designated curation facility.

Any effects to paleontological resources under the Proposed Action would be less than effects analyzed under the JIDP FEIS. Under the Proposed Action, surface disturbance would be reduced by 1,082 acres for 24 YRD Pads rather than 245 single well pads, reducing the potential for effects to paleontological resources overall.

**BLM Mitigation Alternative**

Effects to paleontological resources under the BLM Mitigation Alternative would be the same as those described for the Proposed Action.

**No Action Alternative**

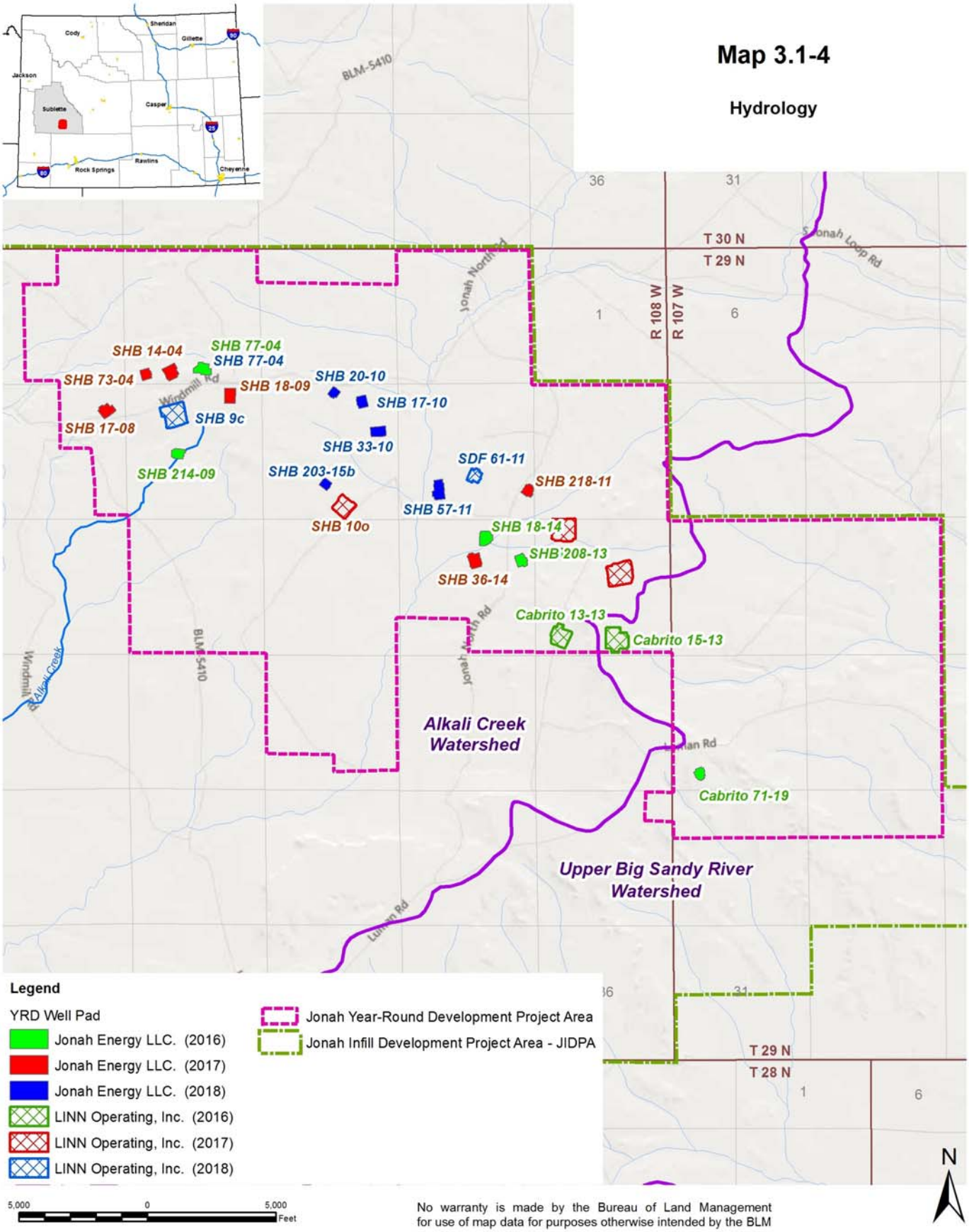
Effects to paleontological resources under the No Action Alternative would be similar to those analyzed in the JIDP FEIS (Section 4.1.6, p. 4-30 to 4-32) and under the Proposed Action, above, but would potentially occur over 1,082 more acres because the well pads would not be consolidated.

### 3.1.4 WATER RESOURCES

#### 3.1.4.1 Current Conditions

Water resources in the JIDPA are discussed in the JIDP FEIS (Section 3.1.6, pp. 3-36 to 3-41). Freshwater aquifers that produce water suitable for domestic or livestock use in this area occur from 100 feet to 1,000 feet below ground surface. Generally, groundwater quality diminishes with increasing depth, where salinity and dissolved solids render water from great depths unusable for domestic, livestock or irrigation purposes. Some water wells produce water suitable for industrial uses from 1,000 to 2,000 feet deep. Water from greater depths is generally too saline for domestic, agricultural or industrial uses and is not economical to obtain.

The YRD Pads would be within the UGRB and the Colorado River drainage system. The YRD Project Area coincides with the Alkali Creek and Upper Big Sandy River watersheds (see Map 3.1-4). Perennial surface water features do not exist within the YRD Project Area; however, Alkali Creek, an intermittent stream, is located in the western third of the YRD Project Area. All other drainages are unnamed ephemeral drainages which may flow due to heavy rains and snowmelt.


Map 3.1-4
Hydrology
Cody
Sheridan
Gillette
Jackson
Sublette
Casper
Rock Springs
Rawlins
Cheyenne
BLM-5410
36
31
T 30 N
T 29 N
R 108 W
R 107 W
1
6
Jonah Northern
Jonah Loop Rd
SHB 14-04
SHB 77-04
SHB 77-04
SHB 73-04
SHB 18-09
SHB 20-10
SHB 17-10
Windmill Rd
SHB 17-08
SHB 9c
SHB 33-10
SDF 61-11
SHB 214-09
SHB 203-15b
SHB 218-11
SHB 57-11
SHB 10o
SHB 18-14
SHB 208-13
SHB 36-14
Cabrito 13-13
Cabrito 15-13
Jonah North Rd
Windmill & Alkali Creek
BLM 5410
Alkali Creek Watershed
Cabrito 71-19
Upper Big Sandy River Watershed
Lunan Rd
T 29 N
T 28 N
Legend
YRD Well Pad
Jonah Energy LLC. (2016)
Jonah Energy LLC. (2017)
Jonah Energy LLC. (2018)
LINN Operating, Inc. (2016)
LINN Operating, Inc. (2017)
LINN Operating, Inc. (2018)
Jonah Year-Round Development Project Area
Jonah Infill Development Project Area - JIDPA
5,000
0
5,000
Feet
N
No warranty is made by the Bureau of Land Management for use of map data for purposes otherwise intended by the BLM

### 3.1.4.2 Environmental Consequences

**Proposed Action**

Effects to water resources were analyzed in the JIDP FEIS (Section 4.1.8, pp. 4-39 to 4-47). Surface water impacts are not expected from disposal because they would be disposed of at existing permitted facilities. However, natural gas development activities including grading, drilling, earth moving, stockpiling, access road and natural gas gathering line construction, and pit excavation, could have long-term negative impacts to surface water quality through increased sedimentation and runoff. These effects are expected to be less under the Proposed Action compared to effects analyzed in the JIDP FEIS due to reduced surface overall surface disturbance (1,082 acres less surface disturbance).

Jonah Energy would obtain water for drilling and completion from existing water supply wells. LINN Operating may drill one additional water well. Potential effects from drilling water supply wells were analyzed in the JIDP FEIS (Section 4.1.8, pp. 4-39 to 4-47).

Groundwater level impacts for the JIDPA were modeled through the JIDP FEIS (HydroGeo, 2005). Hydraulic fracturing of oil and gas wells was suggested as a cause of groundwater contamination in some areas. However, hydraulic fracturing has occurred in the Pinedale area for decades and to date, no existing water wells in this area have shown any detection of chemicals used in hydraulic fracturing. Geologic factors and the method of gas well construction significantly reduce the likelihood of such an occurrence. In the case of the Proposed Action, water-bearing aquifers occur at depths less than 2,000 feet below the surface while hydraulic fracturing would occur in gas bearing formations at depths of about 8,000 to 14,000 feet. The composition of the formations overlying the production zone, the distances between aquifers and hydraulically fractured zones, multiple strings of well casing, and the cement placed outside the gas well casing provide substantial protection for freshwater aquifers. Because of these geologic conditions and required engineering controls, no adverse effects to groundwater are anticipated from hydraulic fracturing and/or implementation of the Proposed Action. The proposed method of handling the returned hydraulic fracturing fluid is sufficient to reduce the likelihood of the returned hydraulic fracturing fluid contaminating near-surface groundwater or surface waters. Operator-Committed Practices (Appendix B to the JIDP ROD – Attachment B to this EA) would be implemented under the Proposed Action.

**BLM Mitigation Alternative**

Effects to water resources under the BLM Mitigation Alternative would be the same as those described for the Proposed Action.

**No Action Alternative**

Effects to water resources under the No Action Alternative would be similar to effects analyzed in the JIDP FEIS (Section 4.1.8, pp. 4-39 to 4-47) and similar to those discussed above for the Proposed Action. Benefits from reduced surface disturbance under the Proposed Action would not be realized under this alternative.

### 3.1.5 NOISE AND ODOR

#### 3.1.5.1 Current Conditions

**Noise.** Noise is discussed in the JIDP FEIS (Section 3.1.7, p. 3-45). Ongoing natural gas development and production activities from well pad, natural gas gathering line, and road construction, drilling, hydraulic fracturing, production, and compressors are creating noise. A noise study was conducted by Behrens and Associates, Inc. (Behrens) in December 2015 (Behrens, 2016). The purpose of the study was to assess the noise impact of planned drilling and hydraulic fracturing operations at two greater sage-grouse leks. The study also included measurement of baseline/ambient noise levels at the Sand Draw Reservoir and South Rocks greater sage-grouse leks. $L_{50}$ (median measured noise level in dBs - decibel) values were measured between the hours of 6:00 pm and 8:00 am for 7 days over the monitoring period. Monitoring occurred at two locations for each lek. Noise monitoring results are provided in Table 3.1-20.

**Table 3.1-20**
**Measured $L_{50}$ Noise Levels from 6:00 P.M to 8:00 A.M at Greater Sage-Grouse Leks[1]**

| Measurement Location (Lek) | Dec 7 - Dec 8 (dBA) | Dec 8 - Dec 9 (dBA) | Dec 9 - Dec 10 (dBA) | Dec 10 - Dec 11 (dBA) | Dec 11 - Dec 12 (dBA) | Dec 12 - Dec 13 (dBA) | Dec 13 - Dec 14 (dBA) | 7 Day Average (dBA) |
|---|---|---|---|---|---|---|---|---|
| **Sand Draw Reservoir Location 1** | 38.8 | 36.0 | 35.8 | 37.7 | 36.5 | 32.0 | 37.6 | 36.3 |
| **Sand Draw Reservoir Location 2** | 40.1 | 37.5 | 37.1 | 39.2 | 36.9 | 33.8 | 37.1 | 37.4 |
| **South Rocks Location 1** | 33.5 | 31.6 | 29.9 | 31.4 | 34.2 | 27.4 | 34.8 | 31.8 |
| **South Rocks Location 2** | 32.7 | 30.0 | 29.0 | 28.8 | 30.2 | 26.0 | 33.1 | 30.0 |

[1] Behrens, 2016.

Ambient or baseline noise levels at sage-grouse leks are difficult to measure and instead of measuring ambient values at edges of leks, Blickley and Patricelli (2013) recommended a baseline standard of 20 to 22 dBA ($L_{50}$, median measured noise level) for noise management in sage-grouse habitats within the Pinedale Field Office. However, ambient values of 16 to 20 dBA have recently been recommended as default values for protections in sage-grouse habitat (see discussion in Patricelli et al., 2013). Based on noise levels reported for this project by Behrens and Associates, Inc., the BLM has set the "baseline" noise level at 30 dB for the YRD Project.

**Odor.** Odor is discussed in the JIDP FEIS (Section 3.1.7, pp. 3-45 to 3-46). Ongoing natural gas development and production activities are creating odor. The JIDP FEIS Chapter 3, Section 3.1.7 states, "No specific data on odors are available from the JIDPA or the surrounding 2-mile Cumulative Impact Assessment Area; however, odors present in the area, other than the natural odors of vegetation and wildlife, include those from vehicle emissions along roads, natural gas development, activities at well sites, compressor stations, other ancillary facility sites, and livestock.

#### 3.1.5.2 Environmental Consequences

**Proposed Action**

Effects resulting from noise and odor are analyzed in the JIDP FEIS (Section 4.1.9, pp. 4-47 to 4-50).

The JIDP FEIS states that project-related noise and odor would not be anticipated to pose a threat to human health, but could reduce the number of recreationists and visitors that use the area. It also states that odors are likely to be quickly dispersed by the wind. Under this alternative, development would occur during seasonal wildlife timing limitations for greater sage-grouse (March 15 to June 30). Noise-related effects to greater sage-grouse are discussed in Section 3.2.4.2, Special Status Species and specifically greater sage-grouse.

**BLM Mitigation Alternative**

Effects resulting from noise and odor under the BLM Mitigation Alternative would be similar to the Proposed Action; however, additional noise mitigation would be required as described in Section 3.2.4.2, Special Status Species, specifically for effects to greater sage-grouse.

**No Action Alternative**

Effects resulting from noise and odor would be similar to effects analyzed in the JIDP FEIS (Section 4.1.9, pp. 4-47 to 4-50) and under the Proposed Action, above.

Under the No Action Alternative, 245 wells would be developed on 24 YRD Pads rather than 245 well pads as authorized under the JIDP ROD. Ongoing impacts from past and present natural gas development activities would most likely continue. Impacts resulting from noise and odor during development (drilling and completion) would be greater than under the Proposed Action due to 1,082 additional acres of surface disturbance as compared to the Proposed Action.

## 3.2 BIOLOGICAL RESOURCES

### 3.2.1 INVASIVE NON-NATIVE SPECIES AND NOXIOUS WEEDS

#### 3.2.1.1 Current Conditions

Noxious Non-Native, and Invasive Plant Species are described in the JIDP FEIS (Section 3.2.1.3). The State of Wyoming lists 26 plants as designated noxious weeds that the Wyoming Weed and Pest Council and Wyoming Board of Agriculture have found to be detrimental, destructive, injurious, or poisonous and should be controlled within the State of Wyoming. Sublette County Weed and Pest District identified six species that are non-native species (Sublette County, 2015).

The USGS (2007) compiled records of weeds from Sublette County Weed and Pest, requested by the BLM Pinedale Field Office under the Wyoming Landscape Conservation Initiative (WLCI). The map produced in 2007 revealed 11 designated noxious weed species occurred in the County, included in Table 3.2-1. No follow-up compilation has been done.

BLM (2015c) reports that more common undesirable plant species (not all of them designated or declared weeds in Table 3.2-1) such as alyssum (*Alyssum spp.*), halogeton (*Halogeton glomeratus*), kochia (*Neokochia spp*.), lambsquarters (*Chenopodium berlandieri*), Russian thistle (*Salsola kali*) and cheatgrass (*Bromus tectorum*), exist within the JIDPA. Non-native invasive species including cheatgrass, halogeton, and prickly Russian thistle (*Salsola tragus*) are present along roads and newly reclaimed well pads in the YRD Project Area (Sorenson, 2015; Raney, 2015). The JIDP FEIS Chapter 3; Section 3.2.1.3 (p. 3-53) provides a discussion for noxious and invasive weeds.

**Table 3.2-1**
**Noxious Weed Species that Could Occur in Sublette County**

| Common Name/ Scientific Name [1] | Characteristics [2] | Documented in Sublette County |
|---|---|---|
| **State of Wyoming Designated Weed List** | | |
| Field Bindweed<br>*Convolvulus arvensis* | Occurs in cultivated fields and waste places; reproduces by seeds and root stalks. | Yes[3] |
| Leafy Spurge<br>*Euphorbia esula* | Grows in nearly all soil types and habitats; reproduces by seed and rootstalks. | Yes[4] |
| Perennial Sowthistle<br>*Sonchus arvensis* | Common in gardens, cultivated crops, ditch banks, and fertile waste areas; reproduces by seed and creeping roots. | Yes[3] |
| Quackgrass<br>*Agropyron repens* | Occurs in croplands, pastures, rangeland, and roadsides; reproduces by seed or spreading by rhizomes. | Yes[3] |
| Hoary Cress (Whitetop)<br>*Cardaria draba (C. pubescens)* | Prevalent in areas with alkaline or disturbed soils; reproduces from seed and root segments. | Yes[4] |
| Perennial Pepperweed (giant whitetop)<br>*Lepidium latifolium* | Occurs in riparian areas, waste areas, ditches, roadsides, croplands, range and meadows, and disturbed areas; reproduces by seed and deep-seated rootstalks. | Yes[4] |
| Ox-eye Daisy<br>*Chrysanthemum leucanthemum* | Found in meadows, roadsides, and waste places; reproduces by seed. | Yes[5] |
| Skeletonleaf Bursage<br>*Franseria discolor* | Aggressive growth habits; spread mainly by creeping roots. | |
| Russian Knapweed<br>*Centaurea repens* | Occurs in a variety of habitats and forms colonies in cultivated fields, orchards, pastures, and roadsides; reproduces by seeds and creeping rootstocks. | Yes[4] |
| Yellow Toadflax<br>*Linaria vulgaris* | Occurs in rangelands, along roadsides, waste places, and cultivated fields; reproduces by seed and creeping roots. | Yes[4] |
| Dalmation Toadflax<br>*Linaria dalmatica* | Found along roadsides and on rangeland; reproduces by seed and underground rootstalks. | Yes[4] |
| Scotch Thistle<br>*Onopordum acanthium* | Found along waste areas and roadsides; very aggressive; reproduces by seed. | |
| Musk Thistle<br>*Carduus nutans* | Invades pastures, range and forest lands, roadsides, waste areas, ditch banks, stream banks, and grain fields; reproduces rapidly by seed. | Yes[4] |
| Common Burdock<br>*Arctium minus* | Commonly found growing along roadsides, ditch banks, in pastures and waste areas; reproduces by seed. | Yes[3] |
| Dyers Woad<br>*Isatis tinctoria* | Occurs along roadsides and disturbed sites and spreads from there to rangeland and cropland by seeds. | |
| Houndstongue<br>*Cynoglossum officinale* | Found in pastures, along roadsides, and in disturbed habitats; reproduces by seed. | Yes[4] |
| Spotted Knapweed<br>*Centaurea maculosa* | Establish in disturbed soils; very aggressive; reproduces by seed. | Yes[4] |
| Plumeless Thistle<br>*Carduus acanthoides* | Occurs in pastures, stream valleys, fields, and roadsides; reproduces by seed. | |

| Common Name/ Scientific Name [1] | Characteristics [2] | Documented in Sublette County |
|---|---|---|
| Diffuse Knapweed *Centaurea diffusa* | Occurs along roadsides, waste areas, and dry rangelands and dominates disturbed areas; reproduces by seed. | .Yes[4] |
| Canada Thistle *Cirsium arvense* | Initially establishes itself in disturbed soils; reproduces by seed and creeping rootstock. | Yes[4] |
| Purple Loosestrife *Lythrum salicaria* | Infest moist, marshy or wet areas such as canals, ditches, or lake edges; reproduce by seed. | Yes[3] |
| Common St. Johnswort *Hypericum perforatum* | Frequently found on sandy or gravelly soils; reproduces by seed or short runners. | |
| Saltcedar (Tamarisk) *Tamarix* spp. | Invades wetlands, moist ranges, lake sides, stream banks, sandbars, and other saline environments; reproduces by seed. | |
| Common Tansy *Tanacetum vulgare* | Found along roadsides, waste areas, stream banks, and in pastures; reproduces from seed and rootstalks. | |
| Russian Olive *Elaeagnus angustifolia* | Invades low-lying pastures, meadows, or waterways; reproduces by seed. | Yes[5] |
| Black Henbane *Hyoscyamus niger* | Common in pastures, along fencerows, along roadsides, and waste areas. | Yes[3,5] |
| **Sublette County Declared Weed List** | | |
| Scentless Chamomile *Matricaria perforata* | Can grow up to 3 feet tall. The root system tends to be large and fibrous but does not run or creep. | Yes[3] |
| Western Water Hemlock *Cicuta douglasii* | Found in sloughs, wet meadows, along streams and other wet areas; poisonous to all types of livestock and to humans. | Yes[3] |
| Field Scabious *Knautia arvensis* | A perennial that grows in grassland on well-drained, especially basic soils; a member of the teasel family with a deeply-penetrating woody taproot. | Yes[3] |
| Austrian Fieldcress *Rorippa austriaca* | A recent invasive plant in Sublette County; reproduces vegetatively by creeping roots, rarely by seed. | Yes[3] |
| Cheatgrass *Bromus tectorum* | Often becomes established in disturbed areas. Treatments for up to 4 or 5 years (or longer) because cheatgrass seed may survive in soils this long. Matured cheatgrass is a nuisance and fire hazard. | Yes[3,6] |
| Hoary Alyssum *Berteroa incana* | A tap-rooted perennial, biennial, or annual, that spreads through seeds. It is considered toxic to horses causing a number of different symptoms. | Yes[3,5] |

Sources:
[1] Sublette County, 2015.
[2] Whitson et al., 1996.
[3] Roberts, 2016.
[4] USGS, 2007.
[5] Roadifer, 2016.
[6] Sorenson, 2016; Raney, 2016.

### 3.2.1.2 Environmental Consequences

**Proposed Action**

Effects resulting from invasive, non-native species and noxious weeds were analyzed and discussed in the JIDP FEIS (see Section 4.2.1, pp. 4-50 to 4-55, Section 5.1.6, pp. 5-7 to 5-8, and the JIDP ROD Appendix B, pp. B-4, B-6 to B-9).

Noxious, invasive and undesirable weeds could appear in disturbed areas due to wind, animals, water or vehicles and could cause wildlife and livestock illness or death. For example, halogeton, a weed not listed as noxious, can be toxic to livestock and wildlife if eaten in large quantities. Invasive and undesirable weeds could negatively impact wildlife and livestock by occupying space and preventing desirable plant growth. However, undesirable plant species generally disappear (thus, these effects are generally temporary and short-term) once reclaimed areas have been successfully re-vegetated with desired plant species, though some aggressive species may persist and/or spread. Aggressive species that would persist or spread would be monitored through BLM well site inspections, Jonah Interagency Office, and Operators as described in the JIDP ROD and/or treated using current management practices established in the JIDP ROD and Pinedale RMP.

Potential effects from invasive, non-native species and noxious weeds would be less under the Proposed Action compared to those described in the JIDP ROD because surface disturbance would be reduced by 1,082 acres (232 acres for 24 YRD Pads and 1,314 acres for 245 well pads under the JIDP ROD). Linear disturbances for access road and natural gas gathering lines would also be reduced from 334 acres under the JIDP ROD to 37 acres with 24 YRD Pads. Traffic would also be reduced under the Proposed Action resulting in less potential for spreading invasive, non-native species and noxious weeds.

**BLM Mitigation Alternative**

Effects from Invasive, Non-Native Species and Noxious Weeds under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Effects resulting from invasive, non-native species and noxious weeds under the No Action Alternative would be similar to effects analyzed in the JIDP FEIS (see Section 4.2.1, pp. 4-50 to 4-55, Section 5.1.6, pp. 5-7 to 5-8, and the JIDP ROD Appendix B, pp. B-4, B-6 to B-9) and under the Proposed Action, above. Impacts would be greater under this alternative because 1,082 more acres would be disturbed and human presence and traffic would be greater than under the Proposed Action.

## 3.2.2 VEGETATION

### 3.2.2.1 Current Conditions

The JIDP FEIS (Section 3.2.1.1, pp. 3-47 to 3-50) provides a discussion of general plant communities/conditions within the YRD Project Area. The JIDP FEIS used vegetation types based on Wyoming GAP Analysis; that data has been updated by the USGS (2011) and vegetation types were equated to types in JIDP FEIS Chapter 3, Section 3.2.1.1, Table 3.17 (page 3-49). Based on the current GAP Vegetation and Land Cover Map, the Project Area consists of 555.2 acres of Scattered/No Sagebrush (5 percent), 2,048.5 acres of Low Density Sagebrush (19 percent), 6,122.0 acres of Moderate Density Sagebrush (55 percent), 280.1 acres of Greasewood (3 percent), 1,252.9 acres of Desert Shrub (11 percent), 402.2 acres of Wetlands and Riparian Shrub/Woodland (4 percent), 98.5 acres of Unvegetated land (1 percent), and 288.5 acres of Developed Land (3 percent). National Wetland Inventory (FWS,

2010a) data indicate there are 18 wetlands covering 9.74 acres within the YRD Project Area. This information has not been ground verified, and the actual acreage of wetlands could be significantly less.

Jonah Field monitoring has shown reclamation establishment to be variable among locations and operators, possibly due to different soils, aspect, topography, climate or reclamation processes including but not limited to soil preparation, seeding technique, seed quality and availability and climatic zones in which the seed originated. Past and present conditions of reclamation within the Jonah Field may also have been influenced by heavy grazing or the lack of grazing, lack of moisture, and various other natural factors. Reclamation has ranged from good to unsuccessful on first attempts. Some locations within the Jonah Field have been seeded a second time due to early reclamation failures. Typical failures are due to lack of forb and/or shrub components that are required in the reclamation.

The YRD Project Area is within Major Land Resource Area (MLRA) 34A - Cool Central Desertic Basins and Plateaus (U.S. Department of Agriculture - USDA, 2006). Based on soil mapping units, there are 15 provisional Ecological Sites Descriptions (ESDs) within the 7-9 inch (Green River and Great Divide Basins) and 10-14 inch (Foothills and Basins West) precipitation zones that coincide with the YRD Project Area. Rangeland ESDs describe the potential plant communities for a site based on the soil map unit descriptions. Areas for each ESD within the YRD Project Area are provided in Table 3.2-2. Also, climax plant communities associated with each ESD and transitional plant communities, reflecting severe ground disturbance in each ESD are specified, based on available ESD Reports (NRCS, 2015b). These plant communities are consistent with the GAP vegetation for the YRD Project Area. BLM conducted range monitoring at three locations within the YRD Project Area in 2004.

#### 3.2.2.2 Environmental Consequences

**Proposed Action**

Effects to vegetation were analyzed in the JIDP FEIS (Section 4.2.1, pp. 4-50 to 4-55). The YRD Pads, access roads, and natural gas gathering lines would disturb about 232 acres of vegetation; however, this would be 1,082 acres less than if the development were to occur as authorized under the JIDP ROD. Vegetation loss would be short-term for 232 acres and long-term for about 49 acres. Loss of site productivity, change in wildlife habitat, and increased erosion could occur. Forage for livestock and wildlife would temporarily decrease. However, following reclamation, the proposed locations could provide better and/or more forage than the original vegetation. Reclamation could fail, be of less quality or density than original vegetation, or require many years to grow desired vegetation. The Operators would consider baseline site conditions, post topsoil redistribution conditions and ESDs to achieve desired plant quality and density.

Based on current reclamation success reported through monitoring within the Jonah Field, additional reclamation work might be required to achieve more successful reclamation. This could include soil sampling after the YRD Pads have been contoured and topsoil spread to determine what soil amendments would be necessary to restore physical, chemical and biological properties within the soil before seeding. Introduction of non-native species to supplement the missing vegetation components and introduction of irrigation or fencing would help with successful reclamation.

**Table 3.2-2**
**Ecological Site Descriptions, Areas, and Plant Communities**
**Associated with Soil Mapping Units within the Project Area**

| Ecological Site Description Codes and Names | Area (acres | Historic Climax Plant Community (Community Under Severe Disturbance) |
|---|---|---|
| R034AY104WY Clayey (Green River - Great Divide Basins) | 881.96 | Rhizomatous Wheatgrass/Big Sagebrush (Big Sagebrush/Bare Ground) |
| R034AY122WY Loamy (Green River - Great Divide Basins) | 1,504.47 | Mixed Grass/Big Sagebrush (Douglas Rabbitbrush/Rhizomatous Wheatgrass) |
| R034AY144WY Saline Upland (Green River - Great Divide Basins) | 124.34 | Gardner's Saltbush/Bunchgrass (Halogeton) |
| R034AY150WY Sandy (Green River - Great Divide Basins) | 149.74 | Needle-and-thread/Indian Ricegrass (Rabbitbrush/Rhizomatous Wheatgrass) |
| R034AY158WY Shallow Clayey (Green River - Great Divide Basins) | 84.33 | Rhizomatous Wheatgrass/Alkali (early) Sagebrush (Alkali (early) Sagebrush/Rhizomatous Wheatgrass) |
| R034AY162WY Shallow Loamy (Green River - Great Divide Basins) | 315.84 | Bluebunch Wheatgrass/Winterfat (Low Sagebrush/Cheatgrass) |
| R034AY166WY Shallow Sandy (Green River - Great Divide Basins) | 184.09 | Needle-and-thread/Indian Ricegrass (Rabbitbrush/Rhizomatous Wheatgrass) |
| R034AY176WY Very Shallow (Green River - Great Divide Basins) | 52.94 | Bluebunch Wheatgrass (Cheatgrass) |
| R034AY212WY Gravelly (Foothills – Basins West) | 1.48 | Bluebunch Wheatgrass (Cheatgrass) |
| R034AY222WY Loamy (Foothills - Basins West) | 4,121.24 | Mixed Grass/Big Sagebrush (Rabbitbrush/Rhizomatous Wheatgrass) |
| R034AY244WY Saline Upland (Foothills - Basins West) | 527.87 | Gardner's Saltbush/Bunchgrass (Halogeton) |
| R034AY250WY Sandy (Foothills - Basins West) | 421.20 | Needle-and-thread/Indian Ricegrass (Rabbitbrush/Rhizomatous Wheatgrass) |
| R034AY258WY Shallow Clayey (Foothills - Basins West) | 211.20 | Rhizomatous Wheatgrass/Alkali (early) Sagebrush (Alkali (early) Sagebrush/Rhizomatous Wheatgrass) |
| R034AY262WY Shallow Loamy (Foothills - Basins West) | 48.45 | Bluebunch Wheatgrass/Big Sagebrush (Big Sagebrush/Cheatgrass) |
| R034AY423CO Limy Cold Desert | 393.77 | No Report |
| Not Defined | 2,024.88 | N/A |
| **Total** | **11,047.79** | |

**BLM Mitigation Alternative**

Effects to vegetation under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Vegetation effects under the No Action Alternative would be similar to effects analyzed in the JIDP FEIS (Section 4.2.1, pp. 4-50 to 4-55) and under the Proposed Action, above. Impacts would be greater under this alternative as they would occur on an additional 1,082 acres.

### 3.2.3 SPECIAL STATUS PLANT SPECIES

#### 3.2.3.1 Current Conditions

Special status plant species are discussed in the Jonah EIS (Section 3.2.3.4 and 3.2.3.5, pp. 3-68 to 3-71). An official list of threatened, endangered, proposed, and candidate species was obtained for the YRD Project from the FWS on January 29, 2016 (FWS, 2016). No plant species were listed.

The BLM (2014b) lists 40 sensitive plant species of which five species were recorded within or in the vicinity of the JIDPA (JIDP FEIS Chapter 3; Section 3.2.1.3 Table 3-21, pages 3-69 to 3-71). A sixth sensitive plant species is known from historical records (Wyoming Natural Diversity

Database - WYNDD, 2016). Records from the Rocky Mountain Herbarium (2015) indicate two species, Cedar Rim Thistle (*Cirsium aridum*) and Bastard Draba Milkvetch (*Astragalus drabelliformis*), occur on soils and at elevations in the JIDPA that are similar to sites within the YRD Project Area and possibly occur there.

#### 3.2.3.2 Environmental Consequences

**Proposed Action**

Effects to BLM sensitive plant species were analyzed in the JIDP FEIS (Section 4.2.3.2, p 4-74). Potential effects to special status plant species would be reduced under the Proposed Action compared to development authorized under the JIDP ROD. Construction of 24 YRD Pads rather than 245 single well pads would result in 1,082 acres less surface disturbance.

**BLM Mitigation Alternative**

Effects to special status plant species under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Effects to special status plant species would be similar to effects analyzed in the JIDP FEIS (Section 4.2.3.2, p 4-74) and under the Proposed Action, above but would potentially occur on an additional 1,082 acres under this alternative.

### 3.2.4 SPECIAL STATUS ANIMAL SPECIES

#### 3.2.4.1 Current Conditions

Special status animal species were discussed in the JIDP FEIS (Section 3.2.3, pp. 3-66 to 3-68). An official list of threatened, endangered, proposed, and candidate species was obtained for the YRD Project from the FWS on January 29, 2016 (see Attachment K). Six species were identified on the official list (see Table 3.2-3). No critical habitats lie within the YRD Project Area.

**Table 3.2-3**
**U.S. Fish and Wildlife Service Official Species List[1]**

| Species | Status | Has Critical Habitat |
|---|---|---|
| **Birds** | | |
| Yellow-Billed Cuckoo (*Coccyzus americanus)* | Threatened | Proposed |
| **Fishes** | | |
| Bonytail chub (*Gila elegans*) | Endangered | Final designated |
| Colorado pikeminnow (*Ptychocheilus lucius*) | Endangered | Final designated |
| Humpback chub (*Gila cypha*) | Endangered | Final designated |
| Razorback sucker (*Xyrauchen texanus*) | Endangered | Final designated |
| **Mammals** | | |
| Gray wolf (Canis lupus) | Experimental Population, Non-Essential | |

[1] Source: FWS, 2016.

Yellow-billed cuckoos are considered a riparian-obligate species and are usually found in large tracts of cottonwood/willow habitats with dense sub-canopies, but may also be found in urban areas with tall trees (FWS, 2007). None of the habitat requirements for the yellow-billed cuckoo are found in the YRD Project Area; therefore, the yellow-billed cuckoo will not be considered further in this EA.

The Colorado River fish are included because the YRD Project would require water to be withdrawn from the Upper Colorado River Basin and would potentially affect the four endangered fish species and their designated critical habitats downstream from the YRD Project Area.

The YRD Project Area lies south between two extant gray wolf packs, Daniel and Soda Lake, which have been subject to harvest and control measures through 2014 (Wyoming Game & Fish Department - WGFD et al., 2015). The YRD Project Area does not provide suitable habitat for wolves and therefore, the YRD Project would not jeopardize the continued existence of the species. Wolves are not considered further in this EA.

BLM Manual 6840 requires the BLM to conserve sensitive species and their habitats to prevent them from becoming listed under the provisions of the ESA. The current Wyoming Sensitive Species List (BLM, 2016) includes 30 sensitive species within the BLM Pinedale Field Office planning area (Table 3.2-4). Many of the BLM sensitive wildlife species included in Table 3.2-4 have been observed within the JIDPA since monitoring began in 1997 (Jonah Interagency Office, 2015). For more information, refer to the JIDP FEIS throughout Chapter 3, Section (pp. 3-66 to 3-71) for federally listed species and BLM Wyoming sensitive species; the Pinedale RMP FEIS Section 3.18 (pp. 3-127 to 3-140); the Pinedale RMP ROD, including Appendix 18 (pp. A18-1 to A18-41).

Greater-sage grouse (*Centrocercus urophasianus*) has been a focus of conservation because the FWS determined that listing the species as threatened throughout its range was warranted but precluded by other activities (FWS, 2010b). After further review, FWS (2015) found that listing greater sage-grouse was not warranted at the time due to conservation efforts implemented by federal, state, and private landowners. To that end, the BLM developed the ARMPA, which includes the Pinedale Field Office, to prevent listing under the ESA. The ARMPA provides conservation measures that limit or eliminate new surface disturbance in Priority Habitat Management Areas (PHMAs) and Sagebrush Focal Areas (SFAs), and minimize surface disturbance in General Habitat Management Areas (GHMAs) (see definitions in ARMPA Section 1.1).

The YRD Project Area is entirely within designated GHMA (see Map 1.0-2). There are five “occupied” leks within 2 miles of the proposed YRD Pads; however, only two of the leks are “active” leks (Sand Draw Reservoir and South Rocks). An occupied lek is one that has been active during at least one strutting season within the prior 10 years. An active lek is one that has been attended by male greater sage-grouse during the current year’s strutting season. Approximately 10,677 acres or 97 percent of the YRD Project Area is within 2 miles the perimeters of occupied leks. The ARMPA prohibits surface disturbing and/or disruptive activities from March 15 to June 30 to protect greater sage-grouse nesting and early brood-rearing habitats within 2 miles of the lek perimeter of any occupied lek located outside of PHMAs. Peak counts of males attending leks during spring are used as a population index to evaluate trends in greater sage-grouse populations (Connelly et al., 2004). The WGFD compiled annual peak counts of males attending leks through 2015. Peak counts of males, averaged each year for active leks within 2 miles of the YRD Project Area, have been declining during the past 10 years, 2006 to 2015.

**Table 3.2-4**
**BLM Sensitive Wildlife Species that Could Potentially Occur on the Project Area and the Vicinity**

| Common Name<br>Scientific Name | Habitat [1, 2] | Potential Occurrence [2] |
|---|---|---|
| **Mammals** | | |
| Rabbit, Pygmy<br>*Brachylagus idahoensis* | Basin-prairie and riparian shrub | Present,<br>Observed in Project Area |
| Prairie Dog, White-tailed<br>*Cynomys leucurus* | Basin prairie shrub, grasslands | Present,<br>Observed in Project Area |
| Myotis, Long-eared<br>*Myotis evotis* | Conifer and deciduous forests, caves, and mines | None,<br>No Suitable Habitat |
| Pocket Gopher, Idaho<br>*Thomomys idahoensis* | Shallow stony soils | Possible<br>Suspected in JIDPA |
| **Birds** | | |
| Goshawk, Northern<br>*Accipiter gentilis* | Conifer and deciduous forests | None,<br>No Suitable Habitat |
| Sparrow, Sage<br>*Amphispiza belli* | Basin-prairie shrub, mountain –foothill shrub | Present,<br>Observed in Project Area |
| Owl, Burrowing<br>*Athene cunicularia* | Grasslands, basin-prairie shrub | Present,<br>Observed in Project Area |
| Hawk, Ferruginous<br>*Buteo regalis* | Basin-prairie shrub, grassland, rock outcrops | Present,<br>Observed in JIDPA |
| Sage-Grouse, Greater<br>*Centrocercus urophasianus* | Basin-prairie shrub, mountain –foothill shrub | Present,<br>Observed in Project Area |
| Plover, Mountain<br>*Charadrius montanus* | Short-grass & mixed grass prairie, openings in shrub ecosystems, prairie dog towns | Present,<br>Observed in JIDPA |
| Cuckoo, Yellow-billed<br>*Coccyzus americanus* | Open woodlands, streamside willow and alder groves | Unlikely,<br>Observed in Degree Block 16 |
| Swan, Trumpeter<br>*Cygnus buccinators* | Lakes, ponds, rivers | None,<br>No Suitable Habitat |
| Falcon, Peregrine<br>*Falco peregrinus* | Tall cliffs | Possible,<br>Observed in Degree Block 16 |
| Eagle, Bald<br>*Haliaeetus leucocephalus* | Primarily along rivers, streams, lakes, and waterways | Possible<br>Observed in JIDPA |
| Shrike, Loggerhead<br>*Lanius ludovicianus* | Basin-prairie shrub, mountain-foothill shrub | Present,<br>Observed in Project Area |
| Curlew, Long-billed<br>*Numenius americanus* | Grasslands, plains, foothills, wet meadows | Possible<br>Observed in JIDPA |
| Thrasher, Sage<br>*Oreoscoptes montanus* | Basin-prairie shrub, mountain-foothill shrub | Present,<br>Observed in Project Area |
| Ibis, White-faced<br>*Plegadis chihi* | Marshes, wet meadows | None,<br>No Suitable Habitat |
| Sparrow, Brewer's<br>*Spizella breweri* | Basin-prairie shrub | Present,<br>observed in Project Area |
| **Fish** | | |
| Sucker, Bluehead<br>*Catostomus discobolus* | Bear, Snake, and Green drainages, all waters | Present downstream in Big Sandy River |
| Sucker, Flannelmouth<br>*Catostomus latipinnis* | CO River drainage, large rivers, streams, and lakes | Present downstream in Big Sandy River |
| Chub, Roundtail<br>*Gila robusta* | CO River drainage, mostly large rivers, also stream and lakes | Present in Upper Big Sandy HUC |

| Common Name<br>Scientific Name | Habitat [1, 2] | Potential Occurrence [2] |
|---|---|---|
| Northern Leatherside Chub<br>*Lepidomeda copei* | Bear, Snake, and Green River drainages, clear, cool streams and pools | None,<br>Not in Watershed |
| Chub, Hornyhead<br>*Nocomis biguttatus* | Lower Laramie and North Laramie River Watersheds in small to medium sized, moderate to low gradient, clear gravelly streams, preferring pools and slow to moderate runs and is often associated with aquatic plants. Requires gravel areas free of silt for spawning. | None,<br>Not in Watershed |
| Trout, Yellowstone Cutthroat<br>*Onorhynchus clarkii bouvieri* | Yellowstone drainage, small mountain streams and large rivers | None,<br>Not in Watershed |
| Trout, Colorado River Cutthroat<br>*Onorhynchus clarkii pleuriticus* | CO River drainage, clear mountain streams | None,<br>Not in Watershed |
| Trout, Fine-spotted Snake River Cutthroat<br>*Onorhynchus clarkii spp.* | Snake River drainage, clear, fast water | None,<br>Not in Watershed |
| **Amphibians** | | |
| Toad, Boreal (Northern Rocky Mountain population)<br>*Bufo boreas boreas* | Pond margins, wet meadows, riparian areas | None,<br>No Suitable Habitat |
| Frog, Northern Leopard<br>*Lithobates pipiens* | Beaver ponds, permanent water in plains and foothills | Unlikely<br>Suspected in JIDPA |
| Frog, Columbia Spotted<br>*Rana luteiventris* | Ponds, sloughs, small streams | None,<br>No Suitable Habitat |

[1] Source: BLM, 2015.
[2] Potential Occurrence:
Unlikely: May or may not occur in Sublette County but no suitable habitat is present.
Present: Occurs within 3-mile buffer of JIDPA, documented by Aster Canyon Consulting, 2015 or on-site records from WYNDD, 2016.
Possible: Documented in Project vicinity with records of species provided by WYNDD, 2016.
None: Species' distribution not in geographic range and/or no suitable habitat is present within the YRD Project Area.

### 3.2.4.2 Environmental Consequences

**Proposed Action**

Effects to special status species are analyzed in the JIDP FEIS (Section 4.2.3, pp. 4-73 to 4-77). Any water depletion over 0.1 acre-feet is considered "may affect, likely to adversely affect'; however, this water depletion for has already been consulted upon. Mitigation for effects to the Colorado River endangered fish species is in the form of a "depletion charge" to the Upper Colorado River Endangered Fish Recovery Program. The Proposed Action would have an estimated average annual depletion of 734 acre-feet per year. The FWS consultation letter (Appendix D to the JIDP ROD) included an average annual depletion of 1,006.7 acre-feet per year with a total depletion of 12,483 acre-feet over the 12.4 year life of the JIDP. To date (through 2015), total depletion is 6,000 acre-feet. The estimated average annual depletion of 734 acre-feet per year added to the total depletion through 2015 (6,000 acre-feet) would not exceed the 12,483 acre-feet included in the FWS consultation letter.

Effects to greater sage-grouse were analyzed in the JIDP FEIS (Section 4.2.2, pp. 4-64 to 4-66). The analysis indicated there would be increased disturbance of breeding, nesting, brood-rearing, and wintering greater sage-grouse and their habitats resulting from increased habitat removal and noise and traffic associated with increase human presence. The JIDP FEIS notes that impacts to leks and other important habitats (nesting, winter) may be serious enough to cause abandonment of the area. Lease stipulations and COAs and Management Decisions in the Jonah ROD, the Pinedale RMP, and the ARMPA include measures to reduce impacts to greater sage-grouse and include seasonal timing limitations, no surface occupancy buffers, and

noise restrictions at the perimeter of leks. Impacts described in the JIDP FEIS would be greater in the short-term without implementation of the stipulations, COAs, and Management Decisions.

The JIDP ROD required compensatory mitigation (CM) to mitigate impacts to greater sage-grouse that could not be adequately mitigated on-site. The Operators committed to fund varying levels of CM depending on the amount of new surface disturbance authorized equating to a total commitment of $24.5 million in CM funding.

The Project Area is located entirely within GHMA) and not PHMA for greater sage-grouse. Management Decision SSS 9 in the ARMPA for sage-grouse breeding, nesting, and early brood-rearing habitat outside of PHMAs states:

> *Surface disturbing and/or disruptive activities will be prohibited from March 15 to 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 of PHMAs.*

Under the Proposed Action, disruptive activities (development) would occur within 2 miles of the lek or lek perimeter of occupied leks during the timing limitation period (March 15 to June 30); however, construction of YRD Pads, access road, and most natural gas gathering lines would occur outside of the timing limitation period. Impacts analyzed in the JIDP FEIS would continue under the Proposed Action and development during the normally restricted period (March 15 to June 30) would likely accelerate those impacts.

The JIDP FEIS states “disturbance to remaining suitable greater sage-grouse nesting, early brood-rearing, and winter habitats should be avoided to prevent fragmentation of those habitats.” By allowing development during the timing limitation period (March 15 to June 30), overall surface disturbance would be reduced by 1,082 acres compared to disturbance authorized under the JIDP ROD.

The JIDP FEIS noted disturbance to greater sage-grouse from noise and traffic associated with increased human presence. Management Decision SSS 12 in the ARMPA states:

*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 pm to 8:00 am during the breeding season (March 1 to May 15). Specific noise protocols for measurement and implementation will be developed as additional research and information emerges.*

The Operators commissioned a noise impact study (Behrens, 2016) to evaluate the noise impacts from drilling and hydraulic fracturing at each of the YRD Pads to the two active leks (Sand Draw Reservoir and South Rocks). Tables 3.2-5 through 3.2-7 list the modeled noise level at the greater sage-grouse leks by YRD Pad. Modeled drilling-related noise levels at the Sand Draw Reservoir lek range from less than 23 dBA to 46 dBA and at the South Rocks lek range from less than 25 dBA to 41 dBA. Modeled hydraulic fracturing-related noise levels ranged from less than 33 dBA to 52 dBA at the Sand Draw Reservoir lek and from less than 33 to 47 dBA at the South Rocks lek. In Tables 3.2-5 through 3.2-7, results for YRD Pads SHB 77-04 and Cabrito 15-13 are taken from site-specific modeling, values for all other YRD Pads are based on flat terrain modeling.

**Table 3.2-5**
**Modeled Noise Levels at Leks Resulting from Drilling and Hydraulic Fracturing at Jonah Energy YRD Pads**

| YRD Pad | Noise Level (dBA) Sand Draw Reservoir Lek | | Noise Level (dBA) South Rocks Lek | |
|---|---|---|---|---|
| | Drilling[1] | Hydraulic Fracturing[2] | Drilling[1] | Hydraulic Fracturing[2] |
| SHB 214-09 | 37 | 43 | <25 | <33 |
| SHB 208-13 | 28 | 34 | 39 | 45 |
| Cab 71-19 | <25 | <33 | 31 | 37 |
| SHB 18-14 | 32 | 38 | 35 | 42 |
| SHB 77-04[3] | 31.1 | 44.2 | <25 | <33 |
| SHB 34-14 | 29 | 35 | 37 | 42 |
| SHB 36-14 | 31 | 37 | 34 | 40 |
| SHB 218-11 | 32 | 38 | 38 | 44 |
| SHB 14-04 | 41 | 47 | <25 | <33 |
| SHB 73-04 | 39 | 46 | <25 | <33 |
| SHB 17-08 | 36 | 42 | <25 | <33 |
| SHB 18-09 | 43 | 49 | <25 | <33 |
| SHB 203-15B | 38 | 44 | 25 | 33 |
| SHB 33-10 | 41 | 47 | 29 | 35 |
| SHB 17-10 | 44 | 50 | 28 | 34 |
| SHB 20-10 | 46 | 52 | 26 | 33 |
| SHB 57-11 | 35 | 42 | 33 | 39 |

[1] Modeled using measured noise level from Ensign Rig 157.
[2] Modeled using file data from a previously measured Halliburton hydraulic fracture job.
[3] Results taken from site-specific modeling, all other values are based on flat terrain modeling.

**Table 3.2-6**
**Modeled Noise Levels at Sand Draw Reservoir Lek Resulting from Drilling and Hydraulic Fracturing at LINN Operating YRD Pads**

| YRD Pad | Noise Level (dBA) | | |
|---|---|---|---|
| | Drilling[1] | Hydraulic Fracturing[2] | Simultaneous Operations[3] |
| Cabrito 15-13[4] | <23 | <33 | <33 |
| Cabrito 13-13 | <23 | <33 | <33 |
| SHB 10o | 34 | 43 | 44 |
| Cabrito 46-13 | <23 | <33 | <33 |
| Cabrito 23-13 | 26 | 36 | 36 |
| SHB 9c | 38 | 45 | 46 |
| SDF 61-11 | 32 | 42 | 42 |

[1] Modeled using measured noise level from Unit Drilling Rig 326.
[2] Modeled using file data from a previously measured Halliburton hydraulic fracture job.
[3] Simultaneous operations include drilling and hydraulic fracturing on same well pad at the same time.
[4] Results taken from site-specific modeling, all other values are based on flat terrain modeling.

**Table 3.2-7**
**Modeled Noise Levels at South Rocks Lek Resulting from Drilling and Hydraulic Fracturing at LINN Operating YRD Pads**

| YRD Pad | Noise Level (dBA) | | |
|---|---|---|---|
| | Drilling[1] | Hydraulic Fracturing[2] | Simultaneous Operations[3] |
| Cabrito 15-13[4] | 33.2 | 41.5 | 42.1 |
| Cabrito 13-13 | 33 | 42 | 43 |
| SHB 10o | 26 | 34 | 35 |
| Cabrito 46-13 | 41 | 47 | 48 |
| Cabrito 23-13 | 39 | 46 | 47 |
| SHB 9c | <23 | <33 | <33 |
| SDF 61-11 | 33 | 42 | 43 |

[1] Modeled using measured noise level from Unit Drilling Rig 326.
[2] Modeled using file data from a previously measured Halliburton hydraulic fracture job.
[3] Simultaneous operations include drilling and hydraulic fracturing on same well pad at the same time.
[4] Results taken from site-specific modeling, all other values are based on flat terrain modeling.

Noise measurements taken the Sand Draw Reservoir and South Rocks leks as part of the noise impact study showed that ambient/baseline noise ranged from 36.3 dBA to 37.4 dBA at the Sand Draw Reservoir lek and from 30.0 dBA to 31.8 dBA at the South Rocks lek.

Taking the lowest measured noise level of 30.0 dBA at the South Rocks lek and applying Management Decision SSS 12 above, allowable noise levels would be 40.0 dBA at each of the two leks. With this determination, noise would exceed the allowable level of 40.0 dBA during drilling at the following YRD Pads: SHB14-04, SHB 18-09, SHB 33-10, SHB 17-10, SHB 20-10, and Cabrito 46-13 if drilling occurs from 6 pm to 8 am between March 1 and May 15. Noise would exceed the allowable level of 40.0 dBA during hydraulic fracturing at all of the Jonah Energy YRD Pads with the exception of Cabrito 71-19 and SHB 36-14 and at all of the LINN Operating YRD Pads if hydraulic fracturing occurs from 6 pm to 8 am between March 1 and May 15. In addition, noise levels were estimated for simultaneous operations (Simops) at the LINN Operating YRD Pads. Noise would exceed the allowable 40.0 dBA at all of the LINN Operating YRD Pad if Simops occurs from 6 pm to 8 am between March 1 and May 15. Greater sage-grouse are expected to be impacted with noise levels above 40.0 dBA and lek attendance would be expected to continue to decline under this alternative.

Management Decision SSS 6 in the ARMPA states the following for leks outside of PHMAs:

> *Surface occupancy and surface disturbing activities will be prohibited on or within a 0.25 mile radius of the perimeter of occupied sage-grouse leks.*

Under the Proposed Action, there would be no surface occupancy within 0.25 mile radius of the perimeter of an occupied greater sage-grouse lek. Effects to greater sage-grouse would not be expected due to noise and traffic resulting from human presence within 0.25 mile of the lek.

**BLM Mitigation Alternative**

Effects to special status animal species under the BLM Mitigation Alternative would be the same as under the Proposed Action with the exception of effects to greater sage-grouse. Overall, the effects to greater sage-grouse analyzed in the JIDP ROD would occur under this alternative and would be accelerated as described for the Proposed Action – due to relief from seasonal timing limitations. However, the accelerated effects to greater sage-grouse described under the Proposed Action might be slower by not allowing noise levels at the leks to exceed 40 dBA at the lek perimeter between 6 pm and 8 am from March 1 to May 15. Required authorization for new roads and temporary closures of roads might also slow the effects to greater sage-grouse

analyzed in the JIDP ROD. Conversion of approximately 3 miles of fence to drop-down fence would reduce the number of greater sage-grouse strikes. Effects to leks within the Yellow Point Complex could be reduced through implementation of the joint conservation strategy (between the YRD Project Operators and the Pinedale Anticline operators) which would be developed under this alternative.

**No Action Alternative**

Effects to special status species under the No Action Alternative would be similar to effects analyzed in the JIDP FEIS (Section 4.2.3, pp. 4-73 to 4-77) and under the Proposed Action, above. Under this alternative, timing limitations for greater sage-grouse would apply and benefits from reduced surface disturbance under the Proposed Action would not be realized.

### 3.2.5 MIGRATORY BIRDS

#### 3.2.5.1 Current Conditions

Migratory birds are discussed in the JIDP FEIS (Section 3.2.2.2, p. 3-57). The Migratory Bird Treaty Act (MBTA), as amended, implements treaties for the protection of migratory birds. Executive Order (EO) 13186, issued in 2001, directed actions that would further implement the MBTA. As required by the MBTA and EO 13186, the BLM signed a Memorandum of Understanding (MOU) with the FWS in 2010, which identifies implementing strategies to promote conservation and reduce or eliminate adverse impacts to migratory birds. The focus of BLM's conservation efforts are on migratory species and some non-migratory game bird species that are identified as Birds of Conservation Concern (BCC) by the FWS (2008) for specific Bird Conservation Regions (BCR) in the United States. The entire Project Area is in BCR 10, the Northern Rockies region.

A total of 171 bird species listed as Nearctic and Neotropical migratory birds by the FWS, Division of Bird Habitat Conservation, and protected under the MBTA (FWS, 2010c) have been observed on ten Breeding Bird Survey (BBS) routes within 50 miles from the YRD Project Area during the past 20 years. Of those, nine are BCC species that could occur within the YRD Project Area, based on the species' known distributions and habitat associations in western Wyoming (WGFD, 2009). Included in Table 3.2-8 is the Conservation Priority for species identified by Wyoming Partners in Flight (Nicholoff, 2003). Three BCC species have been regularly detected during surveys within the JIDPA by Aster Canyon Consulting (2015). They include sage thrasher (*Oreoscoptes montanus*), Brewer's sparrow (*Spizella breweri*), and sage sparrow (*Amphispiza belli*). Other BCC have been observed less frequently within the JIDAP and 3-mile buffer (Table 3.2-8). Long-term (1994 to 2013) population trends within BCR 10 are available for some of the BCC species (Sauer et al., 2014) and are included in Table 3.2-8.

Raptor species observed nesting in the JIDPA and surrounding 3-mile buffer (Aster Canyon Consulting, 2015) include American kestrel *(Falco sparverius*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), and burrowing owl (*Athene cunicularia*). Raptors that may winter in the YRD Project Area include golden eagle, bald eagle (*Haliaeetus leucocephalus*), rough-legged hawk (*Buteo lagopus*), and short-eared owl (*Asio flammeus*) – (Woolwine, 2016).

#### 3.2.5.2 Environmental Consequences

**Proposed Action**

Effects to migratory birds are analyzed in the JIDP FEIS (Section 4.2.2 and 4.2.3, pp. 4-55 to 4-77) and the Pinedale RMP. All seasonal raptor timing limitations would apply under this alternative (see Attachments B through F to this EA). Analysis in the JIDP FEIS contemplated winter drilling because the JIDPA was not designated as pronghorn crucial winter range at that

time. Under the Proposed Action, there would be 1,082 acres less surface disturbance than authorized in the JIDP ROD.

**Table 3.2-8**
**Birds of Conservation Concern within Bird Conservation Region 10 (Northern Rockies) that Occur or May Occur in the Project Area [1]**

| Common Name<br>Scientific Name | Habitat [2] | Conservation Priority [3] | Observed In JIDPA [4] | BCR Trend [5] 1994 to 2013 |
|---|---|---|---|---|
| Bald Eagle<br>*Haliaeetus leucocephalus* | Nests in a tree in mixed coniferous or cottonwood-riparian forest near large lakes and rivers. Forages on fish, waterfowls, and carrion in winter | Level I | Yes | Increasing |
| Swainson's Hawk<br>*Buteo swainsonii* | Nests in a tree, occasionally on a cliff; in most habitats below 9,000 feet with open areas for foraging. | Level I | No | No trend |
| Ferruginous Hawk<br>*Buteo regalis* | Nests in isolated trees, rock outcrops, artificial structures, ground near prey base. | Level I | Yes | No trend |
| Peregrine Falcon<br>*Falco peregrinus* | Nests on high cliff faces, often near water; forages in adjacent habitats. | Level I | No | No trend |
| Long-billed Curlew<br>*Numenius americanus* | Nests on the ground; often in wet-moist meadow grasslands or irrigated native meadows with aquatic areas nearby. | Level I | Yes | Increasing |
| Loggerhead Shrike<br>*Lanius ludovicianus* | Nest is usually in deciduous tree or shrub in pine-juniper woodland or basin-prairie shrublands. | Level II | Yes | No trend |
| Sage Thrasher<br>*Oreoscoptes montanus* | Nest is concealed in or beneath a sagebrush shrub in sagebrush shrublands. | Level II | Yes | Decreasing |
| Brewer's Sparrow<br>*Spizella breweri* | Nests in sagebrush, occasionally greasewood, rabbitbrush in shrublands. | Level I | Yes | No trend |
| Sage Sparrow<br>*Amphispiza belli* | Usually nests in or under sagebrush shrub in sagebrush shrublands. | Level I | Yes | No trend |

Notes:
[1] Species observed on-site and/or reported on one or more of ten Breeding Bird Survey routes within 50 miles surrounding the Project Area from 1994 to 2013 and occur in habitats present in the Project Area.
[2] WGFD, 2009.
[3] Conservation Priority from the Wyoming Bird Conservation Plan (Nicholoff, 2003).
Level I: Species needs conservation action.
Level II: Species' status requires monitoring.
Level III: Species of local interest
Level IV: Species of concern but not considered a priority species.
[4] Aster Canyon Consulting, 2015.
[5] Sauer et al., 2014.

Ground-disturbing actions during the nesting period could result in nest abandonment, displacement of birds, and possible mortality of nestlings, most likely early in the nesting season (egg laying, incubation) rather than late in the season (Romin and Muck, 2002). Risk of mortality of nestlings and dependent fledglings is greater if adults abandon nests late in the season or nests are destroyed prior to fledging young, and could increase if predators are attracted to areas occupied by humans (Andren, 1994; Chalfoun et al., 2002). Displacement of nesting migratory birds due to noise, human activity, and dust associated could also occur. Displacement/avoidance may be short-term if related to noise and human presence, or long-term if related to habitat removal, alteration, and/or fragmentation (Gilbert and Chalfoun, 2011). Timing limitations for construction between March 15 and August 15 (Appendix 3 to the Pinedale RMP – Attachment D to this EA) would be applied to minimize and avoid these effects.

Disturbances (noise, human activities) to nesting raptors can lead to nest abandonment and nestling mortality (Romin and Muck, 2002; Whittington and Allen, 2008); however, timing

limitations (Appendix 12 to the Pinedale RMP – Attachment F to this EA) would be applied to minimize and avoid these effects.

Fragmentation of sagebrush shrub-steppe habitats affects breeding densities, nesting success, and nest predation of nesting species (Knick and Rotenberry, 2002). Such effects are typical of large-scale conversion of shrubland to grasslands. Fragmentation of nesting habitat allows predator access to breeding sites used by birds along newly created corridors and through edges of habitats that were previously continuous. Habitat fragmentation contributes to higher rates of nest predation in grasslands (Burger et al., 1994) and at habitat edges (Gates and Gysel, 1978; Marini et al., 1995). Corvids, including common ravens and American crows, are opportunistic predators in areas of human presence (Marzluff and Neatherlin, 2006) and prey on other species' nests. Potential effects to migratory birds from habitat fragmentation would be reduced under the Proposed Action Alternative compared to effects analyzed and authorized under the JIDP ROD and the Pinedale RMP. Surface disturbance under this alternative would be reduced by 1,082 acres (development on 24 YRD Pads rather than on 245 single well pads) compared to that authorized under the JIDP ROD. Access roads, human presence, and traffic would also be reduced under the Proposed Action Alternative.

**BLM Mitigation Alternative**

Effects to migratory birds under the BLM Mitigation Alternative would be the same as described for the Proposed Action.

**No Action Alternative**

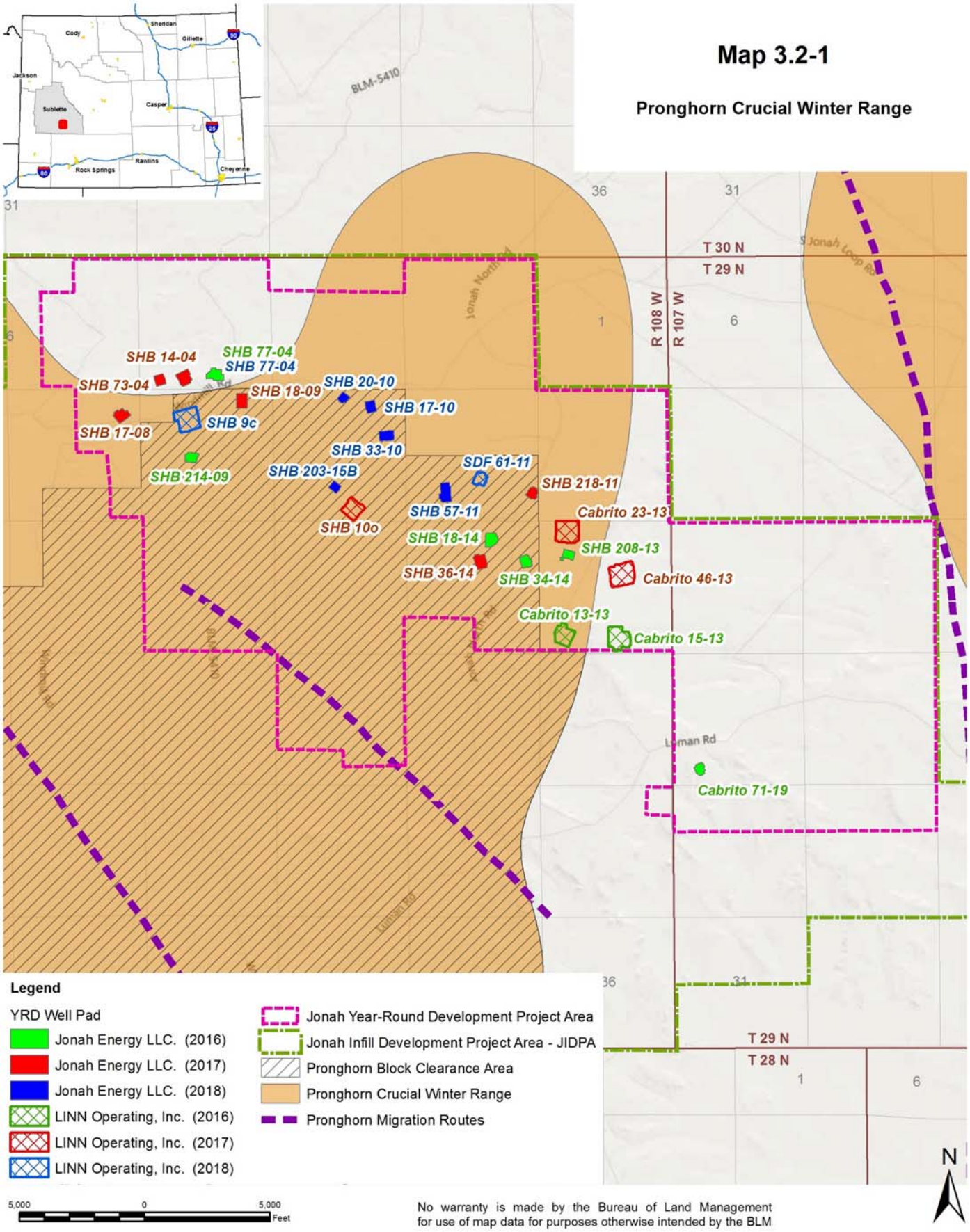
Effects to migratory birds under the No Action Alternative would be similar to effects analyzed in the JIDP FEIS (Section 4.2.2 and 4.2.3, pp. 4-55 to 4-77) which includes 1,082 acres more surface disturbance and habitat fragmentation, more human presence, and more traffic associated with 245 single well pads rather than 24 YRD Pad under the Proposed Action.

### 3.2.6 WILDLIFE AND FISHERIES

#### 3.2.6.1 Current Conditions

Wildlife and fisheries were discussed in the JIDP FEIS (Section 3.2.2, p. 3-53 to 3-66). Pronghorn (*Antilocapra americana*) that exist within the YRD Project Area are part of the Sublette Herd Unit and use the area year-round. In 2014, the WGFD estimated the post-season population at 31,300 pronghorn. The YRD Project Area covers 4,774 acres of pronghorn spring-summer-fall range and 6,274 acres of crucial winter range (see Map 3.2-1). Pronghorn migration routes also cross through the YRD Project Area (Map 3.2-1).

At the time of the JIDP ROD, the WGFD had not designated pronghorn crucial winter ranges within the JIDPA boundaries. In January 2005, a 5-year research project was initiated studying pronghorn demographics and habitat use in the UGRB. Based on field data from the 5-year project and information collected by the WGFD and BLM biologists, the WGFD updated seasonal range designations for pronghorn within the entire Sublette Antelope Herd Unit in 2012 (WGFD, 2012a). As a result of the new information, portions of the JIDPA and now portions of the Jonah YRD Project Area were designated pronghorn crucial winter range (see Map 3.2-1). Because development was already dense in areas where the new delineation overlapped the JIDPA, the WGFD suggested waiving pronghorn crucial winter range restrictions within the Jonah Field where development had at least 16 well pads per 640 acres. This information was provided by WGFD to the BLM in a letter dated November 15, 2012 (WGFD, 2012b). On February 19, 2015, the BLM PFO processed the 2015 block clearance for crucial winter range in the JIDPA (BLM, 2015b) which covered about 82 percent of all crucial winter range within the JIDPA. The assessment was made using pronghorn crucial winter range delineations made by the WGFD as well as biological determinations made by the BLM PFO wildlife biologists.


Map 3.2-1
Pronghorn Crucial Winter Range
Cody
Sheridan
Gillette
Jackson
Sublette
Casper
Rock Springs
Rawlins
Cheyenne
BLM-5410
T 30 N
T 29 N
T 28 N
R 108 W
R 107 W
Jonah Northern Rd
S Jonah Loop Rd
Luman Rd
SHB 14-04
SHB 77-04
SHB 77-04
SHB 73-04
SHB 18-09
SHB 20-10
SHB 17-10
SHB 9c
SHB 17-08
SHB 33-10
SHB 214-09
SHB 203-15B
SDF 61-11
SHB 218-11
SHB 57-11
Cabrito 23-13
SHB 10o
SHB 18-14
SHB 208-13
SHB 36-14
SHB 34-14
Cabrito 46-13
Cabrito 13-13
Cabrito 15-13
Cabrito 71-19
Legend
YRD Well Pad
Jonah Energy LLC. (2016)
Jonah Energy LLC. (2017)
Jonah Energy LLC. (2018)
LINN Operating, Inc. (2016)
LINN Operating, Inc. (2017)
LINN Operating, Inc. (2018)
Jonah Year-Round Development Project Area
Jonah Infill Development Project Area - JIDPA
Pronghorn Block Clearance Area
Pronghorn Crucial Winter Range
Pronghorn Migration Routes
5,000 0 5,000 Feet
N
No warranty is made by the Bureau of Land Management for use of map data for purposes otherwise intended by the BLM

Activities or surface use is currently not allowed from November 15 through April 30 in areas that coincide with pronghorn crucial winter range and are not block cleared. Mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and moose (*Alces alces*) do not occupy any seasonal ranges, including during migrations, within the JIDPA. Other wildlife not included in Table 3.2-8 have been observed within the YRD Project Area since monitoring began in 1997 (Jonah Interagency Office, 2015) and may occur in the YRD Project Area.

Drainages in the eastern portion of the Project Area (e.g., Bull Draw) are within the Upper Big Sandy River Watershed (Hydrologic Unit Code 1404010401). The Big Sandy River supports fish (see Table 3.2-8) but fish occurrence in the few freshwater ponds and emergent wetlands within the YRD Project Area is unlikely.

#### 3.2.6.2 Environmental Consequences

**Proposed Action**

Effects to wildlife and fisheries were analyzed in the JIDP FEIS (Section 4.2.2, pp. 4-55 to 4-72); however, effects to pronghorn from year-round development within pronghorn crucial winter range were not analyzed. Since the JIDP FEIS, research has focused on pronghorn movements and distributions during winter in relation to well-field developments in the Pinedale Anticline Project Area (PAPA) (LeBeau et al., 2015); LeBeau and Rodgers, 2015) and the JIDPA (Beckmann et al., 2011; Seidler et al., 2014). The studies, using locations of radio-telemetered animals, determined that wintering pronghorns utilized habitats relatively close to well pads in the PAPA (LeBeau et al., 2015) but the proportion of time spent in PAPA winter ranges by study animals decreased while the proportion of study animals that left the PAPA increased over time. Habitat loss coupled with year-round development within areas with high levels of well-field infrastructure in crucial winter range in the PAPA led to decreased use of affected crucial winter ranges (Beckmann et al., 2011). Likewise, pronghorn were found to utilize movement corridors away from intensively developed areas of the Jonah Field (Beckmann et al., 2011; Seidler et al., 2014). At the time of the JIDP ROD (2006), pronghorn did not utilize the central portion of the Jonah Field before implementation of infill drilling (Seidler et al., 2014), and infill developments since 2006 have limited the necessity for crucial winter range protections within the block-cleared portions of crucial winter range (WGFD, 2012b).

All of the YRD Pads are located in areas that have been block cleared (meaning seasonal timing limitations do not apply) with the exception of SHB 17-08, SHB 208-13, Cabrito 23-13, and Cabrito 13-13. The timing limitations from November 15 to April 30 would normally apply to these four YRD Pads; however, under the Proposed Action, the Operators have requested that the timing limitations be waived for these four YRD Pads. The four YRD Pads would increase the density of well-field infrastructure within areas of pronghorn crucial winter range that currently have relatively low levels of well-field development. Year-round development under the Proposed Action would likely lead to decreased pronghorn winter use of affected portions of the YRD Project Area, similar to observations made in the PAPA (Beckmann et al., 2011; LeBeau et al., 2015).

Under the Proposed Action, habitat loss would be 1,082 acres less than that analyzed under the JIDP FEIS. With the reduced surface disturbance and reduced number of well pads (24 YRD Pads vs 245 single well pads), human presence and traffic would also be reduced. However, development traffic would occur during winter which could affect movement of pronghorn movement. As shown in studies of pronghorn movements, roads, fencing, and energy development present barriers to animal movement (Seidler et al., 2014). For example, woven-wire sheep fences are impermeable to pronghorn and are well-known as total barriers to migration (Yoakum, 1979). Although YRD Pads are not proposed near WGFD designated

pronghorn migration routes (see Map 3.2-1), impediments to movement of displaced pronghorn resulting from fences would continue under the Proposed Action.

Overall effects to wildlife resources under the Proposed Action would be less than effects analyzed in the JIDP FEIS and authorized in the JIDP ROD. Surface disturbance for 24 YRD Well Pads would be 1,082 acres less than disturbance for 245 single-well pads. With the reduced surface disturbance and number of well pads, human presence and traffic would also be reduced which would minimize effects to wildlife resources.

**BLM Mitigation Alternative**

Effects to wildlife and fisheries under the BLM Mitigation Alternative would be the similar to those under the Proposed Action; however effects to pronghorn would be less. Conversion of approximately 3 miles of fence into drop-down fence, and installation of approximately 10 fence gates and/or crossings in known pronghorn crossing areas would mitigate impediments to movement of displaced pronghorn as described above under the Proposed Action.

**No Action Alternative**

Effects to wildlife and fisheries under the No Action Alternative would be similar to that analyzed in the JIDP FEIS (Section 4.2.2, pp. 4-55 to 4-72) and under the Proposed Action, above. Pronghorn movement and displacement would occur as described under the Proposed Action in the areas that are block cleared and an additional 1,082 acres of habitat would be removed compared to the Proposed Action. Benefits discussed above under the BLM Mitigation Alternative by the conversion of fences to let-down fences and installation of fence crossings would not be realized.

## 3.3 HERITAGE RESOURCES AND HUMAN ENVIRONMENT

### 3.3.1 NATIVE AMERICAN RELIGIOUS CONCERNS

#### 3.3.1.1 Current Conditions

Native American Sensitive Sites and Traditional Cultural Properties (TCPs) are described in the JIDP FEIS (Section 3.3.3, p. 3-74). The Site 48SU4000 District is a Native American-sensitive site in the YRD Project Area. This area is considered sensitive to the Native American Shoshone and Ute tribal representatives. Without further consultation with tribal groups concerning Site 48SU4000 District work would be limited to outside of the sites basin and well away from rock outcrops. Bottomhole locations may be reached from outside of the area without impacting the contiguous sites or the basin area of Site 48SU4000 District. The current boundaries of Site 48SU4000 District may not accurately contain all components of the Site 48SU4000 District and may shift and expand (Attachment L).

Other areas of the Jonah Field may also be sensitive sites or considered TCPs to tribes. These will be evaluated on a case by case basis. Further tribal consultation is needed in areas recently opened to gas exploration and extraction.

#### 3.3.1.2 Environmental Consequences

**Proposed Action**

Potential effects to Site 48SU4000 District were analyzed in the JIDP FEIS (Section 4.3, p. 4-81 and 4-82). Consultations with Native American groups were previously conducted under the Jonah Programmatic Agreement (PA). YRD Pads Cabrito 15-13 and Cabrito 46-13 are located within the area defined as Site 48SU4000 District. Once the APDs for these well pads are submitted to the BLM, if certain types of sites are encountered (e.g. cairns, medicine wheels,

rock art, fire hearths, burials, etc.), the BLM would consult Native American groups. All tribal interests or sites and projects that are of concern to the tribal councils and the Tribal Historic Preservation Officers can be considered on a case-by-case basis as determined during site-specific APD and ROW reviews, by consultation. The tribes rely upon information provided to them by BLM to determine sensitive sites, practicalities, and general project information. The tribal recommendation consists of a visual inspection (on-site examination) for anything considered sensitive. The BLM would review potential impacts on a site-specific basis to determine what measures are necessary to prevent or mitigate significant impacts to culturally sensitive areas.

The potential for effects to Site 48SU4000 District is less under the Proposed Action than as authorized under the JIDP ROD. Surface disturbance would be reduced by 1,082 acres for development on 24 YRD Pads rather than 245 single well pads. Associated access roads, natural gas gathering lines, human presence, and traffic would also be reduced.

**BLM Mitigation Alternative**

Effects to cultural resources under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Potential effects to Site 48SU4000 District would be similar to effects analyzed in the JIDP FEIS (Section 4.3, p. 4-81 and 4-82) and under the Proposed Action, above.

Under the No Action Alternative, the benefits under the Proposed Action (24 YRD Pads vs 245 single well pads and associated reduction in 1,082 acres of surface disturbance, reduced human presence, and reduced traffic) would not be realized and there would be greater potential for impacts to the Site 48SU4000 District. Ongoing impacts from past and present natural gas development activities would continue.

### 3.3.2 CULTURAL AND HISTORICAL RESOURCES

#### 3.3.2.1 Current Conditions

Cultural and historical resources are discussed in the JIDP FEIS (Section 3.3, pp. 3-71 to 3-84). Eight sections occur within the YRD Project Area. Approximately 452 cultural resource projects have been conducted within the YRD Project Area. These projects include Class III inventories for well pads, pipelines, access roads, seismic lines, and block areas; as well as construction monitors and open trench inspections, Class II sampling surveys, testing and evaluation projects, and data recovery projects. These projects have been conducted between 1992 and 2015. Approximately 3,110.5 acres are listed in the Wyoming Cultural Records Office (WYCRO) database as inventoried in the YRD Project Area. However, acreage is not listed consistently for projects in the YRD Project Area. No acreage is listed for several projects, especially linear projects, and total acreage exceeding the total possible amount per section (i.e., 640 acres) was often listed.

Existing information from the cultural projects within the YRD Project Area indicates that approximately 308 cultural sites have been recorded in the YRD Project Area. Approximately 288 (94 percent) of the cultural sites are prehistoric and include lithic scatters, lithic landscapes, open camps, quarries, housepits, stone circles, cairns, and rock shelters. Very few historic sites are located within the YRD Project Area. The region experienced sparse settlement and was used primarily for sheep and cattle grazing. Sparse historic debris, a cabin, and a Civilian Conservation Corps camp are located in the YRD Project Area.

The JIDPA has been divided into four Cultural Management Areas (CMAs) based on site density and sensitivity. The intensity of cultural resource management varies between each CMA and the CMAs range from high-to-low culturally sensitive areas.

Since 2007, cultural resources within the YRD Project Area and the JIDPA have been managed in accordance with the Jonah PA. The National Register of Historic Places (NRHP) eligibility criteria for cultural resources are evaluated in accordance with the Jonah PA Research Design and Management Plan. The Jonah PA was amended in 2015 (Amendment 2) to reflect new cooperators and names (Attachment M).

#### 3.3.2.2 Environmental Consequences

**Proposed Action**

Effects to cultural resources were analyzed in the JIDP FEIS (Section 4.3, pp 4-79 to 4-84). Potential effects to cultural resources would be reduced under the Proposed Action compared to that authorized under the JIDP ROD. Surface disturbance associated with the 24 YRD Pads, access roads, and natural gas gathering lines would be 232 acres compared to 1,314 acres for 245 well pads as authorized under the JIDP ROD, a reduction of 1,082 acres and 221 well pads.

YRD Pads, natural gas gathering lines, and access roads would be located in areas covered by approximately 23 cultural resource projects which include Class III inventories, construction monitors and open trench inspections, and testing and evaluation projects. No cultural report is on record for the proposed SHB 218-11 well pad. YRD Pads, access roads, and natural gas gathering lines would be within approximately 30 cultural sites and four CMAs (see Table 3.3-1). These sites include prehistoric lithic scatters, lithic landscapes, open camps, housepits, quarries, and the Site 48SU4000 District. Site densities are especially high in a band along Sand Draw in the central portion of the YRD Project Area. NRHP evaluations of these sites range from not eligible, to eligible, to non-contributing portions of eligible sites, to unevaluated. The CMAs range from high-to-low culturally sensitive areas. Archaeologically sensitive sediments (San Arcacio-like) are present on the lower terraces along the central stretch of Sand Draw (Appendix F).

Development in the YRD Project Area has the potential to adversely affect significant archaeological sites and deposits if not undertaken with caution. Potential direct impacts to NRHP-eligible cultural properties would primarily result from construction-related activities; however, these potential impacts would be mitigated on a case-by-case basis following procedures outlined in the Jonah PA (Amendment 2). Use of the Jonah PA and its appendices will help the BLM draw projects from the Jonah Squares funds to mitigate some adverse effects to cultural resources.

Effects to sites would be evaluated with specific Jonah PA research potentials in mind. Direct impacts to known NRHP-eligible cultural resources would be minimized through avoidance of known archaeological sites. Other mitigation would include construction monitoring and open trench inspections, testing and designation of non-contributing portions of eligible sites, pre-construction testing outside known cultural sites, and data recovery. Surveys to determine the presence of eligible cultural resources for the SHB 218-11 may be required.

Known and unknown archaeological sites could be impacted under normal or frozen soil conditions. A qualified archaeologist would monitor construction to minimize impacts to any discoveries. The Operators would “self-report” all archaeological discoveries to the BLM and would stop work to allow qualified cultural resource specialists to examine/remove the discoveries to avoid/minimize damage.

**Table 3.3-1**
**Potentially Affected Cultural Sites**

| YRD Well Pad | Location | Sites[1] | CMA | Disturbance |
|---|---|---|---|---|
| **Operated by Jonah Energy** | | | | |
| SHB 17-08 | Sec. 8, T29N, R. 108W | 48SU2578 (E) – ppl | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 73-04 | Sec. 4, T29N, R. 108W | 48SU3423 (E, NC) | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 14-04 | Sec. 4, T29N, R. 108W | 48SU3430 (E, NC)<br>48SU2580 (NE) | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 77-04 | Sec. 4, T29N, R. 108W | 48SU2580 (NE) | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 18-09 | Sec. 9, T29N, R. 108W | 48SU2581 (NE)<br>48SU3455 (E ) - acc/ppl | 3 | Proposed Well Pad, Access Road (2), and Natural Gas Gathering Line |
| SHB 214-09 | Sec. 9, T29N, R. 108W | 48SU2198 (NE)<br>48SU6599 (NE)<br>48SU6601 (NE) - ppl | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 20-10 | Sec. 10, T29N, R. 108W | 48SU3071 (NE) | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 17-10 | Sec. 10, T29N, R. 108W | None | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 33-10 | Sec. 10, T29N, R. 108W | 48SU6270 (E) | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 203-15B | Sec. 10, T29N, R. 108W | 48SU6060 (NE) – ppl<br>48SU5378 (NE) - ppl | 3 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 218-11 | Sec. 11, T29N, R. 108W | 48SU2765 (NE) – ppl<br>48SU2766 (NE) - ppl | 1 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 57-11 | Sec. 11, T29N, R. 108W | 48SU4666 (E) | 1 | Proposed Well Pad, Access Road (2), and Natural Gas Gathering Line |
| SHB 18-14 | Sec. 14, T29N, R. 108W | 48SU4394 (NE)<br>48SU4396 (E ) | 1 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 36-14 | Sec. 14, T29N, R. 108W | 48SU4396 (E ) | 1 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 34-14 | Sec. 14, T29N, R. 108W | None | 1 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| SHB 208-13 | Sec. 13, T29N, R. 108W | None | 1 | Proposed Well Pad and Access Road |
| Cabrito 71-19 | Sec. 19, T29N, R. 107W | 48SU3054 (NE) | 2 | Proposed Well Pad, Access Road, and Natural Gas Gathering Line |
| **Operated by LINN Operating** | | | | |
| SHB 9c | Sec. 9, T29N, R. 108W | 48SU2196 (NE)<br>48SU2580 (NE)<br>48SU2197 (Uneval) | 3 | Proposed Well Pad and Access Road |
| SHB 10o | Sec. 10, T29N, R. 108W | 48SU6673 (NE)<br>48SU4936 (NE) | 3 &1 | Proposed Well Pad and Access Road |
| SDF 61-11 | Sec. 11, T29N, R. 108W | 48SU4668 (NE) - acc/ppl | 1 | Proposed Well Pad and Access Road |
| Cabrito 13-13 | Sec. 13, T29N, R. 108W | 48SU2895 (NE)<br>48SU2896 (NE) - acc/ppl | 1&2, 1 | Existing Well Pad and Access Road |
| Cabrito 15-13 | Sec. 13, T29N, R. 108W | 48SU2892 (NE)<br>48SU2206 (NE)<br>48SU4000 (E) | 4 | Proposed Well Pad and Access Road |
| Cabrito 46-13 | Sec. 13, T29N, R. 108W | 48SU4000 (E) | 4 | Existing Well Pad and Proposed Access Road |
| Cabrito 23-13 | Sec. 13, T29N, R. 108W | None | 1 | Existing Well Pad and Proposed Access Road |

[1] Eligible (E), Not Eligible (NE), Non-Contributing (NC), Unevaluated (Uneval).

**BLM Mitigation Alternative**

Effects to cultural resources under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

The potential for effects to cultural resources is much greater under the No Action Alternative than under the Proposed Action. Effects to cultural resources under this alternative would be similar to those analyzed in the JIDP FEIS (Section 4.3, pp 4-79 to 4-84) and under the Proposed Action, above, but would occur over a much smaller area (24 YRD Pads vs 245 single well pads and associated reduction in 1,082 acres of surface disturbance).

### 3.3.3 VISUAL RESOURCES

#### 3.3.3.1 Current Conditions

Visual resources are discussed in the JIDP FEIS (Section 3.6, p. 3-136) and in the Pinedale RMP ROD Chapter 2, Section 2.3.12 (p. 2-40). The YRD Project Area is within the Class IV visual resource management (VRM) designation which allows major modification to the landscape.

#### 3.3.3.2 Environmental Consequences

**Proposed Action**

Effects to visual resources were analyzed in the JIDP FEIS (Section 4.6, pp. 4-110 to 4-112).

The 24 YRD Pads would be located within an existing oil and gas field among hundreds of other wells pads, roads, and production facilities. Although some of the YRD Pads would be larger than those authorized under the JIDP ROD, surface disturbance would be reduced from 1,314 acres to 232 acres, a reduction of 1,082 acres.

Impacts and associated mitigation under the Proposed Action would be similar to what was analyzed in the JIDP FEIS and the Pinedale RMP. However, surface disturbance for well pads, access roads, and natural gas gathering line construction would be greatly reduced by 1,082 acres. Development activities and production equipment would not be visible from any highways, county roads, towns, or residences. However, they would be visible from undeveloped areas and within the Jonah Field; resulting in negative long-term visual impacts.

Implementation of the Proposed Action would not alter the VRM classification within the YRD Project Area and would be consistent with the VRM guidelines in the JIDP FEIS Chapter 4, Section 4.6 (pp. 4-110 to 4-112) and Chapter 5, Section 5.1.12 (p. 5-10); the JIDP ROD Appendix B (p. B-14) and the Pinedale RMP ROD Section 2.3.12 (p. 2-40) and Appendix 3 (pp. A3-17 to A3-18).

**BLM Mitigation Alternative**

Effects to visual resources under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Effects to visual resources under the No Action Alternative would be similar to those analyzed in the JIDP FEIS (Section 4.6, pp. 4-110 to 4-112) and under the Proposed Action, above, but would occur over an additional 1,082 acres and an additional 221 well pads.

### 3.3.4 SOCIOECONOMICS

#### 3.3.4.1 Current Conditions

Socioeconomic resources are discussed in the JIDP FEIS (Section 3.4, pp. 3-85 to 3-128). Residences do not exist within a 1-mile radius of the YRD Project Area, which is outside of the one-quarter mile "no surface occupancy" (Pinedale RMP FEIS Appendix 3, General Guidelines, p. A3-4) buffer of an occupied dwelling.

Although not contemplated in the JIDP FEIS, the use of new technologies (multi-well pads and directional drilling) has lowered the number of worker days required for drill rig mobilization/demobilization and reclamation from estimates in the JIDP FEIS.

#### 3.3.4.2 Environmental Consequences

**Proposed Action**

Effects to Economic Activity from Development and Production, Government Revenues, and Social Impacts are analyzed in the JIDP FEIS (Chapter 4, Section 4.4 (pp 4-87 to 4-92). On a per well basis, effects of the Proposed Action would be similar to those described in the JIDP FEIS.

Currently, the use of new technologies (multi-well pads and directional drilling) has lowered the number of worker days required for rig mobilization/demobilization and reclamation from estimates in the JIDP FEIS (see discussion above in Section 3.3.5.1, Current Conditions). These technologies would be used in the YRD Project Area only with year-round development. Adhering to timing limitations in the YRD Project Area would require additional rig mobilizations and demobilizations, the costs of which would render directional drilling on multi-well pads economically infeasible.

Worker days required for rig mobilization/demobilization on a single well pad are estimated in the JIDP FEIS at 75 worker days per well pad (Volume 2, Appendix B, JIDP Development Procedures Technical Support Document – Table 2.2). Approximately 18,375 worker days would be required for rig mobilization/demobilization under the JIDP ROD for drilling on 245 single well pads. Under the Proposed Action with year-round development, worker days would be reduced to 1,800 worker days for rig mobilization/demobilization on 24 YRD Pads. Although the development workforce would be less than that analyzed in the JIDP FEIS, the workforce would be steady because timing limitations for greater sage-grouse and big game winter ranges would not apply and workers would be employed on a year-round basis.

Similarly, the JIDP FEIS estimates 50 worker days for reclamation of a single well pad resulting in 12,250 worker days for reclamation of 245 single well pads. Under the Proposed Action, worker days for reclamation would be reduced to 1,200 for 24 well pads.

As discussed above, although the workforce for the Proposed Action represents a reduction in workforce compared to the estimates in the JIDP FEIS, it would not represent a reduction in workforce from current conditions. Year-round development would provide for a steady workforce throughout the year.

**BLM Mitigation Alternative**

Socioeconomic-related effects under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Effects to Socioeconomic Resources under the No Action Alternative were analyzed in the JIDP FEIS (Section 4.4, pp. 4-92 to 4-96) and the Pinedale RMP. Ongoing impacts from past and present natural gas development activities would continue.

Under the No Action Alternative, the benefits describe above under the Proposed Action would not be realized. The 245 wells would not be developed on multi-well pads and directional drilling would not be utilized. Worker days for rig mobilization/demobilization would be similar to that estimated in the JIDP FEIS (Volume 2, Appendix B, JIDP Development Procedures Technical Support Document – Table 2.2). The reduction in worker days and stable workforce through the year would not be realized as discussed under the Proposed Action. There would be 16,575 more worker days for rig mobilization/demobilization under the No Action Alternative compared to the Proposed Action (18,375 vs 1,800). There would be 11,050 more worker days for reclamation under the No Action Alternative compared to the Proposed Action (12,250 vs 1,200 worker days). Without year-round development, drilling and completion would not occur in the YRD Project Area (within 2 miles of a greater sage-grouse lek) from March 15 to June 30 and workers would be temporarily unemployed. This could result in increased claims for unemployment insurance and the potential out-migration of workers in search of steady employment elsewhere.

### 3.3.5 TRANSPORTATION AND ACCESS

#### 3.3.5.1 Current Conditions

As discussed in the JIDP FEIS (Section 3.5.4, p. 3-136), surface transportation in the YRD Project Area is provided by an extensive network of collector and resource roads. The two principal roadways to the JIDPA are State Highway 191, which links the field to Rock Springs and Pinedale, Wyoming, and State Highway 351, which links the field to Big Piney and Marbleton, Wyoming (see Map 1.0-1).

The main access to the YRD Project Area is from the Luman Road, which runs east from State Highway 191 to the YRD Project Area. The Jonah North Road, which runs north-south connecting to State Highway 351, also provides access to the YRD Project Area. Further detail on the roads in the JIDPA and the YRD Project Area and associated traffic is discussed in the JIDP FEIS Transportation Plan (Appendix B, Subappendix DP-A).

#### 3.3.5.2 Environmental Consequences

**Proposed Action**

Potential transportation-related effects were analyzed in the JIDP FEIS (Section 4.5.4, pp. 4-108 to 4-109). Under the Proposed Action, transportation-related effects during development would be less than that analyzed in the JIDP FEIS due to the reduction in traffic associated with development and operation of 24 YRD Pads rather than 245 single well pads as authorized under the JIDP ROD. Access roads would be reduced by approximately 34 miles under this alternative (3.2 miles for 24 YRD Pads) compared to that authorized under the JIDP ROD for 245 well pads (36.8 miles or 0.15 mile per well pad).

**BLM Mitigation Alternative**

Transportation-related effects under the BLM Mitigation Alternative would be similar to those under the Proposed Action and would have less effect than the No Action Alternative.

**No Action Alternative**

Under the No Action Alternative, transportation-related effects would be similar to those analyzed in the JIDP FEIS (Section 4.5.4, pp 4-108 to 4-109). The reduced transportation-related effects described above for the Proposed Action (reduction of 34 miles of access road) would not be realized under this alternative. Ongoing impacts from past and present natural gas development activities would continue.

### 3.3.6 HAZARDOUS MATERIALS

#### 3.3.6.1 Current Conditions

Hazardous materials are discussed in the JIDP FEIS (Section 3.7, p. 3-138). Some hazardous materials could be used or produced during ongoing drilling, completion, production and reclamation. The term hazardous materials as used here means:

- any substance, pollutant, or contaminant (regardless of quantity) listed as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, 42 USC §9601 et seq., and the regulations issued under CERCLA,

- any hazardous waste as defined in the Resource Conservation and Recovery Act (RCRA) of 1976, as amended, and

- any nuclear or nuclear byproduct as defined by the Atomic Energy Act of 1954, as amended, 42 USC § 2011 et seq.

Refer to the JIDP ROD Appendix B (pp. B-2, B-5, and B-15) and the JIDP FEIS Appendix B, DP-C (pp. DP-C-1 to DP-C-28) for more information.

#### 3.3.6.2 Environmental Consequences

**Proposed Action**

Potential effects resulting from hazardous materials were analyzed in the JIDP FEIS (Section 4.7, pp. 4-112 to 4-114) and Chapter 5, Section 5.1.13 (p. 5-10) and the JIDP ROD Appendix B (pp. B-4 to B-6 and B-15). Hazardous material releases could negatively impact human health, wildlife, air, soil, groundwater and surface water quality. The proposed operations would comply with all applicable federal and state laws concerning hazardous materials and the respective Spill Prevention Control and Countermeasure Plan (SPCC Plans) for Jonah Energy and LINN Operating, thus minimal negative impacts would be anticipated and most likely temporary.

The potential for effects resulting from hazardous materials could be less under the Proposed Action than analyzed under the JIDP ROD due to development of 24 YRD Pads rather than 245 single well pads resulting in less surface disturbance, less rig mobilization/demobilization and overall reduced human presence and traffic. However, effects from well drilling and completion would not be less because 245 wells would be developed.

**BLM Mitigation Alternative**

Potential effects from hazardous materials under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Under this alternative, effects resulting from hazardous materials would be similar to those analyzed in the JIDP FEIS (Section 4.7, pp. 4-112 to 4-114) and Chapter 5, Section 5.1.13 (p. 5-10) and the JIDP ROD Appendix B (pp. B-4 to B-6 and B-15) and under the Proposed Action, above. The benefits discussed above under the Proposed Action (24 YRD Pads vs 245 single well pads and associated reduction in surface disturbance, access roads, human presence, and traffic) would not be realized under this alternative. Ongoing impacts from past and present natural gas development activities would continue.

## 3.4 LAND RESOURCES

### 3.4.1 RECREATION

#### 3.4.1.1 Current Conditions

Recreation resources are discussed in the JIDP FEIS Section 3.4.10 (pp. 3-123 to 3-128). Recreation activities currently occur throughout the year within and around ongoing natural gas development in the Jonah Field. The YRD Project Area also has opportunities for hunting, sightseeing, and wildlife viewing. The Pinedale RMP allows off-highway vehicle (OHV) traffic which is limited to existing roads and trails within the YRD Project Area. There are no fishing or boating opportunities within the YRD Project Area due to the lack of perennial surface waters. Developed recreation facilities do not exist within the YRD Project Area.

#### 3.4.1.2 Environmental Consequences

**Proposed Action**

Potential effects to Recreation Resources were analyzed in the JIDP FEIS (Section 4.5.3, pp. 4-100 to 4-104). Natural gas development could negatively impact the long-term visual and aesthetic experience of persons engaged in recreational activities such as hunting, sightseeing, wildlife viewing, and recreational travel. Development would likely displace game animals, causing reduced hunting opportunities or success rates. Developed recreation sites would not be impacted because they do not exist within several miles of the YRD Pads.

Although effects to recreation resources under the Proposed Action would be similar to those authorized in the JIDP ROD, they would be reduced by development on 24 YRD Pads rather than on 245 single well pads resulting in 1,082 acres less surface disturbance. Under this alternative, the YRD Pads would be developed in 36 months compared to 49.5 months as authorized under the JIDP ROD. Reclamation of the 24 YRD Pads would take less time than authorized under the JIDP ROD presenting more likely opportunities for recreation with the reduced human presence and traffic.

**BLM Mitigation Alternative**

Effects to recreation under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Under the No Action Alternative, effects to Recreation would be similar to those analyzed in the JIDP FEIS (Section 4.5.3, pp 4-104 to 4-107) and under the Proposed Action, above. Ongoing impacts from past and present natural gas development activities in the Jonah Field would most likely continue. The reduced number of well pads (24 YRD Pads vs 245 single well pads) and the resulting reduction surface disturbance (1,082 acres), access roads, human presence, and traffic would not be realized under the No Action Alternative. Similarly, the reduced development period would also not be realized. Development would extend an additional 13.5 months compared to the Proposed Action. There is more surface disturbance to reclaim under this alternative than under the Proposed Action.

### 3.4.2 LIVESTOCK GRAZING

#### 3.4.2.1 Current Conditions

Livestock/grazing management is discussed in the JIDP FEIS Section 3.4.10 (pp. 3-123 to 3-128). The YRD Project Area coincides with the Sand Draw Allotment and the Stud Horse Common Allotment (see Map 3.4-1). The Sand Draw Allotment contains about 31,740 acres. About 7,299 acres or 552 Animal Unit Months (AUMs) (about 13.2 acres/AUM) coincide with the YRD Project Area. The Sand Draw Allotment grazing permittee is permitted to use the Sand Draw Allotment for cattle grazing from May 1 through June 21 of each year.

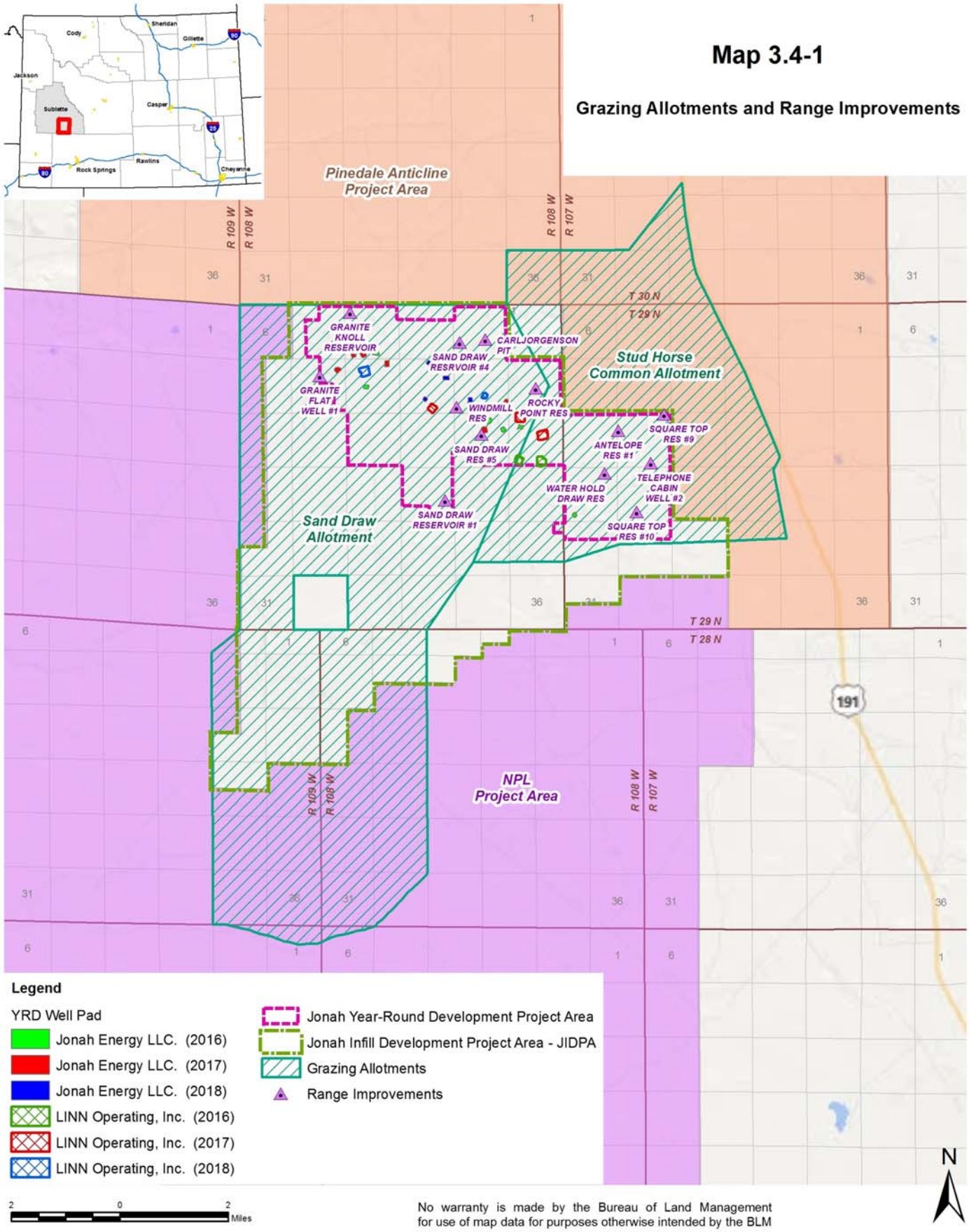
The Stud Horse Common Allotment contains about 15,555 acres. About 3,749 acres or 468 AUMs (about 8 acres/AUM) coincide with the YRD Project Area. The Stud Horse Common Allotment grazing permittee is permitted to use the Stud Horse Common Allotment for cattle grazing from May 1 through June 30 of each year.

Range improvements are shown on Map 3.4-1. There are 13 range improvements within the YRD Project Area consisting of reservoirs and wells for stock watering.

#### 3.4.2.2 Environmental Consequences

**Proposed Action**

Potential effects to livestock grazing were analyzed in the JIDP FEIS (Section 4.5.2, pp 4-100 to 4-104). Under this alternative, effects to livestock grazing would be greatly reduced compared to impacts analyzed in the JIDP FEIS. The proposed 245 wells would be developed on 24 multi-well pads rather than on 245 single well pads resulting in a reduction of 1,082 acres of surface disturbance (232 acres for YRD Pads, access roads, and natural gas gathering lines vs 1,314 acres as authorized under the JIDP ROD). Changes in vegetation impact livestock usability and would occur on 1,082 acres less under this alternative. Potential for introduction of weeds that could potentially reduce the forage is also reduced. The reduction in roads and traffic would reduce the potential for collisions and livestock mortality under this alternative. The 24 YRD Pads and associated access roads and natural gas gathering lines could potentially remove 185 acres (about 14 AUMs) from the Sand Draw Allotment and 47 acres (about 6 AUMs) from the Stud Horse Common Allotment. Approximately 49.3 acres would be needed for long-term use of the YRD Pad and access; therefore, most of the vegetation loss would be temporary and short-term.


Map 3.4-1
Grazing Allotments and Range Improvements
Pinedale Anticline Project Area
NPL Project Area
Stud Horse Common Allotment
Sand Draw Allotment
GRANITE KNOLL RESERVOIR
GRANITE FLAT WELL #1
SAND DRAW RESRVOIR #4
CARLJORGENSON PIT
WINDMILL RES
ROCKY POINT RES
SAND DRAW RES #5
SAND DRAW RESERVOIR #1
ANTELOPE RES #1
SQUARE TOP RES #9
TELEPHONE CABIN WELL #2
WATER HOLD DRAW RES
SQUARE TOP RES #10
R 109 W
R 108 W
R 107 W
T 30 N
T 29 N
T 28 N
191
Legend
YRD Well Pad
Jonah Energy LLC. (2016)
Jonah Energy LLC. (2017)
Jonah Energy LLC. (2018)
LINN Operating, Inc. (2016)
LINN Operating, Inc. (2017)
LINN Operating, Inc. (2018)
Jonah Year-Round Development Project Area
Jonah Infill Development Project Area - JIDPA
Grazing Allotments
Range Improvements
2 0 2 Miles
No warranty is made by the Bureau of Land Management for use of map data for purposes otherwise intended by the BLM
N

Successful reclamation would establish forage resources which could be more diverse and/or more abundant for livestock grazing than the original vegetation. Non-competitive, non-native species may be considered to benefit livestock by providing quantity and quality of forage comparable to native vegetation if successful vegetation cannot be established after 2 or 3 attempts and all other options have been exhausted. Grazing could modify the plant communities in reclaimed areas. It is currently unknown if vegetation impacts from grazing in the YRD Project Area would be positive or negative. In general, grazing can increase forbs and shrubs and decrease grasses. Vegetation monitoring would comply with the JIDP ROD.

Livestock mortality could occur from vehicles hitting livestock crossing roads in the YRD Project Area. The potential for this impact is less than that authorized under the JIDP ROD because access roads would be reduced by about 34 miles (3.2 miles for 24 YRD Pads and 36.8 miles for 245 single well pads). The amount of traffic within the YRD Project Area would also be reduced from that analyzed in the JIDP FEIS.

Most range improvements in the YRD Project Area are more than 500 feet from the YRD Pads with the exception of Sand Draw Reservoir #5 which is approximately 250 feet from the SHB 36-14 YRD Pad. Construction and operation on the SHB 36-14 YRD Pad is not likely to affect the Sand Draw Reservoir #5 and no other range improvements would be impacted. Range improvements are less likely to be affected under the Proposed Action due to 1,082 less acres of surface disturbance, reduced human presence, and reduced traffic for development on 24 well pads rather than 245 well pads under the No Action Alternative. Ongoing impacts from past and present natural gas development activities would continue.

**BLM Mitigation Alternative**

Effects to livestock grazing under the BLM Mitigation Alternative would be the same as under the Proposed Action.

**No Action Alternative**

Under the No Action Alternative, effects to livestock grazing would be similar to those analyzed in the JIDP FEIS (Section 4.5.2, pp 4-100 to 4-104) and under the Proposed Action, above. Under this alternative, the reduction in well pads (24 YRD Pads vs 245 single well pads) and resulting reduction in surface disturbance of 1,082 acres would not be realized. There would also be more potential for impacts to range improvements under the No Action Alternative due to 1,082 more acres of surface disturbance and 221 more well pads than under the Proposed Action. Ongoing impacts from past and present natural gas development activities would continue.

# 4.0 CUMULATIVE EFFECTS

The cumulative effects of past, present, and future development are discussed in the Jonah II Field EIS, the Modified Jonah Field II EA, and the JIDP FEIS (BLM, 2006a). The Proposed Action would result in less surface disturbance than that analyzed under the JIDP FEIS and authorized by the JIDP ROD. Cumulative effects analyses for air quality, greater sage-grouse, and pronghorn are provided below; cumulative effects analyses for other resources are the same as described in the JIDP FEIS Appendix B (BLM, 2006a) and the JIDP ROD Decision Section, pages 1 to 3 (BLM, 2006b).

## 4.1 AIR RESOURCES AND CLIMATE

### 4.1.1 INTRODUCTION

The Continental Divide-Creston (CD-C) Project FEIS (BLM, 2014c) is used for addressing cumulative impacts for the YRD Project cumulative air quality and AQRV assessment, including regional ozone formation. For the CD-C impact analysis, the CAMx (Comprehensive Air quality Model with Extensions; ENVIRON, 2010) photochemical grid model (PGM) was used to predict maximum potential regional-wide ambient air quality and AQRV impacts at federal PSD Class I and other sensitive PSD Class II areas, as well as designated acid-sensitive lakes. The CD-C Project analysis included a regional air quality assessment (including ozone) and AQRV analysis for southwest Wyoming including the region surrounding the YRD Project Area. The analyses were performed using the CAMx model and two years of meteorological data, years 2005 and 2006. The CD-C analysis analyzed regional impacts for a base case year 2008 and for future year 2022.

The CD-C analysis included impact assessments at 12 PSD Class I and sensitive Class II areas, and at 19 sensitive lakes throughout the CD-C Project modeling domain, including Class I and sensitive Class II areas and sensitive lakes nearby the YRD Project Area. The nearby Class I and sensitive Class II areas in the CD-C analysis are the Class I Bridger and Fitzpatrick Wilderness Areas, and Class II Popo Agie and Gros Ventre Wilderness Areas and Wind River Roadless Area. The nearby sensitive lakes included in the CD-C analysis are Black Joe, Deep Hobbs, Lazy Boy and Upper Frozen lakes in the Bridger Wilderness Area, Ross Lake in the Fitzpatrick Wilderness Area, and Lower Saddlebag Lake in the Popo Agie Wilderness Area.

### 4.1.2 REGIONAL EMISSIONS

**RFD Emissions**

The CD-C cumulative assessment included maximum emissions from reasonably foreseeable development (RFD) sources within the study area. RFD is defined as (1) air emissions from the undeveloped portions of authorized NEPA projects and RMPs, and (2) air emissions from not-yet-authorized NEPA projects (if emissions were quantified when modeling commences). A listing of RFD projects and emissions which were included in the study is presented in Table 4.1-1. Map 4.1-1 indicates the locations of each of the RFD projects and Map 4.1-2 illustrates the extents of CD-C modeling domain. Emissions for year 2008 (a maximum emissions year) were included for the JIDP.

The JIDP emissions were included as RFD emissions in the CD-C modeling analysis. The maximum estimated JIDP project emissions, which were expected to occur during year 2008, were modeled. These emissions are inclusive of the maximum emissions associated with all 245 wells developed year-round as part of the YRD Project which are expected to occur in Project Year 3 and are 315.0 tpy of CO, 276.7 tpy of $NO_x$, 337.2 tpy of VOC, 2.0 tpy of $SO_2$, 52.3 tpy of $PM_{10}$, and 20.6 tpy of $PM_{2.5}$.

**Table 4.1-1**
**RFD Emissions within the CD-C Project Study Area**

| RFD Project | Inventory Year | Emissions (tpy) | | | | | |
|---|---|---|---|---|---|---|---|
| | | $NO_x$ | VOC | CO | $SO_2$ | $PM_{10}$ | $PM_{2.5}$ |
| CD-C - Proposed Action | 2022 | 4,742 | 14,716 | 8,588 | 2 | 2,235 | 455 |
| CD-C – Existing Wells | 2022 | 1,757 | 42,249 | 1,852 | 2 | 449 | 153 |
| Beaver Creek | 2016 | 105 | 85 | 103 | 0 | 89 | 14 |
| LaBarge Platform | 2027 | 676 | 1,534 | 383 | 96 | 110 | 36 |
| NPL | 2022 | 472 | 310 | 623 | 10 | 968 | 145 |
| Monell Arch | 2021 | 253 | 276 | 220 | 8 | 33 | 17 |
| Moneta Divide | 2018 | 1,035 | 3,662 | 364 | 0 | 1,108 | 140 |
| Rock Springs Field Office | 2031 | 998 | 3,318 | 2,369 | 1 | 516 | 93 |
| Little Snake Field Office - Alt B (Preferred) | 2021 | 559 | 2,712 | 1,103 | 3 | 378 | 55 |
| Kremmling Field Office - Alt. C (Preferred) | 2028 | 738 | 5,914 | 191 | 3 | 2,473 | 408 |
| White River Field Office | 2021 | 3,320 | 8,564 | 7,054 | 20 | 1,037 | 198 |
| Colorado River Valley Field Office | 2021 | 2,287 | 9,240 | 4,525 | 8 | 916 | 155 |
| Grand Junction Field Office - Alt B (Preferred) | 2018 | 3,373 | 2,686 | 4,160 | 135 | 2,397 | 525 |
| Uncompahgre Field Office - Alt. D (Preferred) | 2028 | 3,271 | 2,498 | 3,327 | 138 | 1,118 | 494 |
| Bird Canyon | 2020 | 658 | 641 | 481 | 5 | 250 | 64 |
| Moxa Arch Existing Wells | 2018 | 1,550 | 19,596 | 1,178 | 1 | 232 | 79 |
| Moxa Arch Proposed Action New Wells | 2018 | 1,186 | 1,647 | 1,776 | 0 | 583 | 124 |
| Moxa Arch Proposed Action ROD Wells | 2018 | 64 | 166 | 128 | 0 | 30 | 6 |
| Hiawatha Existing Wells (CO &WY) | 2017 | 318 | 4,136 | 352 | 0 | 41 | 9 |
| Hiawatha Proposed Action New Wells (CO & WY) | 2017 | 1,555 | 919 | 1,861 | 1 | 318 | 100 |
| Pinedale | * | 1,381 | 2,286 | 1,250 | 53 | 53 | 79 |
| Jonah Infill Drilling Project | 2008 | 1,099 | 2,705 | 686 | 62 | 62 | 28 |
| **Total** | | **31,397** | **129,860** | **42,574** | **548** | **15,396** | **3,377** |
| *Based on the Pinedale Supplemental EIS Alternative C Phase II emissions levels. | | | | | | | |

Table 4.1-1 also indicates the Project Year inventoried for each RFD project when maximum emissions are expected to occur. Full development of proposed projects inventoried as RFD may or may not coincide with full development of the YRD Project. As a result, the assumption that all RFD projects are fully developed during the maximum year of the YRD Project development results in conservatism in the cumulative impact analysis.

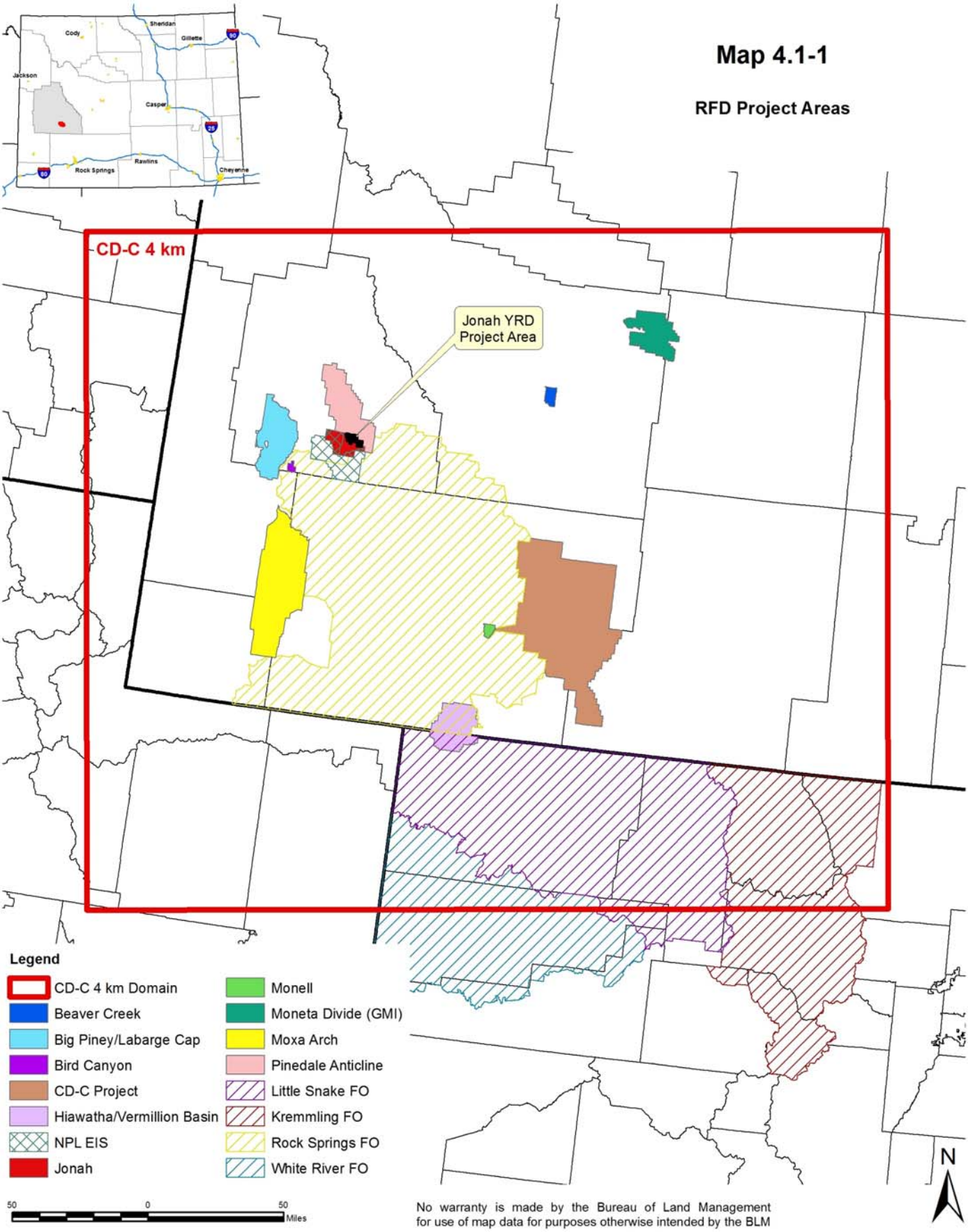
**Other Regional Emissions**

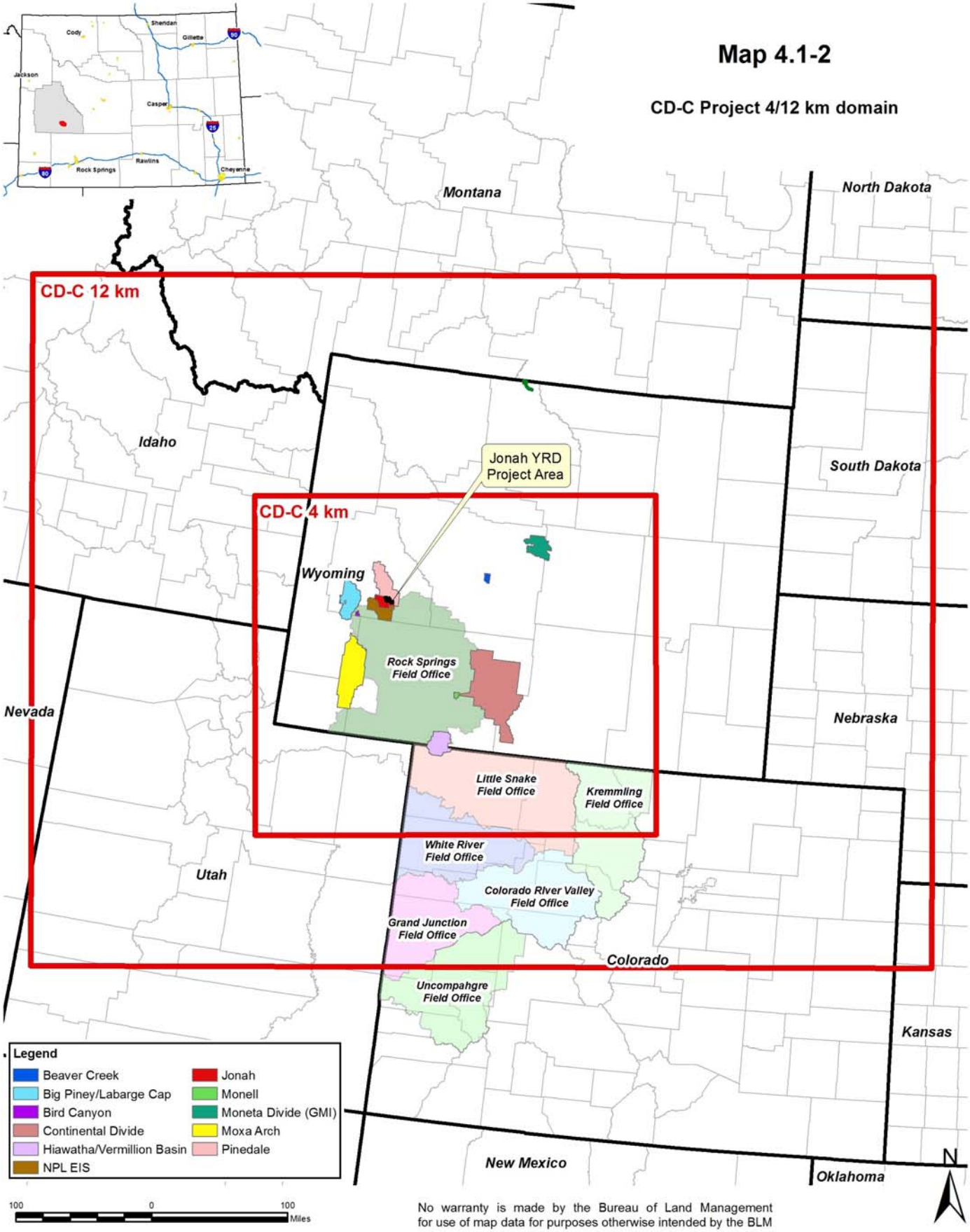
Regional emissions inventories for all other source type categories were quantified for the entire study area shown in Map 4.1-1. Emissions of CO, $NO_x$, $SO_2$, $PM_{10}$, and $PM_{2.5}$, and VOC were inventoried for both the 2008 baseline year and for year 2022. A complete discussion of the emissions inventories included in the cumulative study is reported in Section 2 of the CD-C Project Air Quality Technical Support Document (AQTSD) (BLM, 2014c).

### 4.1.3 CUMULATIVE ANALYSIS

**Criteria Pollutants Impacts**

The CD-C cumulative modeling analysis estimated potential impacts to ambient air concentrations from air pollutant emissions of $NO_x$, $SO_2$, $PM_{10}$, $PM_{2.5}$, VOCs, and CO expected to result from RFD sources emissions and other cumulative (regional) emissions sources. The estimated impacts in the vicinity of the YRD Project Area are discussed below.


Map 4.1-1
RFD Project Areas
Sheridan
Cody
Gillette
Jackson
Casper
Rawlins
Rock Springs
Cheyenne
CD-C 4 km
Jonah YRD
Project Area
Legend
CD-C 4 km Domain
Beaver Creek
Big Piney/Labarge Cap
Bird Canyon
CD-C Project
Hiawatha/Vermillion Basin
NPL EIS
Jonah
Monell
Moneta Divide (GMI)
Moxa Arch
Pinedale Anticline
Little Snake FO
Kremmling FO
Rock Springs FO
White River FO
50
0
50
Miles
N
No warranty is made by the Bureau of Land Management
for use of map data for purposes otherwise intended by the BLM


Map 4.1-2
CD-C Project 4/12 km domain
Cody
Sheridan
Gillette
Jackson
Casper
Rawlins
Rock Springs
Cheyenne
Montana
North Dakota
CD-C 12 km
Idaho
Jonah YRD
Project Area
South Dakota
CD-C 4 km
Wyoming
Rock Springs
Field Office
Nevada
Nebraska
Little Snake
Field Office
Kremmling
Field Office
White River
Field Office
Utah
Colorado River Valley
Field Office
Grand Junction
Field Office
Colorado
Uncompahgre
Field Office
Kansas
Legend
Beaver Creek
Big Piney/Labarge Cap
Bird Canyon
Continental Divide
Hiawatha/Vermillion Basin
NPL EIS
Jonah
Monell
Moneta Divide (GMI)
Moxa Arch
Pinedale
New Mexico
Oklahoma
N
100
0
100
Miles
No warranty is made by the Bureau of Land Management
for use of map data for purposes otherwise intended by the BLM

## Regional Ozone Impacts

The CD-C analysis included estimates of future year regional ozone impacts using two analysis methods. One method uses the change in the PGM modeled concentrations between base case or current year (DVC) (year 2008) and future year (DVF) (year 2022) simulations to scale observed ozone concentrations from monitoring sites to obtain projected future year ozone concentrations. This method utilized EPA's Modeled Attainment Test Software (MATS) (Abt, 2012) projection tool with the CAMx 2008 Base Case and 2022 scenario ozone concentrations to estimate ozone impacts. The second method uses the absolute modeling results from the CAMx model to estimate ozone impacts. Two years of meteorology (2005 and 2006) were modeled with CAMx.

The YRD Project Area is located within the UGRB ozone nonattainment area. The EPA has recently proposed to determine that this area attained the 2008 NAAQS by the applicable attainment date of July 20, 2015, based on complete, quality-assured and certified ozone monitoring data for 2012–2014 (EPA 2015b). On October 1, 2015, the EPA lowered the ozone NAAQS from 75 ppb (established in 2008) to a more stringent value of 70 ppb (EPA, 2015a). The EPA expects to issue detailed guidance on the designation process in early 2016, but has indicated that attainment designations for the 2015 NAAQS will be based on 2014-2016 data. State recommendations for designations of attainment and nonattainment areas are due to EPA by October 1, 2016 and EPA has a statutory obligation to finalize designations by October 1, 2017. Therefore, at the time of writing of this document, the attainment status of the YRD Project Area and all Wyoming counties under the 2015 NAAQS is not yet known and the designations under the 2008 NAAQS remain in place.

The CAMx predicted current year DVCs indicate areas where ozone concentrations are above the NAAQS (70 ppb) in the vicinity of the YRD Project Area in 2008 (maximum of 78.7 ppb) with the concentrations slightly decreasing in year 2022 (maximum of 77.7 ppb). The estimated ozone concentrations using absolute CAMx model results indicates ozone concentrations in the vicinity of the YRD Project Area that are above the 70 ppb NAAQS for both the base year 2008 and future year 2022 for the year meteorology year 2006 simulation. The estimated absolute model ozone concentrations in the vicinity of the YRD Project Area are 77.4 ppb in year 2008 and decreases slightly to 77.0 ppb in 2022. The 2-year average of the absolute model ozone concentrations is in the 71-73 ppb range in the vicinity of the YRD Project Area. A detailed discussion of the ozone analysis is provided in Section 4.5.4 of the CD-C AQTSD (BLM, 2014c).

## Regional $NO_2$, $SO_2$, CO, $PM_{10}$, and $PM_{2.5}$ Impacts

The results of the cumulative modeling showed that $NO_2$, $SO_2$, CO, $PM_{10}$, and $PM_{2.5}$ concentrations in the vicinity of the YRD Project Area would be well below the applicable NAAQS and WAAQS. Additional detail on the modeling results are provided in Section 4.5.3 of the CD-C AQTSD (BLM, 2014c).

## Visibility Impacts

The cumulative visibility analysis follows the approach that was developed by the FWS and the NPS and was documented in a letter sent on February 10, 2012 to the WDEQ-AQD (FWS and NPS, 2012). The approach uses the two EPA Regional Haze Rule (RHR) metrics goals:

- Improvement in visibility for the 20 percent worst visibility days
- No worsening in visibility for the 20 percent best visibility days

Although the cumulative visibility approach uses the RHR metrics, the cumulative visibility analysis for the regional emissions sources is not comparable to a state's RHR State Implementation Plan (SIP) analysis because different basic assumptions are used in the analysis, such as different future emissions years, different emissions projections and different observed visibility baseline years.

The CAMx 2008 and 2022 model outputs were used to project the observed visibility conditions from all cumulative emissions, including RFD sources, at IMPROVE sites within the 4 km domain from the baseline period (2006 to 2010) to 2022 for the worst 20 percent and best 20 percent days, using the EPA's MATS tool. 2022 visibility projections for the worst 20 percent and best 20 percent days were also made without the RFD sources. This allows an assessment of the effects of emissions from the RFD emissions on the RHR visibility metrics.

Tables 4.1-2 through 4.1-5 indicate improved visibility in 2022 compared to the 2006 to 2010 baseline years at the nearby Class I and Class II areas for both the best and worst 20 percent days. Impacts from RFD sources on 2022 haze are estimated to vary between 0.01 dv and 0.16 dv among the nearby Class I and Class II areas.

**Table 4.1-2**
**Cumulative Visibility Results for Best 20 Percent Days - Using 2005 Meteorology**

| Best 20 Percent Days - 2005 Meteorology | | | | |
|---|---|---|---|---|
| **Class I or Class II Area** | **Baseline Visibility (2006-2010) (dv)** | **Cumulative and RFD sources (Cumulative 2022 Visibility) (dv)** | **No RFD Sources (Cumulative 2022 Visibility) (dv)** | **Difference Between Cumulative and RFD Sources and No RFD Sources (dv)** |
| Bridger Wilderness Area | 1.39 | 1.17 | 1.14 | 0.03 |
| Fitzpatrick Wilderness Area | 1.39 | 1.19 | 1.16 | 0.03 |
| Gros Ventre Wilderness Area | 1.39 | 1.18 | 1.16 | 0.02 |
| Popo Agie Wilderness Area | 1.39 | 1.28 | 1.15 | 0.13 |
| Wind River Roadless Area | 1.39 | 1.17 | 1.13 | 0.04 |

**Table 4.1-3**
**Cumulative Visibility Results for Worst 20 Percent Days - Using 2005 Meteorology**

| Worst 20 Percent Days - 2005 Meteorology | | | | |
|---|---|---|---|---|
| **Class I or Class II Area** | **Baseline Visibility (2006-2010) (dv)** | **Baseline Visibility (2006-2010) (dv)** | **Cumulative and RFD sources (Cumulative 2022 Visibility) (dv)** | **No RFD Sources (Cumulative 2022 Visibility) (dv)** |
| Bridger Wilderness Area | 10.58 | 10.28 | 10.23 | 0.05 |
| Fitzpatrick Wilderness Area | 10.58 | 10.27 | 10.24 | 0.03 |
| Gros Ventre Wilderness Area | 10.58 | 10.31 | 10.29 | 0.02 |
| Popo Agie Wilderness Area | 10.58 | 10.45 | 10.29 | 0.16 |
| Wind River Roadless Area | 10.58 | 10.26 | 10.21 | 0.05 |

**Table 4.1-4**
**Cumulative Visibility Results for Best 20 Percent Days - Using 2006 Meteorology**

| Best 20% Days - 2006 Meteorology | | | | |
|---|---|---|---|---|
| **Class I or Class II Area** | **Baseline Visibility (2006-2010) (dv)** | **Baseline Visibility (2006-2010) (dv)** | **Cumulative and RFD sources (Cumulative 2022 Visibility) (dv)** | **No RFD Sources (Cumulative 2022 Visibility) (dv)** |
| Bridger Wilderness Area | 1.39 | 1.22 | 1.19 | 0.03 |
| Fitzpatrick Wilderness Area | 1.39 | 1.24 | 1.22 | 0.02 |
| Gros Ventre Wilderness Area | 1.39 | 1.24 | 1.22 | 0.02 |
| Popo Agie Wilderness Area | 1.39 | 1.34 | 1.21 | 0.13 |
| Wind River Roadless Area | 1.39 | 1.21 | 1.17 | 0.04 |

**Table 4.1-5**
**Cumulative Visibility Results for Worst 20 Percent Days - Using 2006 Meteorology**

| Worst 20 Percent Days - 2006 Meteorology | | | | |
|---|---|---|---|---|
| **Class I or Class II Area** | **Baseline Visibility (2006-2010) (dv)** | **Baseline Visibility (2006-2010) (dv)** | **Cumulative and RFD sources (Cumulative 2022 Visibility) (dv)** | **No RFD Sources (Cumulative 2022 Visibility) (dv)** |
| Bridger Wilderness Area | 10.58 | 10.30 | 10.28 | 0.02 |
| Fitzpatrick Wilderness Area | 10.58 | 10.32 | 10.31 | 0.01 |
| Gros Ventre Wilderness Area | 10.58 | 10.32 | 10.31 | 0.11 |
| Popo Agie Wilderness Area | 10.58 | 10.56 | 10.40 | 0.16 |
| Wind River Roadless Area | 10.58 | 10.27 | 10.24 | 0.03 |

## Atmospheric Deposition Impacts

Modeled wet and dry fluxes of sulfur (S) and nitrogen (N) due to emissions from the cumulative sources were processed to estimate total annual S and N deposition values at each nearby PSD Class I and sensitive PSD Class II area.

Table 4.1-6 shows maximum predicted total N and S deposition impacts from all emission sources for the year 2022 from either of the 2005 and 2006 meteorology data sets. Estimated cumulative N deposition impacts at all Class I and sensitive Class II areas nearby the YRD Project Area would be above the critical load thresholds. Estimated S deposition impacts would be below the 5.0 kg/ha-yr threshold at all areas.

**Table 4.1-6**
**Cumulative Nitrogen and Sulfur Deposition Impacts**

| Class I or Sensitive Class II Area | Nitrogen Deposition (kg/ha-yr) | Nitrogen Critical Load (kg/ha-yr) | Sulfur Deposition (kg/ha-yr) | Sulfur Critical Load (kg/ha-yr) |
|---|---|---|---|---|
| Bridger Wilderness Area | 2.85 | 2.2 | 1.61 | 5.0 |
| Fitzpatrick Wilderness Area | 3.17 | 2.2 | 1.66 | 5.0 |
| Gros Ventre Wilderness Area | 4.83 | 2.2 | 2.85 | 5.0 |
| Popo Agie Wilderness Area | 3.62 | 2.2 | 1.95 | 5.0 |
| Wind River Roadless Area | 3.49 | 2.2 | 2.04 | 5.0 |

Table 4.1-7 shows the 2022 to 2008 change in maximum N and S deposition at all Class I/II areas from either of the 2005 and 2006 meteorology data sets. The modeling results indicate that cumulative N and S deposition impacts in 2022 would decrease in all Class I/II areas relative to year 2008. The decrease in N deposition is due to various regulatory programs that will reduce $NO_x$ emissions in 2022 compared to 2008.

**Table 4.1-7**
**2022-2008 Change in Cumulative Nitrogen and Sulfur Deposition**

| | Nitrogen Deposition | | Sulfur Deposition | |
|---|---|---|---|---|
| Class I or Sensitive Class II Area | Deposition (kg/ha-yr) | Percent Change | Deposition (kg/ha-yr) | Percent Change |
| Bridger Wilderness Area | -0.3221 | -10.54% | -0.2726 | -14.51% |
| Fitzpatrick Wilderness Area | -0.3118 | --8.97% | -0.1755 | -12.95% |
| Gros Ventre Wilderness Area | -0.4639 | -8.77% | -0.2850 | -9.08% |
| Popo Agie Wilderness Area | -0.3619 | -9.08% | -0.2254 | -16.57% |
| Wind River Roadless Area | -0.3039 | -8.00% | -0.1439 | -6.58% |

**Acid Neutralizing Capacity of Sensitive Lakes**

Modeling results for cumulative sources indicated that there would be no acid neutralizing capacity (ANC) changes at any of the seven nearby lakes that exceed the 10 percent threshold or the ΔANC<1 microequivalents per liter (μeq/L) threshold for the two extremely sensitive lakes. In addition, the cumulative assessment shows that N and S deposition into the sensitive lakes in 2022 would be lower than in 2008 due to regional emissions reductions. This potentially results in an increase in ANC of the sensitive lakes over this time frame, with the lakes becoming more resilient to acid deposition in future years than during the baseline period.

### 4.1.4 CLIMATE CHANGE IMPACTS

As discussed in Section 3.1.1, the current scientific consensus is that anthropogenic emissions of GHGs are causing the global climate system to warm, and the amount of GHGs emitted globally will determine the magnitude of climate change throughout this century (NCA, 2014a). Forecasts of changes in the climate system under different GHG emissions scenarios are made with global climate models. In Wyoming, the number of hot days and warms nights is predicted to increase leading to “increased demand for water and energy and impacts on agricultural practices” (NCA, 2014b).

The GHGs to be emitted by the YRD Project, and from other RFD projects in the study area, are carbon dioxide, methane, and nitrous oxide, all of which have atmospheric lifetimes on the order of years. Emissions of GHGs from any particular source become well-mixed throughout the global atmosphere. GHG emissions from all sources contribute to the global atmospheric

burden of GHGs, and it is not possible to attribute a particular climate impact in any given region to GHG emissions from a particular source.

**Wyoming Basin Ecoregional Assessment**

In recognizing the need for additional information to support planning and decision making over large geographic areas, the BLM has recently developed a Landscape Approach which includes the Rapid Ecoregional Assessment (REA) program. The overall goals of the REA are to identify important ecosystems and wildlife habitats at broad spatial scales; identify where these resources are at risk from development, wildfire, invasive species, and climate change; quantify cumulative effects of anthropogenic stressors as required under NEPA; and assess current levels of risk to ecological resources across a range of spatial scales and jurisdictional boundaries by assessing all lands within an ecoregion. A Rapid Ecoregional Assessment has been developed for the Wyoming Basin, which includes the YRD Project Area (Carr and Melcher, 2015).

As part of the Wyoming Basin REA a climate analysis was developed which included a reasonably foreseeable range of projected changes in temperature, precipitation, and hydroclimate variables for the Wyoming Basin. The "reasonably foreseeable" concept is modeled after the same concept for "reasonably foreseeable development scenarios" required for BLM land use planning and is intended to reflect a range of potential future conditions due to natural variability and uncertainty in the global climate models. Key points from the Wyoming Basin REA climate analysis are excerpted here:

- *Temperatures in the Wyoming Basin have warmed by almost 2ºF in the past 30 years, which is statistically significant. In contrast, precipitation does not show a statistically significant trend compared to precipitation variability of the recent past.*
- *Based on the climate models evaluated for the REA, the Wyoming Basin is projected to warm by about 2.5ºF, with a modeled range of 1.5−3.5ºF by 2030. The projected increase in temperature is higher for the period ending in 2060, with an average increase of about 4.9ºF and a range from 2.7−4.9ºF.*
- *Projections indicate an increase in the minimum temperatures of the coldest days, and an increase in the frequency and temperature of the hottest days. Projected temperatures for 2060 indicate that summers may be as warm as or warmer than the hottest summers in the recent climate.*
- *Climate projections do not show a dramatic change in annual average precipitation. Historical variability in precipitation is high.*
- *Snow water equivalent on April 1 is projected to decrease by at least 20 percent or more by 2030 in many areas, although not in the higher mountains. Based on projections of earlier snowmelt and runoff, soil moisture has the potential to increase earlier in the spring and dry out earlier in the growing season.*
- *Paleoclimate reconstructions of streamflow show considerable variability in records within the last 500 years, including years-to-decades of wetter or drier conditions in reconstructed streamflows.*
- *The projected changes in temperature and shifts in precipitation and streamflow variables have implications for the Wyoming Basins ecosystems. These could include changes in elevation of climate zones, shifts in timing of peak streamflow, shifts in the seasonal pattern of soil moisture, and a longer growing season.*

## 4.2 GREATER SAGE-GROUSE

As stated in the JIDP ROD, effects to greater sage-grouse and its habitats are an issue because of the decline from historic population levels of greater sage-grouse in the JIDPA and the decline in overall populations across their range. Potential project effects to breeding, nesting, brood-rearing, and wintering habitat and habitat function potentially contribute to continued population declines. The JIDP ROD also noted that existing greater sage-grouse protection measures appear to be inadequate within the JIDPA, and with the proposed increase in development, existing protection measures would be even less effective. The JIDP FEIS analysis disclosed the impacts and recognized that the local population would likely be completely displaced and/or locally extirpated due to full field development. The JIDP ROD also noted that the long-term species sustainability would not be affected due to the relatively small size of the JIDPA in relation to overall habitat availability in the Cumulative Impact Analysis Area (CIAA). The CIAA for greater sage-grouse encompasses 1,061,805 acres (1,659 square miles) (Map 3.18 in the JIDP FEIS – BLM, 2006a). In 2006, existing disturbance within the CIAA included approximately 28,767 acres (45 square miles), or 2.7% of the CIAA, and resulted primarily from agriculture (70%) and road and pipeline rights-of-way (21%). In 2006, there were approximately 52 known leks in the CIAA, with the highest percentage of those occurring east of Highway 191 (BLM, 2006a), 2015 GIS data show 164 occupied leks, 65 unoccupied leks, and 1 undetermined lek within the CIAA (WGFD, 2015).

Development under the JIDP ROD would increase disturbance up to 4.8% and would likely result in some disturbance to nesting, brood-rearing, and wintering greater sage-grouse. It was anticipated that the impact would contribute to the decline in regional greater sage-grouse populations and therefore be cumulatively significant (BLM, 2006b).

The JIDP FEIS noted that although greater sage-grouse still use the JIDPA, the direct and indirect impacts of previous developments in the JIDPA may have already rendered the area unsuitable for long-term greater sage-grouse use, and further habitat loss and disturbance would occur under the proposed development. Recovery of habitat functionality for greater sage-grouse may take over 100 years (Braun 1998; Slater 2003). However, it is anticipated that a mosaic of sagebrush habitat age classes would be available on the JIDPA within a shorter time frame.

The JIDP FEIS stated that to maintain or move PFO greater sage-grouse habitat toward RMP goals, existing PFO area-wide and statewide stipulations on leases and COAs on APDs and rights-of-way apply a Controlled Surface Use restriction within 0.25 mile of an occupied lek. There are also timing stipulations protecting greater sage-grouse while breeding, nesting, and brood-rearing, and wintering. These stipulations do not preclude exploration and development from occurring in nesting and wintering habitat outside of the timing restriction dates, and therefore, habitat is not protected from development. Given the noted decline in greater sage-grouse use of the JIDPA, existing protection measures within the JIDPA appear to be inadequate (BLM, 2006a).

The leks that would be affected by the YRD Project are part of the Yellow Point lek complex, which once consisted of at least 14 active leks, spanning the Jonah Field and the southern end of the Pinedale Anticline Gas Field. The Yellow Point lek complex is monitored annually as required by the Wildlife Monitoring and Mitigation Matrix (WMMM) from the 2008 Final Supplemental EIS ROD for the Pinedale Anticline Oil and Gas Exploration and Development Project (BLM, 2008c). The WMMM identifies triggers/thresholds, where, if exceeded, mitigation measures must be implemented. The triggers include decreases in the number of active leks, peak male numbers, winter habitat use, and exceedances of 10 dBA over background noise levels (BLM et al., 2015). Current monitoring results indicate that the Yellow Point lek complex is

still below the identified triggers. As of 2015, nine leks remain, three of which have had no males in attendance for several years (Sand Draw 3 lek since 2008, Stud Horse Butte East lek since 2009, and The Rocks lek since 2011) (BLM et al., 2015). It is uncertain what impacts displaced greater sage-grouse would have on neighboring leks. Mitigation for drilling through wildlife timing stipulations would include reduced emissions due to entering and leaving the well pads only once, reduced surface disturbance and habitat fragmentation, and shorter turn-around time for reclamation to begin (BLM, 2011).

With adherence to the measures in the ARMPA (see Chapter 3 section), cumulative effects to the species as a whole within the CIAA, may be reduced and, in some areas, avoided.

### 4.3 PRONGHORN

The JIDP ROD implemented three strategies to respond to the cumulative effects to pronghorn: 1) return field habitat function in the shortest time possible; 2) perform on-site mitigation to the extent practicable and employ compensatory (off-site) mitigation; and 3) institute an adaptive management process to ensure monitoring and both on- and off-site mitigation are effective. The YRD Project differs from the analysis in the JIDP FEIS in that crucial winter range has been designated within the YRD Project Area and year-round development is proposed; however, excepting four YRD Pads, all other YRD Pads are located in a block cleared area, therefore, not managed as crucial winter range. Offsetting the effects of year-round development and the effects of the four YRD Pads within crucial winter range is the reduction of 1,082 acres of habitat disturbance that would not be affected under the Proposed Action and which was analyzed under the JIDP FEIS. The reduction falls within the first strategy listed in the JIPD ROD, of returning the field habitat function in the shortest time possible. Implementation of the measures in the BLM Mitigation Alternative (i.e., conversion fence lines into let-down fences and installation of fence crossings in known antelope crossing areas) would fall under the second strategy of performing mitigation, and on-going monitoring would ensure the third strategy continues. Any changes in cumulative effects associated with the YRD Project would be expected to be less than those analyzed in the JIDP FEIS.

## 5.0 REFERENCES


Abt Associates. 2012. Modeled Attainment Software, User's Manual. Abt Associates Inc., Bethesda, Maryland. October. Accessed online: http://www.epa.gov/ttn/scram/guidance/guide/MATS-2-5-1_manual.pdf.

Andren, H. 1994. Effects of Habitat Fragmentation on Birds and Mammals in Landscapes with Different Proportions of Suitable Habitat - a Review. Oikos 71:355–366.

Aster Canyon Consulting, Inc. 2015. 2015 Jonah Infill Drilling Project Area Wildlife Monitoring Final Report. Jonah Infill Drilling Project Area, Sublette County, Wyoming.

Beckmann, J.P, R.G. Seidler, and J. Berger. 2011. Wildlife and Energy Development. Pronghorn of the Upper Green River Basin. Final Report. Wildlife Conservation Society, Bronx, New York.

Behrens and Associates, Inc. (Behrens). 2016. Jonah Year-Round Development Project Drilling and Fracing Noise Impact Analysis Report. January.

Bilbey, S. A., P. Robinson, and J. E. Hall, 2007, Assessment of existing paleontological data along with field survey results for the Jonah Field – EnCana Oil & Gas (USA), BP, and Ultra Resources, Inc. in Townships 28, 29, and 30 North, Ranges 107, 108, and 109 West,

Sublette County, Wyoming on Bureau of Land Management Lands: 64 pages; Confidential Appendix D submitted to the BLM only, 58 pages.

Blickley, J.L., and G.L. Patricelli. 2013. Noise Monitoring Recommendations for Greater Sage-grouse Habitat in Wyoming. Prepared for Pinedale Anticline Project Office and Wyoming Game and Fish Department, Pinedale, Wyoming.

Braun, C.E. 1998. Sage-grouse Declines in Western North America: What Are the Problems: Proceedings of the Western Association of State Fish and Wildlife Agencies 78:139–156.

Brochu, C. A. 2010. A new alligatorid from the Lower Eocene Green River Formation of Wyoming and the origin of Caimans: Journal of Vertebrate Paleontology, v. 30, no. 4, p. 1109-1126.

Bureau of Land Management. 2006a. Final Environmental Impact Statement for the Jonah Infill Drilling Project, Sublette County, Wyoming. BLM Wyoming State Office. Cheyenne, Wyoming.

Bureau of Land Management. 2006b. Record of Decision for the Jonah Infill Drilling Project Environmental Impact Statement, Sublette County, Wyoming. BLM Wyoming State Office Cheyenne, Wyoming. March 14, 2006.

Bureau of Land Management. 2008a. Record of Decision and Approved Pinedale Resource Management Plan. Wyoming State Office, Pinedale Field Office. November.

Bureau of Land Management. 2008b. BLM NEPA Handbook.

Bureau of Land Management. 2008c. Record of Decision: Final Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project. Pinedale Field Office, Wyoming.

Bureau of Land Management. 2011. Environmental Assessment For Year-Round Drilling Through Wildlife Timing Stipulations in the Jonah Infill Drilling Project Area. DOI-BLM-WY-100-EA11-105. February.

Bureau of Land Management. 2012a. Guidance for Conducting Air Quality General Conformity Determinations. Instruction Memorandum No. 2013-025. BLM Washington, D.C. 20240-0036. December 4, 2012. Accessed online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2013/IM_2013-025.html. December 2015.

Bureau of Land Management. 2012b. Final Environmental Impact Statement, Continental Divide-Creston Natural Gas Development Project-Department of the Interior, Bureau of Land Management Wyoming High Desert District – Rawlins Field Office, Wyoming, November.

Bureau of Land Management. 2014a. Air Resources Technical Report for Oil and Gas Development, New Mexico, Oklahoma, Texas, and Kansas. Bureau of Land Management, New Mexico State Office. February 2014.

Bureau of Land Management. 2014b. BLM Wyoming Sensitive Species Table. USDI-BLM Plant Conservation Program. Accessed online: http://www.blm.gov/wy/st/en/programs/pcp.html. December 2015.

Bureau of Land Management. 2014c. Final Environmental Impact Statement, Continental Divide-Creston Natural Gas Development Project, Draft Air Quality Technical Support Document -Department of Interior, Bureau of Land Management Wyoming High Desert District - Rawlins Field Office, Wyoming, June.

Bureau of Land Management. 2015a. Approved Resource Management Plan Amendment for Greater Sage-Grouse. USDI-Bureau of Land Management, Wyoming State Office, Cheyenne, Wyoming.

Bureau of Land Management. 2015b. Pinedale Field Office Letter to Greg Schamber, Jonah Energy LLC dated February 23, 2015.

Bureau of Land Management. 2015c. Environmental Assessment, Jonah Energy, LLC. EA Number WY-100-EA15-182. USDI BLM, Pinedale Field Office, Pinedale, Wyoming.

Bureau of Land Management. 2016. BLM Wyoming Sensitive Species List. Wyoming State Office, Cheyenne, Wyoming. Accessed online: http://www.blm.gov/wy/st/en/programs/Wildlife.html. January.

Bureau of Land Management and United States Forest Service. 2007. The Gold Book - Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. Fourth Edition.

Bureau of Land Management, Wyoming Department of Environmental Quality, Wyoming Game & Fish Department, and Wyoming Department of Agriculture. 2015. The Pinedale Anticline Project Office. 2014-15 DRAFT Greater Sage-grouse Annual Report Pinedale Anticline Project Area. December.

Burger, L.D., L.W. Burger, and J. Faaborg. 1994. Effects of Prairie Fragmentation of Predation on Artificial Nests. Journal of Wildlife Management 58:249-254.

Carr, N.B., and Melcher, C.P., eds. 2015. Wyoming Basin Rapid Ecoregional Assessment: U.S. Geological Survey Open-File Report 2015–1155, 896 p. Accessed online: http://dx.doi.org/10.3133/ ofr20151155.

Chalfoun, A. D., F. R. Thompson, III, and M. J. Ratnaswamy. 2002. Nest Predators and Fragmentation: a Review and Meta-analysis. Conservation Biology 16:306–318.

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Council on Environmental Quality (CEQ). 2014. Draft Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews. 40 CFR Parts 1500, 1501, 1502, 1505, 1506, 1507, and 1508. January 2014.

Drucker. S. 2016. BLM Pinedale Field Office Archaeologist. Personal Communication with Sue Ann Bilbey, Uinta Paleontological Associates Inc. January 14.

ENVIRON. 2010. “User’s Guide Comprehensive Air Quality Model with Extensions (CAMx) Version 4.50.” ENVIRON International Corporation, Novato, California. Accessed online: www.camx.com. September.

Environmental Protection Agency (EPA). 2005. Guideline on Air Quality Models. Updated 2005. Environmental Protection Agency Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. Published in Federal Register, Vol. 70, No. 216, November 9, 2005.

Environmental Protection Agency. 2011. Inventory of U.S. Greenhouse Emissions and Sinks: 1990 – 2009. EPA 430-R-11-005. Accessed online: http://epa.gov/climatechange/emissions/downloads11/US-GHG-Inventory-2011-Complete_Report.pdf. February 2012.

Environmental Protection Agency. 2014a. Dose-Response Assessment for Assessing Health Risks Associated With Exposure to Hazardous Air Pollutants, Table 2, Acute Dose-Response Values for Screening Risk Assessments (9/18/2014). Technology Transfer Network - Air Toxics Web Site. Accessed online: http://www2.epa.gov/sites/production/files/2014-05/documents/table2.pdf.

Environmental Protection Agency. 2014b. Dose-Response Assessment for Assessing Health Risks Associated With Exposure to Hazardous Air Pollutants, Table 1, Prioritized Chronic Dose-Response Values (5/9/2014). Technology Transfer Network - Air Toxics Web Site. Accessed online: http://www2.epa.gov/sites/production/files/2014-05/documents/table1.pdf.

Environmental Protection Agency. 2015a. 40 CFR Parts 50, 51, 52, 53, and 58, National Ambient Air Quality Standards for Ozone, Environmental Protection Agency Final Rule. Federal Register Volume 80, No. 206, 10/26/2015. Accessed online at http://www.gpo.gov/fdsys/pkg/FR-2015-10-26/pdf/2015-26594.pdf.

Environmental Protection Agency. 2015b. Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Several Areas Classified as Marginal for the 2008 Ozone National Ambient Air Quality Standards: A Proposed Rule by the Environmental Protection Agency on 08/27/2015. Accessed online at: http://www.gpo.gov/fdsys/pkg/FR-2015-08-27/pdf/2015-21196.pdf.

Environmental Protection Agency. 2015c. Oil and Natural Gas Sector: Emission Standards for New and Modified Sources: A Proposed Rule by the Environmental Protection Agency on 08/1/2015. 40 CFR Part 60, EPA-HQ-OAR-2010-0505, FRL-9929-75-OAR, RIN 2060-AS30. Accessed online: http://www.epa.gov/airquality/oilandgas/actions.html.

Environmental Protection Agency. 2015d. Greenhouse Gas Reporting Program. Accessed online: http://www2.epa.gov/ghgreporting/ghgrp-2014-reported-data.

Environmental Protection Agency. 2016. Clean Air Status and Trends Network (CASTNET). Accessed online: http://www3.epa.gov/castnet/site_pages/PND165.html. January 2016.

Federal Land Managers' Air Quality Related Values Workgroup (FLAG). 2010. Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report – Revised (2010). U.S. Forest Service-Air Quality Program, National Park Service-Air Resources Division, U.S. Fish and Wildlife Service-Air Quality Branch. October 2010.

Fox, Douglas, Ann M. Bartuska, James G. Byrne, Ellis Cowling, Rich Fisher, Gene E. Likens, Steven E. Lindberg, Rick A. Linthurst, Jay Messer, and Dale S. Nichols. 1989. A Screening Procedure to Evaluate Air Pollution Effects on Class I Wilderness Areas. General Technical Report RM-168. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. 36 pp.

Gates, J.E. and L.W. Gysel. 1978. Avian Nest Dispersion and Fledging Success in Field-Forest Ecotones. Ecology 59:871-883.

Gilbert, M., and A.D. Chalfoun. 2011. Energy Development Affects Populations of Sagebrush Songbirds in Wyoming. Journal of Wildlife Management 75:816-824.

HydroGeo, Inc. 2005. Erosion, Sediment Transport, and Salinity Modeling Technical Report: Jonah Infill Drilling Project, Sublette County, Wyoming. Prepared for TRC Mariah Associates, Inc., Laramie, Wyoming.

Intergovernmental Panel on Climate Change (IPCC). 2013. Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Stocker, T. F., D. Qin, G. K. Plattner, M.

Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley (eds.)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 1,535 pp.

Jonah Interagency Office. 2015. JIDPA Monitoring. Accessed online: http://www.wy.blm.gov/jio-papo/jio/monitoring.htm).

Knick, S. T., and J. T. Rotenberry. 2002. Effects of Habitat Fragmentation on Passerine Birds Breeding in Intermountain Shrubsteppe. Studies in Avian Biology 25:130-140.

LeBeau, C., and P. Rodgers. 2015. Pronghorn Migration Supplement for the Pinedale Anticline Project Area. 2015 Draft Annual Report. Report to Pinedale Anticline Project Office, Pinedale, Wyoming.

LeBeau, C., R. Nielson, and H. Sawyer. 2015. Pronghorn Monitoring in the Pinedale Anticline Project Area. 2015 Annual Report. Report to Pinedale Anticline Project Office, Pinedale, Wyoming.

Marini, M.A., S.K. Robinson, and E.J. Heske. 1995. Edge Effects on Nest Predation in the Shawnee National Forest, Southern Illinois. Biological Conservation 74:203-213.

Marzluff, J.M., and E. Neatherlin. 2006. Corvid Response to Human Settlements and Campgrounds: Causes, Consequences, and Challenges for Conservation. Biological Conservation 130: 301-314.

National Park Service (NPS). 2014. National Park Service Air Resources Division, Email from Andrea Stacy NPS to Charis Tuers, BLM Wyoming State Office regarding applicable critical load values for Wyoming and Colorado. August 15, 2014.

National Climate Assessment (NCA). 2014a. Melillo, Jerry M., Terese, T. C. Richmond, and Gary W. Yohe, eds. 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi: 10.7930/J0Z31WJ2.

National Climate Assessment. 2014b. Shafer, M., D. Ojima, J. M. Antle, D. Kluck, R. A. McPherson, S. Petersen, B. Scanlon, and K. Sherman. 2014: Ch. 19: Great Plains. Climate Change Impacts in the United States: The Third National Climate Assessment. J. M. Melillo, Terese (T. C.) Richmond, and G. W. Yohe, eds. U.S. Global Change Research Program, 441–461. doi:10.7930/J0D798BC. Accessed online: http://nca2014.globalchange.gov/report/regions/great-plains.

Natural Resources Conservation Service (NRCS). 2015a. Web Soil Survey – Sublette County, Wyoming, WY665. Version 10. Accessed online: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. September.

Natural Resource Conservation Service. 2015b. Ecological Site Description ESD Reports. Accessed online: https://esis.sc.egov.usda.gov/Welcome/pgApprovedSelect.aspx.

Nicholoff, S. H., compiler. 2003. Wyoming Bird Conservation Plan, Version 2.0. Wyoming Partners in Flight. Wyoming Game and Fish Department, Lander, Wyoming.

National Oceanic and Atmospheric Administration (NOAA). 2013. National Climate Data Center. State of the Climate: Global Analysis for Annual 2013. National Climate Data Center, December 2013. Accessed online at: <http://www.ncdc.noaa.gov/sotc/global/2013/13>.

Patricelli, G.L., J.L. Blickley, and S.L. Hooper. 2013. Recommended Management Strategies to Limit Anthropogenic Noise Impacts on Greater Sage-grouse in Wyoming. Human-Wildlife Interactions 7(2):230-249.

Raney, K. 2015. LINN Operating Inc. Email Communication with Edge Environmental, Inc. December 30.

Roadifer, K. 2016. BLM Pinedale Field Office. Personal Communication with Edge Environmental, Inc. January.

Roberts, B. 2016. Natural Resource Specialist, BLM Pinedale Field Office. Personal Communication with Edge Environmental, Inc. January.

Robinson, P., G. F. Gunnell, S. L. Walsh, W. C. Clyde, J. E. Storer, R. Stucky, D. J. Froehlich, I. Ferrusquiz-Villafranca, and M. C. McKenna, 2004, Wasatchian through Duchesnean biochronology, in Woodburne, M. O., ed., 2004, Late Cretaceous and Cenozoic mammals of North America: Biostratigraphy and geochronology: Columbia University Press, New York, p. 105-155.

Rocky Mountain Herbarium. 2015. Rocky Mountain Herbarium Specimen Database. Updated 10/08/2014. University of Wyoming, Department of Botany. Accessed online: http://www.rmh.uwyo.edu/data/search.php. December 2015.

Romin, L.A., and J.A. Muck. 2002. Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances. U.S. Fish and Wildlife Service, Utah Field Office, Salt Lake City, Utah.

Saros, J.E., Clow, D.W., Blett, T. & A.P. Wolfe. 2010. “Critical nitrogen deposition loads in high-elevation lakes of the western U.S. inferred from Paleolimnological records”. Water, Air & Soil Pollution, DOI 10.1007/s11270-010-0526-6.

Sauer, J.R., J.E. Hines, J.E. Fallon, K L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2014. The North American Breeding Bird Survey, Results and Analysis 1966 - 2012. Version 02.19.2014 USGS Patuxent Wildlife Research Center, Laurel, Maryland.

Seidler, R.G., R.A. Long, J. Berger, S. Bergen, and J.P. Beckmann. 2014. Identifying Impediments to Long-distance Mammal Migrations. Conservation Biology 29(1):99-109.

Slater, S.J. 2003. Sage-grouse (*Centrocercus urophasianus*) Use of Different-aged Burns and the Effects of Coyote Control in Southwestern Wyoming. M.S., Department of Zoology and Physiology, University of Wyoming.

Sorenson, J. 2015. Reclamation Specialist, Jonah Energy LLC. Email Communication with Edge Environmental, Inc. December 30.

Sublette County Weed & Pest District. 2015. Noxious Weeds. Accessed online: http://sublettecountyweed.com/. December.

U.S. Department of Agriculture. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. USDA Handbook 296.

U.S. Fish and Wildlife Service. 2007. Yellow-billed Cuckoo, Western Distinct Population Segment. U.S. Fish and Wildlife Service, Species Assessment and Listing Priority Assignment Form, Sacramento Field Office, Sacramento, California.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia.

U.S. Fish and Wildlife Service. 2010a. Classification of Wetlands and Deepwater Habitats of the United States. USDI-Fish and Wildlife Service, Washington, D.C. Accessed online: http://www.fws.gov/wetlands/. December 2015.

U.S. Fish and Wildlife Service. 2010b. Endangered and Threatened Wildlife and Plants; 12-Month Findings for Petitions to List the Greater Sage- Grouse (*Centrocercus urophasianus*) as Threatened or Endangered. Notice of 12-month petition findings. Federal Register 75(55):13910-14014.

U.S. Fish and Wildlife Service. 2010c. General Provisions; Migratory Bird Revised List and Permits; Final Rule. Federal Register 75(39):9282-9314.

U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List Greater Sage-Grouse (*Centrocercus urophasianus*) as an Endangered or Threatened Species; Proposed Rule. Federal Register 80(191):59858-59942/.

U.S. Fish and Wildlife Service. 2016. Official Species List for the Jonah YRD Project Area. Letter dated January 29.

U.S. Fish and Wildlife Service and National Park Service. 2012. Letter on Cumulative Visibility Metric Approach from Sandra V. Silva, Chief, Branch of Air Quality, U.S. Fish and Wildlife Service and Carol McCoy, Chief, Air Resource Division, National Park Service to Kelly Bott, Wyoming Department of Environmental Quality. February.

U.S. Geological Survey. 2007. Weeds Data for Sublette County, Wyoming. Shapefiles. Wyoming Landscape Conservation Initiative. Accessed online: https://www.sciencebase.gov/catalog/item/4f4e486fe4b07f02db50cfa9?community=Wyoming+Landscape+Conservation+Initiative. December 2015.

U.S. Geological Survey. 2011. Gap Analysis Program (GAP). National Land Cover, Version. Accessed online: http://gapanalysis.usgs.gov/gaplandcover/data/. December 2015.

Visibility Information Exchange Web System (VIEWS). 2016. Regional Haze Rule Summary Data. Accessed online: http://views.cira.colostate.edu/web. January 2016.

Western Regional Climate Center (WRCC). 2016. Historical climate data for LaBarge, Wyoming. Accessed online: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wy5252. January 2016.

Whittington, D.M., and G.T. Allen. 2008. Guidelines for Raptor Conservation in the Western United States. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C.

Whitson, T.D. (editor). 1996. Weeds of the West. Western Society of Weed Science and Cooperative Extension of the Western States, University of Wyoming, Laramie, Wyoming.

Woolwine, D. 2016. Wildlife Biologist BLM Pinedale Field Office. Personal Communication with Edge Environmental, Inc. January.

Wyoming Department of Environmental Quality. 2012. Air Quality Division. Nonattainment information. Accessed online: http://deq.wyoming.gov/aqd/winter-ozone/resources/nonattainment-info/. January 2015.

Wyoming Department of Environmental Quality. 2013. Air Quality Division Oil and Gas Production Facilities. Chapter 6, Section 2 Permitting Guidance, September 2013.

Wyoming Department of Environmental Quality. 2015a. Air Quality Division. Meteorological observations collected at Juel Spring, Wyoming.

Wyoming Department of Environmental Quality. 2015b. Air Quality Division. Air Quality Standards and Regulations. Accessed online: http://soswy.state.wy.us/Rules/default.aspx.

Wyoming Department of Environmental Quality. 2015c. Background pollutant concentration data provided the Wyoming Department of Environmental Quality Air Quality Division, December 2015.

Wyoming Game and Fish Department. 2009. Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming. Wyoming Game and Fish Department, Nongame Program, Lander, Wyoming.

Wyoming Game and Fish Department. 2012a. Updated seasonal range designations for pronghorn within the entire Sublette Antelope Herd Unit.

Wyoming Game and Fish Department. 2012b. Letter dated November 15, 2015 from John Emmerich, Deputy Director to Shane DeForest, BLM Pinedale Field Manager regarding New Pronghorn Crucial Winter Range Designations Within the Boundaries of the Jonah Infill Drilling Project.

Wyoming Game and Fish Department. 2015. Greater Sage-grouse GIS Data. Available upon request: https://wgfd.wyo.gov/Wildlife-in-Wyoming/Geospatial-Data.

Wyoming Game and Fish Department, National Park Service, USDA-APHIS-Wildlife Services, and U.S. Fish and Wildlife Service. 2015. 2014 Wyoming Gray Wolf Population Monitoring and Management Interim Report: January 1, 2014 through September 23, 2014. Wyoming Game and Fish Department. Cheyenne, Wyoming.

Wyoming Natural Diversity Database. 2016. Data compilation for Edge Environmental, Inc., completed January 6, 2016. Unpublished report. Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming.

Yoakum, J.D. 1979. Managing Rangelands for Pronghorns. Rangelands 1(4):146-148.